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AN ANALYSIS OF THE EFFECT OF MATCHING STUDENT
LEARNING STYLE TO THE METHOD OF INSTRUCTION

by

Addamae Akin

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AN ANALYSIS OF THE EFFECT OF MATCHING STUDENT LEARNING STYLE TO THE METHOD OF INSTRUCTION

Addamae Akin, Ed.D.

Western Michigan University, 1992

The purpose of this study was to determine if matching student learning style and teacher teaching style will result in any difference in achievement of students in the classroom as measured by the number of students receiving credit in ninth-grade world history classes.

The study was conducted in a mid-size Macomb County, Michigan, school district. Two hundred fifteen ninth-grade students and four teachers participated in this study. World history classes were used because of their heterogeneous grouping and because it was a required ninth-grade class.

Students were administered the Learning Style Profile (Keefe & Monk, 1986) from the National Association of Secondary School Principals (NASSP) by building counselors. Teachers took the same test. The test determined the learning style of students and teachers on the auditory and visual components of the test. The final grades for the class were collected on all students to determine whether they earned credit in world history.

Test scores were reported along a continuum divided into quartiles. A match was determined by teachers and students scoring in the same quartile.

The chi square was used to determine the relationship between the match/no match and pass/fail variables at the .05 level of significance. The data failed to support the hypothesis:

There is no difference in the proportion of those students who matched and those who did not match their teacher's score on the auditory, visual, or both components on the Learning Style Profile.

This study failed to support previous research. Possible reasons for the result might include not all components of the test were used in the study nor were all hours of the school day included. Also, there was no intervention program for students, and teachers participated in numerous staff development programs during the study.

The reform initiatives of state and federal mandates for inclusion, Section 504, portfolios, child study planning committees, and at-risk students allow programs to accommodate differing cognitive and affective learning styles of students. Further studies should explore these variables.

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Western Michigan University, 1992

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DEDICATION

To Dad, for your love and guidance. It has gotten you

a doctor in the house.

Addamae Akin

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Addamae Akin

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CHAPTER I

INTRODUCTION

Education represents constant changes. It is not a stagnant process, but one that evolves to meet the needs of an everchanging society. Media attention focuses not on the successes of education, but on the apparent shortcomings. The rising number of dropouts and graduates who enter the work force unprepared have become the public's concern. So once again, education is seeking methods to meet student needs. Student learning styles is one method being explored. Learning style is a method of individualizing instruction at little or no cost. This study investigated the matching of student learning styles and teacher teaching styles in an effort to improve student outcomes.

The attempts made to improve the quality of education are described throughout the history of education. The historical descriptions illustrate that change and improvement have been a continual process. Improvements are found in curriculum revisions, adaptations of new teaching methods, and new organizational patterns for schools.

The past six decades have emphasized various educational themes for school improvement. In particular, the last three decades have seen curriculum revisions in almost all subject matter areas. The changes made in the 1960s have had a profound effect on American

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education. In the early 1960s, the emphasis for change was in science because of the post-Sputnik panic. The science curriculum formulated a wider variety of course offerings and a greater scope for science in the total curriculum. Within a short period of time, new curricula were developed in other subject areas--the New Math, Project English, and social studies. These changes were made under the assumption that if the right things were taught, then students would be able to compete globally. Unfortunately, subsequent research indicated that the "new things" were being learned no more effectively than the "old things" (Anderson, 1979).

With unfavorable research findings, the emphasis was changed for the latter half of the decade of the 1960s to instructional improvement through the use of different methods of presenting materials. Teaching machines, programmed texts, problem-solving, and individualized instruction were some of the different methods tried. In addition to classroom presentation changes, new organizational patterns for schools were developed. These patterns included formal structured classrooms, informal-unstructured classrooms, modular scheduling, open classrooms, and a school-within-a-school. Individualized instruction was also developed in the form of modular scheduling (Thomson, 1971), variable grouping (Ringis, 1971), and non-gradedness (Rollins, 1968). All tried to improve the quality of education. Individualized instruction has been further refined to include individualized programs. The basis for these special programs was the application of behavioral objectives. This form of individualization has received so much interest that objectives are

being pooled in banks to facilitate their use (Popham, 1971).

Another method of individualized instruction is to use different instructional strategies with different students. Programmed instruction (O'Day, 1971), computer-assisted instruction (Bundy, 1968), and independent study (Lonnon & Bodine, 1971) are examples of such strategies. This trend continued to grow and develop in the late 1960s and early 1970s. Individually Guided Education (IGE), Individually Prescribed Instruction (IPI), Program for Learning According to Needs (PLAN), and Learning for Mastery (LFM) were created in this period (Anderson, 1979). While all of the above methods have added to the body of knowledge concerning individualized instruction, they have met with only limited success. The search continues for a method to improve student outcomes that is generalizable to a variety of educational settings and needs. Learning styles emerges as a key element in the movement to make learning and instruction more responsive to the needs of the individual learner.

Before individualized instruction strategies could be utilized appropriately, an assessment of individual learner characteristics was needed. Instruments that measured reading ability, level of mental development, socioeconomic background, interests, learning styles, and others have been developed. Despite the ability to identify these traits for each individual, little evidence exists to substantiate any relationship between students possessing certain characteristics and particular instructional strategies (Allen, 1973). Isaac and Michael (1981) agreed that "instead of seeking

general principles of education applying to everyone, seek empiri-
cally established principles about how to deal with people of par-
ticular types" (p. 216). Kemp (1971) reasoned that since research
has shown that students learn in different ways, the next generation
of research efforts should determine why "some students find certain
teaching strategies more appealing and effective than others"
(p. 17). The research on learning style and teaching style has been
a direct result of this line of thinking.

Since the mid-1970s, many research efforts have studied learn-
ing styles. Gregorc's (1979) Style Delineator is a self-assessment
of an individual's learning style. The work of Dunn and Dunn
(1975a) and Gregorc (1979) led to the development of the Learning
Styles Inventory. Kolb's (1976) Learning Style Inventory is direct-
ed to secondary students and adults. The National Association of
Secondary School Principals (NASSP) established a task force to
review learning styles. Their research resulted in the Learning
Style Profile (Keefe & Monk, 1986a).

The knowledge of learning styles gives the teacher another key
to understanding students.

> Interviews have also revealed that the instructional mate-
> rials and techniques used by teachers have a direct effect
> on many students. If the approach fit the preferred
> learning mode, the learner usually reacted favorable. If,
> on the other hand, the methods were mismatched, the stu-
> dents "worked hard to learn," "learned some and missed
> some materials," or "tuned out." Could it be that the
> most successful students in a given classroom happen to
> possess learning preferences of the teachers? We believe
> this to be so. (Gregorc & Ward, 1977, p. 24)

Teachers are the single most important element in the school; more important than the quality of the facilities, the quality of the equipment and materials, or the level of financing (Davies, 1970). If teachers are the single most important element in schools, then the question should be asked, "What is there about the teacher that determines why this is the most important single element?" (Witkin, 1973, p. 2). Literature on learning and teaching styles suggests the match or mismatch of styles between teacher and student may determine how well they get along, with important consequences for the learning process. An increasing number of studies are investigating the effect of matching student learning style and teacher teaching style on academic development.

Statement of the Problem

The main purpose of this study was to determine if matching student learning style and teacher teaching style would result in any difference in achievement of students in the classroom as measured by the number of students receiving credit in ninth grade world history classes.

Specifically, the assessment of the students' learning style and teacher teaching style was determined. Performance was determined by the final grade each student was assigned at the end of a 20-week semester.

Specific objectives of this study were:

1. To determine whether students whose match between the auditory component of the Learning Style Profile and the auditory

component of the teachers' Learning Style Profile are more success-
ful in passing the course than students and teachers who do not
match.

2. To determine whether students whose match between the
visual component of the Learning Style Profile and the visual compo-
nent of the teachers' Learning Style Profile are more successful in
passing the course than students and teachers who do not match.

3. To determine whether students whose match between both the
auditory and visual components of the Learning Style Profile and
both the auditory and visual components of the teachers' Learning
Style Profile are more successful in passing the course than stu-
dents and teachers who do not match.

Significance of the Study

The goal of educators is to maximize student learning. Indi-
vidualizing instruction is one method used to meet this goal. At-
tempts to individualize instruction have produced many organiza-
tional changes. Some of these changes include teaching machines,
programmed texts, modular scheduling, open classrooms, variable
grouping, and nongradedness.

Before new strategies can be implemented, more knowledge about
the individual student is needed. The need to understand how a
student learns brought about the development of learning style as-
sessments. Learning style consists of how a learner perceives,
interacts with, and responds to the learning environment. It is
demonstrated in that pattern of behavior and performance by which an

individual approaches educational experiences (Keefe & Languis, 1983). Knowledge of student learning styles provide teachers with important information about individual students.

Information about learning styles has a direct implication on how subject matter should be presented. The way in which subject matter is presented determines a teacher's teaching style. This study examined if matching student learning style and teacher teaching style improved student success in passing a course.

At the district level, results of this study can provide information to help reduce the number of failing grades earned by ninth-grade students. Implications of this study are also generalizable to other districts for the following reasons:

1. Most high schools have similar organizational structure.

2. Information gained from the identification of learning styles will aid school personnel in developing individualized educational programs for students.

3. Matching learning styles and teaching styles is another tool for working with at-risk students. Potential dropouts may experience success if teachers teach to students' learning styles.

4. Matching learning styles and teaching styles is a model for instruction not dependent on grade level or subject.

Definition of Terms

In this study, the independent variable was the match between students' learning style as measured by the Learning Style Profile and teachers' teaching style also measured by the Learning Style

Profile.

The dependent variable was the number of students receiving credit in ninth-grade world history classes. Ninth-grade world history was selected for study for the following reasons.

1. World history is a required class for ninth graders. By 10th grade many students reach the dropout age of 16 years old.

2. It is essential for at-risk students to meet success in required classes to stay in school.

3. World history is representative of the cognitive demands of other required classes.

4. Class lists are computer generated for world history and represents a cross section of ninth graders as opposed to ability grouping found in math classes.

The following variables are defined operationally:

Style: A pervasive quality in the behavior of an individual. A quality that persists even when cognitive demands are changed (Blue, 1981).

Learning style: According to Keefe and Languis (1983), the NASSP Task Force has defined learning style as:

> the composite of characteristic cognitive, affective, and
> physiological factors that serve as relatively stable
> indicators of how a learner perceives, interacts with, and
> responds to the learning environment. It is demonstrated
> in that pattern of behavior and performance by which an
> individual approaches educational experiences. Its basis
> lies in the structure of neural organization and personal-
> ity which both molds and is molded by human development
> and the learning experiences of home, school, and society.
> (Keefe & Languis, 1983, p. 2)

For the purposes of this study, learning style was categorized as: (a) auditory, (b) visual, or (c) both. The Learning Style Profile Examiner's Manual (Keefe & Monk, 1986b) defines these terms as follows: (a) auditory: perceptual response--initial reaction to information as auditory response; (b) visual: perceptual response--initial reaction to information as visual response; and (c) both: auditory and visual perceptual responses are equal.

Match/no match: Using the auditory and visual subscores of the Learning Style Profile, there is a match of styles when the student and teacher subscores are the same. If the student and teacher subscores do not agree, there is a no match of styles.

Pass/fail: To receive credit, as determined by district standards, a student must receive the report card grade of A, B, C, or D. Failure is determined by the report card grade E.

Teaching style: A dominate pattern of behavior and method of approach as used by teachers in the classroom. This includes a teacher's personal behaviors and the media used to transmit to or receive data from the learner. "Teachers tend to teach by the way they learn unless there is a conscious effort to do otherwise" (Kmaak, 1983, p. 11).

Statement of Assumptions

The following assumptions are necessary to the study effort:

1. The conceptual framework outlined in the Learning Style Profile serves as a model for assessment of learning style of both students and teachers.

2. The reliability and validity factors of the instrumentation of the NASSP (Keefe & Monk, 1986a) Learning Style Profile are sufficient and comparable to similar learning style assessments.

3. The selection of subject matter in and of itself did not affect the treatment significantly.

4. Grades were indicators of the student's degree of success (receiving credit) in any given class.

5. Variables not assessed or controlled in this study were uniformly distributed over the entire sample.

Limitations of the Study

1. The study was limited to all ninth-grade world history students and their teachers in one selected suburban school district.

2. The results and implications from the data were restricted to grades as the sole determining factor of achievement.

3. Only those variables, auditory, visual, or both, that constitute a match or no match between the teachers' and the students' style related to semester grades assigned to each student were considered in this study.

Organization of the Study

The remainder of this study is organized as follows:

An historical background of the development of learning styles in education is given in Chapter II. A number of learning styles inventories are reviewed. Teaching style and related research are discussed.

Described in Chapter III is the methodology used in this study. Instrumentation identification, reliability, and validity are discussed. Data collection and analysis are detailed.

Explained in Chapter IV are the matching techniques utilized in this study. Statistical analysis is explained and displayed in appropriate charts and graphs.

The study is summarized in Chapter V. A brief review of the paper, conclusions resulting from statistical analysis, and recommendations for further research are made.

Chapter Summary

This chapter contains an overview of the study. The overview includes a history of school improvement, specific programs for individualizing instruction, and the development of learning style assessments. Also included is a statement of the problem, the significance of the study, a definition of terms, statement of assumptions, limitations of the study, and the organization of the study.

An historical background of the development of learning styles in education is given in Chapter II. A number of learning style inventories are reviewed. Teaching style and related research are discussed.

CHAPTER II

REVIEW OF THE LITERATURE

The intent of this chapter is to review literature pertinent to learning styles and teaching styles. The review of literature is divided into the following areas: historical background, learning style inventories, and teaching style. The research hypotheses are also presented.

Historical Background

The development of educational strategies appears to have evolved in 10-year cycles. The progressive educators of the 1930s worked with the needs of the child. The war times of the 1940s saw a curriculum that was society-centered. The 1950s and early 1960s was a time of "structure of the (subject) discipline" (Keefe, 1987, p. 2) approach. The late 1960s and 1970s emphasized the humanistic approach in schools throughout the curriculum. The decade of the 1980s stressed the themes of back to basics and educational account-ability (Keefe, 1987). The early 1990s appear to be emphasizing student development in critical thinking, problem solving, decision making, and real world application. The proper identification of learning styles may provide teachers with the necessary tools to help students learn better while providing rationale to substantiate decision making.

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The concept of how people learn, learning style, is not a new one. Early Greek and Roman philosophers formulated ideas about learning that influenced educators for centuries. Aristotle's mnemonic techniques of association and visual imagery are used today, and the Greeks' classification of temperaments has been a basis for the work on personality types for the past 50 years (Cornett, 1983).

At the turn of the century, German psychologists discussed cognitive style. In the early 20th century, Montessori (cited in Semple, 1983) developed materials to promote sensory and motor development. Allport (1937) used the word style in his work of the 1930s and Witkin (1954) began his work in perceptual styles in the 1940s.

During the 1970s, Witkin (1973) published the Group Embedded Figures Test; Hunt (1971) developed the Paragraph Completion Method; Gregorc (1979) formulated the Gregorc Style Delineator; Dunn, Dunn, and Price (1975) designed the Learning Style Inventory; and Hill and Nunney (1971) explored Educational Cognitive Style. The term learning styles emerged in the 1970s.

Learning styles are defined as "characteristic, cognitive, affective, and physiological behaviors that serve as relatively stable indicators of how learners perceive, interact with, and respond to the learning environment" (Keefe, 1979, p. 16). The three elements of learning styles--cognitive, affective, and physiological/environmental domains--are defined as follows: The cognitive aspects consider the way one decodes, encodes, processes, stores, and retrieves information. These aspects represent ends of the continuum and individuals usually fall somewhere between. The

affective part of learning style includes emotional and personality characteristics related to such areas as motivation, attention, losses of control, interests, willingness to take risks, persistence, responsibility, and sociability. An educator's knowledge of this aspect of learning style will indicate whether intrinsic reinforcement or extrinsic rewards are best for students. Another portion of the affective aspect is the type of group or individual with which a person learns best, given a particular task. The physiological aspects are easiest to understand but should not be overemphasized. The physiological part includes sensory perception (visual, auditory, kinesthetic, taste, and smell), environmental characteristics (noise level, light, temperature, and room arrangement) need for food during study, and times of day for optimum learning (Cornett, 1983).

With the present state of research and instrumentation, it is impossible to evaluate students on all these characteristics. However, it is important to understand how the cognitive, affective, and physiological dimensions are related to learning style.

Table 1 is a summary of the major cognitive, affective, and physiological styles. Inclusion of a style is based on the present level of significance of its research, its conceptual importance, or its practical utility. The styles that seem to have the greatest implication for improving the learning process have been marked with an asterisk.

Learning style emerges from this picture as a key element in the movement to make learning and instruction more responsive to the

Table 1

Student Learning Style

Cognitive styles	
Reception styles	Concept formation and retention styles
*Perceptual modality preferences	*Conceptual tempo
*Field independence vs. dependence	Conceptualizing styles
Scanning	Breadth of categorizing
Constricted vs. flexible control	Cognitive complexity vs. simplicity
Tolerance for incongruous or unrealistic experiences	*Leveling vs. sharpening
Strong vs. weak automatization	
Conceptual vs. perceptual-motor dominance	

Affective styles	
Attention styles	Expectancy and incentive styles
*Conceptual level	*Locus of control
Curiosity	*Achievement motivation
Persistence or perseverance	Self-actualization
Level of anxiety	Imitation
Frustration tolerance	Risk taking vs. cautiousness
	Competition vs. cooperation
	Level of aspiration
	Reaction to reinforcement

Table 1--Continued

Affective styles

Attention styles	Expectancy and incentive styles
	*Social motivation
	Personal interests

Physiological styles

---

*Sex-related behavior

Health-related behavior

Time-of-day rhythms

Need for mobility

Environment elements

Note. The asterisk denotes those styles that seem to have the greatest implication for improving the learning process.

Note. Summary of information from Student Learning Styles: Diagnosing and Prescribing Programs (pp. 14-17) by J. W. Keefe, 1979, Reston, VA: National Association of Secondary School Principals.

needs of individual students. Learning styles in this larger context have been defined as characteristic cognitive, affective, and physiological behaviors that serve as relatively stable indicators of how learners perceive, interact with, and respond to the learning environment. Cognitive styles are information-processing habits, affective styles, and motivational processes. Physiological styles are biologically-based response modes.

Learning Style Inventories

The variety of instruments available to determine learning styles are explored in the next section. Learning style tests assess cognitive, affective, or physiological concepts. There are two categories of these tests: theoretical and practical. Theoretical tests are used to examine only one concept, while practical tests are used to examine more than one concept.

Theoretical Tests

People in Society Scale

Rotter (1966) developed the People in Society Scale (Internal/ External). This questionnaire is used to find out how people react to certain important events that they experience in society. The responses indicate whether or not a person believes that rewards are contingent upon his or her own behavior. The paper-and-pencil test can be administered in groups or individually. There are 29 items in a force-choice format. The items attempt to sample Internal/ External (I/E) beliefs across a range of conditions, such as interpersonal situations, school, government, work, and politics. Low scores indicate feelings of internal control, while higher scores are a sign of external control.

Group Embedded Figures Test

Witkin (1954) conducted a major investigation of cognitive style at Brooklyn College. Witkin's study described the dimension of field

dependence/independence. Field dependence is a dimension of cognitive style. Individuals who display field dependence tend to have difficulty separating field from ground, are inclined to respond to a stimulus as a whole, tend to be dependent on others, and are socially oriented. The field independence dimension describes individuals with the following characteristics: can perceive items as discrete from their background, can reorganize an already organized field, can provide structure to unstructured material, tend to be articulate when describing themselves and their experience, and tend to be independent. Field dependent individuals have global style, while field independent persons are analytic.

The concept of field dependence/field independence was tested in the Group Embedded Figures Test (GEFT) developed by Witkin, (1954) and later revised. The paper and pencil test was designed to determine how a student perceives and processes information. Students are required to locate eight simple geometric figures hidden within 25 progressively more complex figures and then to trace the outlines of the forms. An 18-point continuum reflects that degree of recognition of the embedded figures while identifying students as field dependent or field independent. A high score reflects an analytic individual, while a low score is a global or nonanalytic individual.

The Paragraph Completion Method

Hunt (1971) developed an instrument for assessing the conceptual level of students called the Paragraph Completion Method (PCM).

Students in Grade 6 through adult level are expected to provide a clear and sincere response to each of six topics. A response is considered at least three complete sentences (Hunt, 1975). The six stimuli topics are: (1) what I think about rules, (2) when I am criticized, (3) what I think about parents, (4) when someone does not agree with me, (5) when I am not sure, and (6) when I am told what to do (Hunt, 1975).

Hunt (1973) indicated that the PCM is a semi-projective test which requires scoring by a trained rater. A person's response is considered to be an indication of how he or she thinks and the scoring procedure is aimed to index his or her thinking on the conceptual level dimension. The topics were selected in order to obtain a sample of how one handles conflict or uncertainty and what he or she thinks about rule structure and authority relations.

The responses to the six stimuli topics are assigned to at least one of four levels of conceptual maturity which combine modes of self-definition with perceptual and behavioral characteristics. In summary, Hunt's (1973) four levels include: (1) Stage 0--self-protective; (2) Stage 1--life experience based on absolute cultural prescription; (3) Stage 2--beginning of self-delineation; and (4) Stage 3--self-distinctive, clear perception of difference between self and others.

Based on student test scores, trained raters place students on a distinguishable level of conceptual maturity. The conceptual maturity of a student is then used to develop an appropriate educational approach. The four considerations used by the raters are:

(1) the conception of the learner's cognitive characteristics based on his responses to the PCM; (2) the conception of the environment, or the educational approaches comprising such alternatives as high/low structure, lecture/independent study, and global/analytic presentations; (3) the conception of the interactive process of theory of instruction; and (4) the desired change or educational objectives. This third area of consideration, theory of instruction, is the most crucial according to Hunt (1975). The conceptual level, in terms of learning style, is a developmental phenomenon which ranges from the "unsocialized" to the "independent" (Kmaak, 1983, p. 14). Using a student's conceptual level of maturity, teachers can determine how much structure the student needs in order to learn best.

Field Dependent/Field Independent

Kagan (1965) investigated the field dependent and field independent person. Field dependent persons are those with a global environmental view, meaning that they tend to perceive all elements within the environment as having an influence or relationship with each other. These field dependent individuals view objects and ideas in their context or surroundings. They are rational and subjective and prefer social studies and the humanities. The field independent individuals tend to perceive all elements within the environment as distinct entities in themselves--as being separate and relatively independent from each other. They view objects and ideas apart from the whole. The field independent person is defined

as being an analytical and objective person who controls his or her own environment. His or her favorite subjects are the sciences and mathematics. Kagan, in his study of the way learners form concepts, concluded there are "impulsive" learners who quickly move to conclusions, and "reflective" learners who carefully spend time considering various possibilities. He defined style as being "thematic"--global approach, or "analytic"--looking at parts and how they fit together.

Gregorc Style Delineator

Gregorc (1979) defined learning style as "the distinctive behaviors which serve as indicators of how a person learns from and adapts to his environment" (p. 234). Using this definition and phenomenological analyses, Gregorc developed the Gregorc Style Delineator to permit individuals to self-assess their learning style pattern and preferences.

The Gregorc Style Delineator establishes four sets of learning style patterns: concrete sequential, abstract random, abstract sequential, and concrete random. The concrete sequential (CS) style reflects a preference for order, precision; schedules; physical, hands-on experiences; and a product-based effort. Emotional sensitivity; physically pleasing environments; strong relationships with others; and flexibility in time, activities, and demands characterize the abstract random (AR) style. Abstract sequential (AS) styles prefer intellectual and vicarious experiences and value logical, rational, theoretical, and analytical approaches to the world. The

concrete random (CR) style looks to the physical world as the opportunity to develop and utilize creative and original problem-solving talents, looks for and gives out options, demands independence, and wants to invent new ideas or products--to create the unexpected. Research by Butler (1984) using the Gregorc Style Delineator indicates the matching of student learning preferences and instructional preferences are the most successful with students. A mismatch, if not controlled, can lead to lower self-concept and poor learning.

Managerial Decision-Making Process

McKenney and Keen's (1974) model develops a managerial decision-making process. This process follows instruments used and ideas discussed in learning styles. The author defined problem solving and decision making in "terms of the process through which individuals organize the information they perceive in their environment, bring to bear habits, and strategies of thinking" (McKenney & Keen, 1974, p. 79). McKenney and Keen's theory seems to parallel those related to or used to define learning style. The model's reporting structure is a four-scale format addressing specifically information gathering and information processing. These two areas are addressed on a scale that determines one's tendency toward predominance to perceptive or receptive modes. Perceptive individuals focus on relationships between items and look for deviations from or conformities with their expectations. Receptive thinkers are sensitive to the stimuli itself and focus on detail rather than relationships. Receptive individuals derive the attributes of the

information from direct examination rather than from fitting it into their precepts. The information processing is related to problem solving and is identified as systematic or intuitive. The systematic individual approaches a problem by structuring it into some logical procedure or some method. Intuitive thinkers usually avoid committing themselves to a formalized structure. They are more sensitive to cues and are willing to jump from one method to another and to discard information if the cues seem to indicate a change would be better.

Learning Style Inventory

Kolb (1976) described learning style as the consequence of hereditary traits and past experiences in combination with the demands of the present environment to create preferences in one of four learning modes. These modes are concrete experience (CE), reflective observation (RO), abstract conceptualization (AC), and active experimentation (AE). The modes, or learning styles, are defined as the converger whose greatest strength lies in the practical application of ideas; the accommodator whose greatest strength lies in doing things--in carrying out plans and experiments--and involving oneself in new experiences and tending to excel in those situations where one must adapt oneself to specific and immediate circumstances; the assimilator who excels in the ability to create theoretical models; and the diverger who possesses a high degree of imaginative ability--can view concrete situations from many perspectives. All individuals tend to approach learning tasks as defined

by all four scales; however, it is the combination of one's preferences by degree that determines which basic learning style type the person most nearly fits. The use of this theory requires the design of instructional materials that develop strengths and encourage the strengthening of nondominant preferences.

Practical Tests

Practical tests are another type of learning style inventories. Practical tests examine more than one concept: cognitive, affective, or physiological.

Edmonds Learning Style Identification Exercise

The Edmonds Learning Style Identification Exercise (ELSIE) was developed by the Edmonds School District in 1969 for use in an individualized foreign language program. The test provides a profile of students' preferred perceptual styles based on patterns of responses to 50 common English words (Reinert, 1977). The results were placed in one of four individual categories: visualization, written word, listening, and activity.

These four categories are defined as follows:

1. Visualization--the relative importance to the learner of actually seeing objects and activities in order for him or her to learn.

2. Written word--distinguished from the first by noting whether a person will get more detail from a certain incident by seeing the event occur or by reading a description of the event.

3. Listening--indicates the degree to which the person is able to learn from hearing the spoken language without recourse to some other mode.

4. Activity--represents the relative importance of some manner of physical activity in the learning process (Reinert, 1977).

The test results are used to recommend effective study techniques for individual students. Students are encouraged to develop weak areas of study through exposure to all four areas. The test results also provide the teacher with a reminder to vary presentation techniques.

Learning Style Inventory

Canfield's (1977) Learning Style Inventory scores what he termed the "four major areas of importance in examining a learner's preference for learning" (p. 23). The four areas are: conditions, content, mode, and expectancy. The scales under conditions reflect a concern for the dynamics of the situation in which learning occurs. These subscales include one's preferences for working closely with peers, with the instructor, or working independently; a preference for organization, details, opportunity for competition, goal setting, and viewing the instructor as an authority. The content scales are related to one's area of interest and assess a preference for numeric--working with numbers; qualitative--working with words or language; inanimate--working with things as in buildings and repairing; and people--working with people as in interviewing. The scales related to modes indicate the general modality through which

the individual prefers to learn. The modalities are termed listen-ing-reading; iconic which is defined as getting information through movies, slides, pictures, and graphs; and direct experience which is handling or performing (hands-on experience), laboratory, and field trips. The expectancy scale deals with how well the individual expects to achieve. The four scales indicate whether the person expects to achieve at a superior level, an above-average level, or a below-average level.

Learning Styles Inventory

Dunn and Dunn (1975a) have completed extensive research in the area of learning styles. Dunn and Dunn's work is based on the as-sessment of students' preferences related to elements in four areas. These areas are: (a) immediate environment (sound, light, tempera-ture, and design); (2) own emotionality (motivation, persistence, responsibility, and need for structure or flexibility); (3) socio-logical needs (self, pair, peers, team, adult, or varied); and (4) physical needs (perceptual, strengths, intake time, and mobility) (Kmaak, 1983). Dunn and Dunn's model is based on the notion that matching student learning styles to instructional methodologies (teaching styles) is an effective means of enhancing learning. According to Dunn and Dunn (1978):

> Several research studies have demonstrated that (1) stu-dents can identify their own learning styles; (2) when exposed to a teaching style consonant with the ways they believe they learn, students score higher on tests, fact knowledge, attitude, and efficiency than do those taught in a manner dissonant with their style; and (3) it is

advantageous to teach and test students in their preferred modalities. (pp. 4-5).

Dunn and Dunn's work indicates that "teachers tend to teach in the style in which they prefer to learn and that they prefer to teach students who demonstrate their own preferred learning style" (Kmaak, 1983, p. 11). Dunn et al. (1981) developed an assessment instrument called the Learning Style Inventory to further explore this theory.

Myers-Briggs Type Indicator

The Myers-Briggs Type Indicator (Briggs & Myers, 1977) is a measure of personality disposition and preferences based on Jung's theory of psychological types. Jung theorized there were two bipolar mental processes (sensing-intuition and thinking-feeling) and two fundamental orientations to life (extraversion and introversion). The Type Indicator has an additional dimension (judgment-perception) to identify the dominant mental process. These four indicators form a matrix of 16 types.

The cognitive dimension of learning styles is found in the sensing versus intuition section of the test. The affective elements of learning style are explored in the thinking versus feeling and extraversion versus introversion portions. The fourth element, judging versus perceiving, is affective or cognitive.

Considering the 16 personality types, one must consider the dominant mental process in each personality. If the dominant process is considered, teachers can present materials to the students' style. For example, if thinking is dominant, students will thrive

on logically organized materials and respond best to teachers who are well organized. If the match doesn't exist, the students cannot bring their best energies and efforts to the learning tasks.

Cognitive Style Mapping

Cognitive Style Mapping is a diagnostic prescriptive technique used to identify and describe an individual's preferred learning style. The original model was developed by Hill of Oakland Community College in the late 1960s (Hill, 1975).

Students are administered the test, the Q-Sort List, to determine the cognitive style map. The map reflects an individual's (student's) cognitive style. Knowledge of one's cognitive style provides ways of acquiring meaning and understanding strengths and weaknesses. The information allows the student to build an individualized (personalized) program of instruction (Hill, 1975).

The cognitive style of an individual is described by three sets of elements: symbolic mediation, cultural determinants, and modalities of inference. Symbolic mediation is defined as "a student's tendency to use certain types of symbols, one's ability to understand words and numbers, qualitative sensory symbols, qualitative programmatic symbols, and qualitative codes" (Hill, 1975, p. 4). Cultural determinants are family, peers, and personal style. The set called modalities of inference refers to the way individuals reason: categories, differences, relationships, or all three. The interaction of these three areas determines an individual's cognitive style.

Learning Style Profile

In late 1982, the National Association of Secondary School Principals (NASSP) convened a Learning Styles Task Force. The Task Force (Keefe & Languis, 1983) defined learning style in this manner:

> the composite of characteristic cognitive, affective, and physiological factors that serve as relatively stable indicators of how a learner perceives, interacts with, and responds to the learning environment. It is demonstrated in that pattern of behavior and performance by which an individual approaches educational experiences. Its basis lies in the structure of neural organization and personality which both molds and is molded by human development and the learning experiences of home, school, and society. (Keefe & Languis, 1983, p. 1)

This definition is the basis of the Learning Style Profile (LSP) instrument developed by the Task Force (Keefe & Monk, 1986a). The LSP contains 23 independent scales that represent four higher order factors: cognitive skills, perceptual responses, study preferences, and instructional preferences (Keefe & Monk, 1986b). The test is intended to help teachers understand students by knowing the strengths and weaknesses of their students' learning styles. The knowledge of student learning style can help teachers organize instruction in a more effective and efficient manner. This one-hour 280-item test is designed for use in Grades 6 through 12.

The National Association of Secondary School Principals Learning Style Profile is the best theoretical model available at this time (Laffey, 1990). This instrument was selected for the study. It summarizes the latest research on learning styles and is targeted for the appropriate population.

Teaching Style

As the individual learner brings a unique style to the class-
room, so does the teacher. The teaching techniques used determine a
teacher's style. That style sets the tone for classroom learning.
Teachers communicate their subject matter in a way that is most
compatible with their learning style (Heikkinen, Pettigrew, &
Zakrajsek, 1985, p. 80).

Teaching style consists of a teacher's personal behaviors and
the media used to transmit to or receive data from the learner.
Teacher behaviors and media used place demands upon the learner to
align his or her style to the method of instruction. The individual
learner is more apt to show success when his or her style is similar
to the learning style of the teacher. Students may struggle when
their learning style is dissimilar to that of the teacher. Specific
instrumentation to determine teaching style is very limited. Most
researchers identify teaching style by the same instrument used by
students to determine learning style. For example, Cafferty (1980/
1981) and McAdam (1971) used Cognitive Style Mapping to determine
the match between teaching and learning style.

The results of a study conducted by Heikkinen et al. (1985)
states that there is a "need for a broader understanding of individ-
ual learning styles or preferred conditions for learning. The im-
portance of a pluralistic approach to teaching cannot be overstated
if maximizing the learning process is a major goal of teacher educa-
tion" (p. 85).

Research Hypotheses

Research demonstrated the existence of learning styles and their relationships to human behavior and performance within an environment. Specifically, selected researchers reported strong relationships among individual learning style, instructional environments and processes, and academic achievement (Carbo, 1980; Cronbach, 1975; Cronbach & Snow, 1977; Dunn & Dunn, 1975b, 1976, 1978, 1979; Glaser, 1972; Hunt, 1971, 1973, 1975; Krimsky, 1982; Lynch, 1981; Pizzo, 1981; Tanenbaum, 1982; White, 1980/1983).

Emerging recognition of the key role of individual differences within the educational process has spawned divergent research designed to investigate the relationships between learning style and such elements as instructional environment, teaching style, instructional methods, and student attitudes and achievement. The data that emerged from those investigations legitimized the prominence of learning styles as an important factor in the judicious, competent education of all youngsters. Pioneering researchers have evidenced significant, supportive findings in a number of areas of learning style theory.

The existence of learning style characteristics unique to each individual has been clearly demonstrated by Cafferty (1980/1981); Copenhaver (1979/1980); Dunn, Dunn, and Price (1979); Griggs and Price (1980); Messer (1979/1980); Robertson (1977/1978); Scerba (1976); Tallmadge and Shearer (1971); and White (1980/1983).

The development and utilization of reliable instruments to identify and discriminate effectively between the learning style characteristics among individuals and groups and to predict academic performance based on matching style with instructional techniques have been the subject of investigations by Dunn, Dunn, and Price (1977, 1978, 1981), Dunn, Dunn, Price, and Saunders (1979), Griggs and Price (1980), and Messer (1979/1980).

Through the establishment of instruments to identify learning style characteristics, researchers reported that students can identify their own learning styles and, as a result, can be matched with complementary instructional techniques to increase their academic achievement (Domino, 1970; Farr, 1971; Messer, 1979/1980; Rich & Bush, 1978). Martin (1977) and Robertson (1977/1978) conducted studies which revealed that through learning styles it was possible to choose instructional programs which facilitated optimal student achievement.

The matching of instructional methods with an individual's learning style was the focus of investigations by a number of individuals. Those studies verified that matching increased academic performance (Cafferty, 1980/1981; Carbo, 1980; Cheek, 1979/1980; Douglass, 1979; Kaley, 1977; Lynch, 1981; Martin, 1977; Tanenbaum, 1982; Trautman, 1979). This investigation of matching student learning style and teacher teaching style duplicated previous efforts for the following reasons: (a) increase student success, thereby minimizing failures for students at risk; (b) aid school personnel in planning individualized educational programs for

students; (c) inform teachers of individual learning styles so adjustments in instruction can be made; (d) suggest alternate approaches of grouping to school personnel; and (e) add to the body of knowledge of learning style and teaching style using different variables.

This study systematically describes the following hypotheses:

Hypothesis 1: If students whose match between the auditory component of the Learning Style Profile and the auditory component of the teachers' Learning Style Profile are more successful in passing the course than students and teachers who do not match.

Hypothesis 2: If students whose match between the visual component of the Learning Style Profile and the visual component of the teachers' Learning Style Profile are more successful in passing the course than students and teachers who do not match.

Hypothesis 3: If students whose match between both the auditory and visual components of the Learning Style Profile and both the auditory and visual components of the teachers' Learning Style Profile are more successful in passing the course than students and teachers who do not match.

Chapter Summary

In this chapter, a review of literature on learning styles, learning style inventories, and teaching style was discussed. The development of learning style inventories is examined in detail. These tests are grouped into two categories, theoretical and practical. Theoretical tests examine one concept: cognitive, affective,

or physiological.   Practical tests examine more than one concept: cognitive, affective, or physiological.

Research has established the importance of learning styles to education.   Studies have verified and reinforced the link between learning styles, teaching styles, and academic achievement.   Yet there has not been practical application of this information.   The purpose of this study was to investigate how local school districts could implement a program to improve individualized instruction by matching learning styles and teaching style.

Chapter III contains a discussion of the specific methodology of this study.

CHAPTER III

METHODOLOGY

As educators continue to seek methods to improve education in response to the public's criticism that students are not prepared for the workplace, increased attention is focused on students at risk. In one suburban school district, educators are disturbed by the number of failures in required classes. A pattern has been established for ninth-grade students wherein 50% of the class failed one or more required courses. Central administration and principals are working with teachers on strategies to reduce failures. One such strategy is the matching of learning style to teaching style.

This chapter contains a description of the method of study used to conduct the examination. Included in this chapter are five major areas: (1) the research design, (2) selection of subjects, (3) the instrumentation, (4) data collection, and (5) statistical analysis procedures.

Research Design

This descriptive study systematically tested the following null hypotheses:

Ho_1: There is no difference in student grades (pass/fail) in ninth-grade world history classes in the match/no match of the auditory component of the Learning Style Profile of student learning

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style and teacher teaching style.

Ho$_2$: There is no difference in student grades (pass/fail) in the ninth-grade world history classes in the match/no match of the visual component of the Learning Style Profile of student learning style and teacher teaching style.

Ho$_3$: There is no difference in student grades (pass/fail) in ninth-grade world history classes in the match/no match of both the auditory and visual components of the Learning Style Profile of student learning style and teacher teaching style.

Selection of Subjects

Community

Roseville, Michigan, is located in a tricounty metropolitan area. The 9.5 square mile suburb has a population of 51,412. The citizens are primarily Caucasian of European ancestry. The median income is $32,337.

Roseville is a residential community with 20,025 housing units, of which 14,571 are owner occupied. The median value of the owner occupied units is $55,400.

The commercial base of the community has 66 wholesale establishments, 370 retail establishments, and 310 service establishments. There is no major industry to provide a strong tax base (U.S. Department of Commerce, 1991).

School District

The school system has a student population of 6,601. These students are serviced by 10 elementary schools, Grades K-6; 2 junior high schools, Grades 7-9; and one high school, Grades 10-12.

Historically, Roseville is representative of many suburban school districts. The 1960s provided a period of rapid growth. Peak enrollment boasted 15,000 students with 18 elementary schools, 3 junior high schools, and 2 high schools.

The 1970s began a period of declining enrollment. Families matured and others moved from their starter homes out of the district. Roseville also experienced financial problems.

The 1980s have brought stabilization to the school population. Increased community support has been demonstrated in recent successful millages.

The 1990s have begun with a tone of uncertainty. School improvement projects continue to involve parents.

Students

The student subjects in this study are ninth graders taking the required world history class. World history classes represent heterogeneous grouping. The scheduling process is computer generated insuring the random selection of students into classes of similar size.

Teachers

The teachers of this study comprise four of the eight members of the social studies department. Teacher assignment is done by the administration and based on course work and North Central Association requirements. All participating teachers have been employed in the district a minimum of 20 years, hold at least a master of arts degree, and have a Michigan permanent teaching certificate.

Instrumentation

The instrument employed in this study was the National Association of Secondary School Principals' (NASSP) Learning Style Profile (Keefe & Monk, 1986a). This test was selected after evaluating several instruments which measure an individual's learning style. This instrument reflects the comprehensive research of the 1980s and provides identification of elements comprising an individual's learning style.

The instruments on learning style reviewed in Chapter II tend to fall into two categories—theoretical and practical or applied. The theoretical instruments group individuals into categories and the interpretation provides broad general definitions of the ways in which individuals perceive all elements of their environment. While the instruments do provide teachers with an understanding of how students perceive in different ways, they provide very little direction in the planning of instructional strategies to address the differences. Witkin (1973), Kagan (1965), Kolb (1976), Gregorc

(1979), and McKenney and Keen (1974) all have theoretical models.

The group of practical or applied learning style inventories assess those elements that an individual tends to prefer as a way of receiving information from his environment. These elements are directed towards specific items that can be interpreted into instructional strategies. Dunn and Dunn (1975a), Canfield (1977), Hill and Nunney (1971), and the NASSP (Keefe & Monk, 1986a) are inventories of this type.

The NASSP's (Keefe & Monk, 1986a) Learning Style Profile test is a 126-item self-assessment inventory. The student responses are scored to determine an individual profile. The 23 style factors comprising the individual profile provide the teacher with direction for planning instructional strategies for the student.

The NASSP National Task Force began the development of a learning styles instrument in 1983. The goal of the task force was to reflect the most recent research in developing this diagnostic tool.

The Learning Style Profile (LSP) piloted 424 items in three domains: cognitive, affective, and environmental. The final draft of 126 items reflects a readability level at Grades 5-6.

Generalizability

Kerlinger (1973) indicated a study can be generalized if this question is answered: "To whom and what can we generalize the results of this study?" (p. 324). The generalizability features of this study include:

1. All students learn.

2. Students approach learning in a style that is unique to them.

3. Learning styles are not dependent on socioeconomic factors.

4. The classes represent heterogeneous grouping based on randomized computer scheduling.

5. The instrument (LSP) used has been standardized using a population of over 2,500 students.

6. The student population of 215 represents 75% of the ninth-grade students enrolled in two high schools.

7. All world history teachers in two high schools participated in the study.

8. The study is generalizable to other subjects or grades. For example, the study could have been conducted using 10th grade English classes.

Instrument Validation

Validation and norming of the LSP was completed in 1986.

Several separate studies were conducted simultaneously to accomplish this task. In the first study, over 5000 students geographically distributed throughout the United States were given the field test version of the Learning Style Profile. Normative data were generated from this sample and the reliabilities of subscales determined.

Two studies were conducted to determine the test-retest reliabilities of the Learning Style Profile subscales. Additional studies examined the relationship of LSP subscales to "parent" instruments. One study compared the LSP Analytic Skill subscale with the Group Embedded Figures Test.[1] Another examined the relationship of the LSP Visual, Auditory, and Emotive Perceptual Response subscales to the Edmonds Learning Style Identification Exercise[2] subscales. A third study evaluated many of the Learning Style Profile preference and orientation

subscales in relation to similar scales on the Learning
Style Inventory.[3] (Keefe & Monk, 1986b, p. 2)

The validity of a test is a measure of its authenticity—
whether it measures what it is intended to measure. For this in-
strument, four types of validity were examined: face, content,
construct, and concurrent.

Face Validity

Face validity means only that a test seeks to measure what the
title indicates. The Learning Styles Task Force screened the appro-
priateness of scales and items on the LSP.

Content Validity

Content validity assesses the match between the content of a
test and the knowledge or skills it attempts to measure. The Learn-
ing Styles Task Force acted as a panel of experts to review the
literature of the field, compile an initial developmental list,
prepare operational definitions, and approve the final content of
each scale.

Construct Validity

Construct validity is concerned with the extent to which a test
measures a specific trait or construct.

> Learning style is such a construct. We cannot directly
> assess learning style but only its manifestations. Learn-
> ing style, conceptually, is a gestalt of cognitive, affec-
> tive, and environmental elements that vary from learner to
> learner. But learning style represents behaviors—skills,
> responses, and preferences—that can be measured. The

construct validity of the Learning Style Profile is an indicator of how well it assesses the varying learning styles of different students.

During the development of the Profile a great deal of emphasis was placed on scale and item conceptualization that would support strong construct validity. The Learning Styles Task Force identified and produced position papers on the most defensible elements of learning style. Extensive use was made of exploratory and confirmatory factor analysis in the field testing of the instrument to ensure the inclusion of concepts and items that exhibited strong factor loading and the exclusion of those that did not. Factor analysis is a computerized statistical technique for identifying the basic interrelationships among sets of test scores. It permits the research to evaluate whether the underlying dimensions of a test are those predicted by the theory. (Keefe & Monk, 1986b, p. 3)

Concurrent Validity

Concurrent validity is a measure of comparison of student scores on two or more comparable tests.

Several separate studies were undertaken to examine the concurrent validity of the Learning Style Profile. Specifically, LSP subscale scores were correlated with similar measures from the Group Embedded Figures Tests, and the Edmonds Learning Style Identification Exercise, and from the Learning Style Inventory. These three instruments served as models for the development of many of the Learning Style Profile subscales. (Keefe & Monk, 1986b, p. 4)

Instrument Reliability

The reliability of a test involves the consistency, dependability, or stability of a test score. This measure provides much the same results for the same group on repeated administrations.

Reliability of the Learning Style Profile was evaluated in two ways: First, internal consistency coefficients (Cronbach's alpha) were calculated for each subscale, using the data from the entire normative sample. Second,

test-retest reliabilities (r_{tt}) were calculated for each subscale from a smaller separate sample for 10-day and 30-day periods of time. An alternate Categorization Skill subscale was adopted as a result of the reliability studies and therefore no test-retest data are available for this subscale at this time.

The average internal consistency reliability for subscales is 0.61, with a range from 0.47 to 0.76. These reliabilities are acceptable for short tests specifically intended to collect initial diagnostic information. (Keefe & Monk, 1986b, p. 2)

Procedure

The Learning Style Profile (Keefe & Monk, 1986a) was administered to students in world history classes. The world history classes were designated because the population is primarily freshmen. Hours 3, 4, and 5 were selected to reduce the number of technical failures. Technical failures are those attendance situations described in the Student Handbook (Rollet, 1987) as mandating a failure. The students were administered the test by counselors with no prior explanation of the elements to be measured. Instructions were read by the counselor directly from the administration manual provided by the NASSP. The objective of testing, determination of their learning style, was explained to students. Students were administered the test in one 55-minute class period. No make-up tests were given. Similar procedures were used in all classes tested. At the end of the second semester, the pass/fail grades for each student in world history were obtained. The pass/fail of each student was then tabulated in relation to the match/no match of the learning/teaching styles.

Data Collection

Learning Styles

Learning styles were determined by the administration of Learning Style Profile (LSP, Keefe & Monk, 1986a). Learning styles are identified as auditory, visual, or both. The selection of these two constructs was based on the use of comparable test subscores of other instruments discussed in Chapter II and the ability of others to easily identify these two styles. The instruments discussed in Chapter II included the Group Embedded Figures Test (Witkin, 1954), the Edmonds Learning Style Identification Exercise (Reinert, 1977), and the Learning Style Inventory (Canfield, 1977). The correlation of subscale scores was less than .75 with a .002 level of significance (Keefe & Monk, 1986b). Therefore, the selection of the constructs of learning style, auditory, visual, or both, provided a strong statistical base for selection. Student tests were machine scored by Standardized Test Scoring, West Trenton, New Jersey.

Teaching Styles

Teachers tend to teach by the way they learn (Kmaak, 1983). Therefore, teaching style was determined by administering the NASSP Learning Style Profile (Keefe & Monk, 1986a) to the teachers. The NASSP Learning Style Profile instrument has not been validated for individuals past Grade 12. However, teaching style reflects an individual's learning style (Heikkinen et al., 1985).

Statistical Analysis

Descriptive research was used in this study. It describes and interprets what is. "It is concerned with conditions or relationships that exist; practices that prevail; beliefs, points of view, or attitudes that are being held; processes that are going on; effects that are being felt; or trends that are developing" (Best, 1970, p. 315).

The statistic used to analyze the nominal data of this research was the chi square. "Chi square is a means of answering questions about data existing in the form of frequencies rather than as scores or measurements along some scale" (Isaac & Michael, 1981, p. 177). Both variables (match/no match and pass/fail) are "discrete dichotomies" as defined by Hinkle, Wiersma, and Jurs (1979, p. 99). This statistic is appropriate for the hypotheses because of the criteria listed in Ary, Jacobs, and Razavieh (1985): (a) "Observations are independent," (b) "categories are mutually exclusive," (c) "observations are measured as frequencies," and (d) "expected frequencies are not too small" (p. 180).

When the fourth criterion from Ary et al. (1985) is not met, a special case of the chi square is used. The special case, the Fisher's exact test, must be used when the frequencies in any cell is less than five.

Isaac and Michael (1981) gave the following restrictions of the use of chi square:

1. Chi square can be used only with frequency data.

2. Chi square requires that individual events or measures are independent of each other.

3. In general, no theoretical frequency should be smaller than five.

4. There must be some logical or empirical bases for the way the data are categorized.

5. The sum of expected and the sum of observed frequencies must be the same.

6. The algebraic sum of the discrepancies between observed and the corresponding expected frequencies will be zero.

Methodological Assumptions

For the purpose of this study, the following assumptions were made:

1. Student learning styles at the age level examined will remain stable, especially for the short duration of the experimental period (Copenhaver, 1979/1980).

2. The selection of the subject matter, world history, in and of itself will not affect the treatment significantly.

3. Testing conditions are controlled.

4. Student selection represents heterogeneous grouping.

5. Teachers tend to teach in the style similar to their own learning style.

6. Grades are indicators of the student's degree of achievement in any given class.

Limitations of the Study

1. Subjects: The study was limited to ninth-grade high school students.

2. Instrument: Of the 23 elements of the Learning Styles Profile of the National Association of Secondary School Principals, only three, auditory, visual, or both, were considered in this study.

3. Dependent variable: The results and implications from the data are restricted to grades being the sole determining factor in achievement.

4. Single school district: While one school district was used, the findings are applicable to similar populations.

Chapter Summary

The methodology used in the study was discussed in this chapter. The match/no match of student learning style and teacher teaching style was investigated with respect to the pass/fail rate in ninth-grade world history classes.

Data collected for this study were obtained by the classroom administration of the Learning Style Profile to determine student learning styles and teacher teaching style. The correlation statistic chi square was used in this study. This procedure was used to determine if students are more successful in earning credit in ninth-grade world history classes when their learning style matches their teacher's teaching style.

Chapter IV contains the findings and analysis of the specified data collection procedures.

CHAPTER IV

ANALYSIS OF DATA

The purpose of this study was to investigate if matching student learning style and teacher teaching style increases student success as determined by the successful completion of the course (pass/fail). Chapter IV reports the analytical techniques used and the research findings.

Analytical Techniques

Four teachers and 215 ninth-grade students in a suburban high school participated in this study. Ninth-grade students in this district must take four required classes. Of these required classes, the only one that is made up of all ninth graders is world history. Therefore, the study focused on this class. Student success is determined by a student earning credit for world history (pass/fail).

Both teachers and students were administered the Learning Style Profile (Keefe & Monk, 1986a) to identify teaching/learning styles in visual, auditory, and both constructs. Test results were reported by a standard score. These scores are placed on the test scale indicator. The scale indicator is divided into four quartiles: weak/low, low average, high average, and strong/high. Student style and teacher style was determined to be a match if both scores placed

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in the same quartile.

Chi square is the statistic used in this study to analyze the data. According to Isaac and Michael (1981):

> Chi square is a means of answering questions about data existing in the form of frequencies, rather than as scores or measurements along some scale. Typically, the questions we want answered when we have such frequency data is whether the frequencies observed in our sample deviate significantly from some theoretical or expected population frequencies. The frequencies refer to the categories which we have classified our data. (p. 177)

Results

Ho_1: There is no difference in the proportion of students who match their teachers on the auditory component of the Learning Style Profile and those who pass that teacher's world history class.

The chi-square analysis performed on the data collected from 215 ninth-grade world history students who either matched (30 students) or failed to match (185 students) their teachers on the auditory component of the Learning Style Profile failed to support the hypothesized relationship between this match and those students successfully completing that teacher's class at an alpha level less than .05 (see Table 2).

This means that the difference between the observed and expected frequencies are not greater than those that would be expected by chance. That is, there exists no reliable evidence of a relationship between the matching of teacher/student styles on the auditory component of the Learning Style Profile and those students' successful completion of their teacher's world history class.

Table 2

Relationship Between the Percentage of Students Passing World
History and the Match With Their Teachers on the Auditory
Component of the Learning Style Profile

Group	Match		No match		Total	
	n	%	n	%	n	%
Pass	20	9.3	127	59.1	147	68.4
Fail	10	4.7	58	27.0	68	31.6
Total	30	14.0	185	86.0	215	100.0

Note. χ^2 = .047 (df = 1, α = .827).

Ho$_2$: There is no difference in the proportion of students who match their teachers on the visual component of the Learning Style Profile and those who pass that teacher's world history class.

The data were collected from 215 ninth-grade students who either matched (87 students) or failed to match (128 students) their teacher on the visual component of the Learning Style Profile. The chi-square analysis failed to support the hypothesized relationship between this match and those students successfully completing that teacher's class at an alpha level less than .05 (see Table 3).

The results indicate that the difference between observed and expected frequencies are not greater than those that would be expected by chance. This shows there is no reliable evidence of a relationship between the matching of teacher/student styles on the visual component of the Learning Style Profile and those students'

Table 3

Relationship Between the Percentage of Students Passing World
History and the Match With Their Teachers on the Visual
Component of the Learning Style Profile

Group	Match		No match		Total	
	n	%	n	%	n	%
Pass	61	28.4	86	40.0	147	68.4
Fail	26	12.1	42	19.5	68	31.6
Total	87	40.5	128	59.5	215	100.0

Note. χ^2 = .205 (df = 1, α = .651).

successful completion of their teacher's world history class.

Ho$_3$: There is no difference in the proportion of students who match their teachers on both the auditory and visual components of the Learning Style Profile and those who pass that teacher's world history class.

The data were collected for the auditory and visual components of the Learning Style Profile from 215 ninth-grade students who either match (6 students) or failed to match (209 students) their teacher's style. The chi-square analysis failed to support the hypothesized relationship between this match and those students successfully completing that teacher's class at an alpha level less than .05.

Fisher's exact test, a special case of the chi square, was used because the frequency in some cells was less than five (Ary et al.,

1985). This information is displayed in Table 4.

Table 4

Relationship Between the Percentage of Students Passing World
History and the Match With Their Teachers on Both
Auditory and Visual Components of the
Learning Style Profile

Group	Match		No match		Total	
	n	%	n	%	n	%
Pass	4	1.9	143	66.5	147	68.4
Fail	2	0.9	66	30.7	68	31.6
Total	6	2.8	209	97.2	215	100.0

Note. Fisher's exact test (df = 1, α = .617).

The results indicate that the difference between observed and expected frequencies are not greater than those expected by chance. This does not show a relationship between the matching of teacher/student styles on both auditory and visual components of the Learning Style Profile and those students' successful completion of their teacher's world history class.

Chapter Summary

The focus of this study was to determine if matching teacher teaching style and student learning style increased the successful completion of the course (pass/fail) by students.

The analytical techniques, the statistics used, and the research results with tables are discussed in this chapter.

The conclusions and recommendations for further study are discussed in Chapter V. A summary of the study is also included.

CHAPTER V

SUMMARY, DISCUSSION, AND RECOMMENDATIONS

Summary

Education is constantly in motion. The pressure for changes comes as a result of society and media demands. Education reacts to these pressures to develop new programs. Some educational changes have been in the area of curriculum, different methods of presentation such as computer-assisted instruction (Bundy, 1968) and independent study (Lonnon & Bodine, 1971), and individualized instruction.

While these changes have been tried, no one method is the perfect solution for educational reform. Educators continue to modify and work with concepts developed from these changes. One such concept is individualized instruction. Working to individualize instruction required some type of assessment. Assessment instruments such as measures of reading ability, level of mental development, socioeconomic background, interests, and learning styles have been constructed. As research on individualized instruction continues, one area of exploration is in learning/teaching style.

Historically, learning styles have been a part of educational thought since Greek and Roman times. Research has been concentrated on learning styles since the 1950s. Tests developed are found in two categories: Theoretical and practical. Some of the theoretical

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tests are: People in Society Scale (Rotter, 1966), Group Embedded Figures Test (Witkin, 1954), the Paragraph Completion Method (Hunt, 1971), Field Dependent/Independent (Kagan, 1965), Style Delineator (Gregorc, 1979), Managerial Decision-Making Process (McKenney & Keen, 1974), and Learning Style Inventory (Kolb, 1976). Practical tests include Edmond's Learning Style Identification Exercise (Reinert, 1977), Learning Style Inventory (Canfield, 1977), Learning Styles Inventory (Dunn & Dunn, 1975a), Myers-Briggs Type Indicator (Briggs & Myers, 1977), and Cognitive Style Mapping (Hill, 1975). Using the knowledge and format from previous tests, the Learning Style Profile was developed by Keefe and Monk (1986a) through the National Association of Secondary School Principals (NASSP).

The Learning Style Profile was used in this study to determine if the matching of student learning style and teacher teaching style will result in any difference in the pass/fail of students in ninth-grade world history classes. This investigation was done because of counselors' and administrators' concern for the high number of ninth-grade failures in required classes.

A Macomb County, Michigan, school district was the site for this study. Ninth-grade world history students participated in this descriptive study. The Learning Style Profile was administered to students and teachers during the first marking period. Styles were determined by the component scores on the auditory and visual portion of the Learning Style Profile. At the end of the second semester, final grades were recorded to determine if a student earned credit (pass/fail) in the class. The chi square was performed on

the null hypotheses and found no significant difference in the match/no match of styles and pass/fail of the course.

Discussion

Specific objectives of this study were:

1. To determine whether students whose match between the auditory component of the Learning Style Profile and the auditory component of the teachers' Learning Style Profile are more successful in passing the course than students and teachers who do not match.

2. To determine whether students whose match between the visual component of the Learning Style Profile and the visual component of the teachers' Learning Style Profile are more successful in passing the course than students and teachers who do not match.

3. To determine whether students whose match between both the auditory and visual components of the Learning Style Profile and both the auditory and visual components of the teachers' Learning Style Profile are more successful in passing the course than students and teachers who do not match.

Performing the chi square at the alpha level of .05 significance, the data failed to support the research hypotheses. A review of literature, including Edmund's Learning Style Identification Exercise (Reinert, 1977), Canfield's (1977) Learning Style Inventory, Dunn and Dunn's (1975) Learning Style Inventory, and Hill's (1976) Cognitive Style Mapping, produced the opposite results.

There are several possible explanations that may have influenced this study's findings.

1. In an effort to reduce technical failures mandated by the district attendance policy, first and sixth hours were excluded from the study. The result may have eliminated a random sampling of ninth-grade world history students and may have skewed the results.

2. Concurrent with this study, participating teachers received staff development training on individualizing instruction. Therefore, teachers may have made adjustments to their teaching style. Varying their approach to instruction would support the null hypotheses that there is no difference if student learning styles and teacher teaching styles are matched.

3. There were no program interventions designed for students. Students were administered the Learning Style Profile without follow-up in helping them understand the results or take responsibility for adjustments.

4. Only two components (auditory and visual) of the Learning Style Profile were scored in the match/no match of styles. If more components had been considered, a broader understanding of students' learning style might have altered the findings.

Recommendations

Although the results of this study did not concur with previous research on learning and teaching styles, this researcher believes that further study on this subject is warranted.

There are several initiatives that are impacting educational programs across the country and specifically in Michigan. The programs for kindergarten through 12th grades represent mandates by

the Michigan Department of Education or federal legislation and are designed to meet the unique needs of the individual student. Traditionally, students have been required to fit into the school's educational process. The following reform initiatives are mandating that educational programs be designed or adapted to accommodate differing cognitive and affective learning styles of students:

1. Section 504 (Rehabilitation Act, 1973): Students with attention deficit disorder (ADD) and attention deficit hyperactive disorder (ADHD) can have significant learning problems, but may not qualify for special education services. Under the protection of Section 504, state and local educational agencies must adapt the curriculum to meet the needs of each handicapped child. This requires that teachers implement adaptation in regular educational programs to address the instructional needs of these children. A knowledge of learning styles would allow teachers to vary presentations, implement different classroom strategies, and modify classroom requirements to meet individual needs.

2. Inclusion: As part of meeting the needs of special education students in the least restrictive environment, special education teachers and general education teachers are doing more team teaching and co-teaching. Teaming and co-teaching provides the opportunity to individualize instruction. Grouping for instruction, presentation of materials, and fostering empathy between students as well as student and teachers could be developed by utilizing information on learning styles.

3. Child study planning committee: This concept was borrowed from special education's Individual Education Planning Committee (IEPC). It is intended to bring together a school support group dedicated to providing a plan tailored to help individual students succeed. The process requires documentation of the individual plan, implementation, and evaluation of educational strategies used. Understanding a student's unique learning style can aid in the development and implementation of the special designed program.

Portfolios: Secondary students in Michigan are required to develop an educational development plan (EDP) and maintain records of demonstrated learnings in a portfolio. The portfolio is intended to help students acquire a better understanding of self, more responsibility for their learning, and focus learning on a field of interest. The inclusion of a learning style inventory may help students develop their EDP and portfolio.

5. At-risk students: Alternative educational programs are being designed by school districts in an effort to help students with special needs succeed. The educational approach cannot be a replica of existing programs, but must consider individual differences. Different classroom packages could be developed based on student learning styles. Guidance personnel could help students make better choices for course work, teachers, and work experience. Additionally, a program director could hire teachers with a learning style/teaching style that complements the program and staff.

In conclusion, current research has developed to the level of sophistication that no one construct can be the solution for

educational reform. School improvement must take a holistic approach to positive change. Learning style/teaching style may not be the answer, but can contribute to the solution. In a recent publication, <u>Learning Styles</u>, by the American Association of School Administrators (1991), the impact of learning styles was summarized.

> One thing seems clear, however: learning styles is not going to go away. Even though most see it as only part of the reform picture, there is a growing consensus that a style-based approach to learning complements other school reform thrusts. Some see it as providing an overarching framework for integrating cooperative learning, multicultural education, alternative forms of assessments and other initiatives. Others see it as an integral component for building parental support. Children are messengers, says Hodges, and if they are excited about school, parents will get excited, too.

> The real test, say most, is the degree to which teachers, administrators, and staff members accept and respect differences among themselves and are willing to change. (p. 49)

Appendix A

Human Subjects Institutional Review Board
Approval Letter

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Kalamazoo, Michigan 49008-3899

WESTERN MICHIGAN UNIVERSITY

Date: July 8, 1992

To: Addamae Akin

From: Mary Anne Bunda, Chair *Mary Anne Bunda*

Re: HSIRB Project Number: 92-05-09

This letter will serve as confirmation that your research protocol, "An Analysis of the Effects of Matching Student Learning Style to the Method of Instruction" has been approved under the exempt category of review by the HSIRB. The conditions and duration of this approval are specified in the Policies of Western Michigan University. You may now begin to implement the research as described in the approval application.

You must seek reapproval for any changes in this design. You must also seek reapproval if the project extends beyond the termination date.
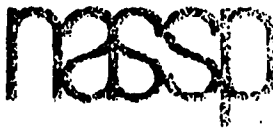
The Board wishes you success in the pursuit of your research goals.

xc: Cowden, ED Leadership

Approval Termination: July 8, 1993

Appendix B

Learning Style Profile

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07-30-92 04:14 PM

The National Association of Secondary School Principals

1904 Association Drive • Reston, Virginia 22091 • Tel: 703-860-0200 • Fax: 703-476-5432

FAX COVER SHEET

MESSAGE TO: _Addemae Akin_   MESSAGE FROM: _Bob Mahaffey_

FIRM: _Rossville Community School_   DATE: _7/30/92_

FAX: _313 771-1772_   NO. OF PAGES: _2_

COMMENTS:

Permission granted,
Original will be mailed.

Serving all Administrators in Middle Level and High School Education

NATIONAL ASSOCIATION OF SECONDARY SCHOOL PRINCIPALS

LEARNING STYLE PROFILE

James W. Keefe and John S. Monk
with
Charles A. Letteri, Marlin Languis, Rita Dunn

EVERY STUDENT HAS A PERSONAL LEARNING STYLE.

The questions in this booklet will show you *your* learning style—how you learn and how you like to learn. They will help you know yourself better and aid your teachers in their teaching.

Read each question carefully. When you decide on the answer you like best, mark the letter for that answer on your answer sheet. Be sure that the answer number is the same as the question in the booklet.

Use only a #2 pencil to mark the answer sheet. Please do not mark in the booklet. Mark only one answer for each question. Answer marks should be clean and clear. If you make a mistake or want to change an answer, erase your first answer neatly.

This *Profile* is not timed. You should be able to finish it in one class period. You need not hurry but do not waste time.

YOU WILL NOTICE THAT SOME QUESTIONS ARE PRINTED UPSIDE DOWN ON THE BACKS OF THE PAGES. DO ALL THE ITEMS ON THE FRONTS OF THE PAGES FIRST. WHEN YOU REACH THE BACK OF THE BOOKLET, TURN IT AROUND AND BEGIN THE ITEMS ON THE BACKS OF THE PAGES.

07/24/92   09:35   FAX 313 771 1772   P02

July 23, 1992

FAX 703-476-5438

NASSP
Attention: Rob Mahaffey

I would like one copy of a letter of permission from James W. Keefe to copy a page entitled "LEARNING STYLE PROFILE".

I purchased copies to use in my research and would like to include a copy in my report.
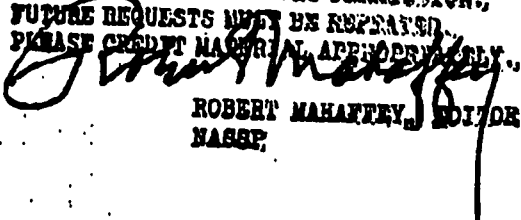
Please FAX back to FAX No. 313-771-1772.

Thank You.

ADDAMAE AKIN

PERMISSION IS GRANTED FOR YOUR USE OF
NASSP MATERIALS AS SPECIFIED ABOVE.
THIS IS A ONE-TIME ONLY PERMISSION.
FUTURE REQUESTS MUST BE REPEATED.
PLEASE CREDIT MATERIAL APPROPRIATELY.

ROBERT MAHAFFEY, EDITOR
NASSP

July 23, 1992

FAX 703-476-543**

NASSP
Attention: Rob Mahaffey

I would like one copy of a letter of permission from James W.
Keefe to copy a page entitled "LEARNING STYLE PROFILE".

I purchased copies to use in my research and would like to
include a copy in my report.

Please FAX back to FAX No. 313-771-1772.

Thank You.

ADDAMAE AKIN

Appendix C

Teacher Consent Form

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TEACHER CONSENT FORM

Addamae Akin is conducting research on learning styles/ teaching styles. Ms. Akin is a doctoral student at Western Michigan University and conducting the research as a fulfill- ment of graduation requirements.

The research investigates student learning styles and teacher teaching styles in an effort to reduce student failures. This proposal results from concern over the high number of failures of ninth-grade students. During the last year, 50% of the ninth-grade class failed one or more required classes.

The research is conducted in two parts. The first part is the administration of the NASSP Learning Styles Profile to ninth- grade students in selected world history classes during one class period in the spring. The second part identifies your teaching style by the following criteria:

1. Personal assessment by the teacher as measured by the NASSP Learning Styles Profile.

2. Based on observations by building principal, counselors or teacher consultants, an analysis of teacher teaching styles will be determined (see attached). Taking the Learning Styles Profile will take approximately one preparation period during the school day.

Teacher participation in this study will provide additional information on learning styles and teaching styles and how the matching might affect student success.

In this study, no individual names will be used nor will it be part of a school evaluation process. Confidentiality is assured by assigning numbers to individual participants. Only group data will be reported. At any time if you wish to with- draw, you may do so without prejudice.

If you have any questions concerning this research, contact Addamae Akin; at work at 445-5624 and after 6:00 p.m. at 689-2241, or Dr. David Cowden at Western Michigan University (616) 387-3883.

****

☐   I agree to participate in this reseach.

_____
Signature

_____
Date

July 1, 199&

Aquaniae AKin

Consent Forms: A Checklist

S T
1. Does the consent form state who is doing the experiment?

✓ ✓   2. Does the consent form state the nature, purpose, and duration of the experiment, including the fact that it is experimental?

✓ ✓   3. Does the consent form state the uses to be made of the data?

✓ ✓   4. Does the consent form state the procedures to be employed in the experiment?

N/A   5. Does the consent form state the hazards, inconveniences, and risks the subject will undergo, so far as they are known?

N/A   6. If appropriate, does the consent form state the availability of compensation and treatment if the subject is injured?

✓ ✓   7. Does the consent form state the benefits that might be expected?

N/A   8. Does the consent form, if the experiment is therapeutically related, disclose the alternate procedures the subject may choose?

N/A   9. Does the consent form state the conditions of participation, if any?

✓ ✓   10. Does the consent form contain a statement of the extent to which the confidentiality of the data will be maintained?

✓ ✓   11. If appropriate, does the consent form describe the procedures to be employed in maintaining confidentiality?

✓ ✓   12. Does the consent form mention that the subject is at liberty to withdraw his or her prior consent to the experiment or discontinue participation in the experiment at any time without prejudice?

✓ ✓   13. Does the consent form contain instructions as to who and how to contact someone if questions or problems should arise later on?

N/A   14. Does the consent document contain any exculpatory language?

✓ ✓   15. Is there a place for the date of signing and for the signature of the subject and witness?

N/A   16. If appropriate, does the consent form state that the procedure may involve unforeseeable risks?

N/A   17. If appropriate, does the consent form state that any significant new findings affecting risk will be reported to the subject?

N/A   18. If appropriate, does the consent form state the circumstances under which the experimenter may terminate the subject's participation?

N/A   19. If appropriate, does the consent form state any possible additional costs the subject may have to bear?

N/A   20. If appropriate, does the consent form state the consequences of the subject's withdrawal from the study?

✓ ✓   21. If appropriate, does the consent form state the approximate number of subjects in the study?

P = Parent
S = Student
T = Teacher

Appendix D

Data Entry Descriptions

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AKIN - DATA ENTRY DESCRIPTIONS

TEACHER ID:	*ID*	*AUD*	*VIS*
	1 DIGIT: 1-4	2 DIGIT SCORE	2 DIGIT SCORE

STUDENT ID: 3 DIGIT

AUDITORY:	*SCORE*	*MATCH*
	2 DIGIT SCORE	1 YES; 2 NO

VISUAL:	*SCORE*	*MATCH*
	2 DIGIT SCORE	1 YES; 2 NO

BOTH: 1 "YES" IF BOTH OF PREVIOUS
"MATCH" ENTRIES ARE 1'S.
OTHERWISE, 2 NO.

PASS/FAIL:	*Y/N*	*GRADE*
	1 YES; 2 NO	SINGLE LETTER

Appendix E

Data Summary Sheet

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Akin – Data Summary SHEET

TEACHER ID			STUD. ID	AUDITORY		VISUAL		BOTH	PASS/FAIL	
ID	AUD	VIS		SCORE	MATCH	SCORE	MATCH	MATCH	Y/N	GRADE

Page _____

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