

The Relative Effects of Age and Learning Style Mismatch on
Adult Students' Academic Achievement and Perception of
Instructors

by

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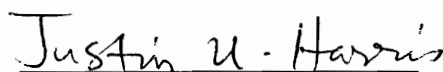
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(Abstract)

This study investigated the relationship between students' age, achievement, evaluation of the instructors and the match-mismatch of students' and instructors' learning styles. Seventeen (17) business instructors and 302 business students comprised the population. The students were selected as an intact group enrolled in the participating faculty members' class.

The relationship between age and learning style mismatch and evaluation and age and learning style mismatch and grade was not significant using Kolb LSI and Gregorc Style Delineator. The particular learning style of the instructor did not significantly affect grade nor evaluation using Kolb LSI and the Gregorc Style Delineator. However, submodel analysis revealed that instructors' learning style converger contributed to grade and accommodator style contributed to evaluation using Kolb LSI. Instructors' learning styles abstract sequential and concrete random contributed to grade using the Gregorc Style Delineator.

The particular learning style of the student did not affect the relationship between learning style mismatch and grade and learning style mismatch and evaluation using Kolb LSI and the Gregorc Style Delineator. Submodel analyses indicated that students with learning styles accommodator and diverger who matched their instructors contributed to

grade and students with learning style diverger when matched contributed to evaluation.

The findings of this study were generally contrary to research.

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Chapter 1

Introduction

Background of the Problem

The role of student and teacher individual differences has been a major concern in contemporary curriculum design (Irvine, 1986). The outcomes of the interactions of the various aspects of individual differences have been implicated in affecting student satisfaction with school, motivation, and academic success (Grant & Sleeter, 1986; Snow, 1986).

Malcolm Knowles (1973) has written that understanding how a person learns and helping people understand how to learn is a major requisite for a successful educational program. Identifying learning styles as a basis for providing responsive instruction has never been more important than now, as educators meet the needs of a diverse student population (Dunn, Beaudry, & Klavas, 1989). The responsibility of education is to offer the individual an opportunity for a high level of achievement in life and to maximize learning for each individual (Cross, 1976). To effectively achieve this goal, instructional theory has attempted to identify the numerous variables and individual differences operating in the teacher–learning process which might affect educational outcomes (Mehdikhani, 1983).

Learning style continues to draw the attention of faculty and administrators in education. The sense that individual faculty members have of how they learn, their awareness that others often seem to approach things differently, and their success and failure with different groups (even when those groups are taught the same way) reveal

clearly that students learn differently (Claxton & Murrell, 1988). Lagrand (1969) noted that "too often in our attempts at giving all equal opportunity in education, we labor under the mistaken notion that each student should be treated equally" (p. 87).

Learning Styles and Instruction

Many attempts have been made to define learning styles, ranging from definitional statements to elaborate categorizations of learning style elements (Henson & Borthwick, 1984). Gregorc (1979) defined learning style from a phenomenological point of view. The problem of identifying both how individuals learn and why they learn as they do necessitated an ideographic methodology which would encourage an individual to reflect on his or her learning experiences in order to identify the meaning of those experiences and their effects upon him. Gregorc (1979) suggested that "learning style consists of distinctive behaviors which serve as indicators of how a person learns from and adapts to his environment. It also gives clues as to how a person's mind operates" (p. 234). Dunn and Dunn (1979) defined learning style as "the manner in which at least eighteen different elements from four basic stimuli affect a person's ability to absorb and retain" (p. 87). Keefe (1979) organized learning styles into modes, elements, and domains. He defined "learning styles as characteristic cognitive, affective, and psychological behaviors that serve as relatively stable indicators of how learners perceive, interact with, and respond to the learning environment" (p. 44). These definitions raise the question of whether learning style is a pervasive quality in the behavior of an individual, a quality that persists though the content may change.

The relationship between teachers' and students' learning styles has received some considerable attention in the literature. Many educators support the contention that learning style match and mismatch with teacher's teaching style affects student

achievement. Research on the relationship of students and instructors whose learning styles were matched has shown that matched students received higher grades than those who were mismatched (Cafferty, 1980; Carbo, 1980; Dunn & Dunn, 1979; Hunt, 1978). There appears to be limited research concerning the effects of degrees of learning style mismatch and students' achievement and satisfaction with instruction among older students. Dorsey and Pierson (1984) suggested that further research is needed to study the effects of learning style match and mismatch, age, and prior work experience on achievement among adult students so that university officials will have a concrete basis for developing the best academic program to meet the needs of the growing adult student population.

Hunt (1978) suggested that ". . . teachers spent a lot of time planning and implementing their instructional program. They cared about their students but they had never considered the effects of their own learning styles on the instructional decisions they were making for their students" (p. 270).

Davis, et al. (1988) conducted a study matching teaching approach with student learning styles. The population included 196 freshmen and seven instructors. The Kolb Learning Style Inventory was administered to the entire population in the study. The results of this study revealed that there was no significant difference in student achievement as measured by grade between students who were matched, not matched, or partially matched with the teacher's learning style.

Davis (1988) stated that while there is a tendency for opposites to have lower grades than students who were matched or partially matched to the teachers' learning style, the results of this study indicated that grades were equally distributed across all learning

styles of students. Additionally, learning style did not influence student grades. There was no significant difference in the mean ranks of the students' learning styles.

Thompson and O'Brien (1991) after studying the effects of teaching styles, student learning styles, matched and mismatched conditions, student age and gender in relation to course grades in post-secondary education, found that neither the learning styles of students nor the match or mismatch between students' styles and those of their instructors were associated with any significant main effects on course grade. They suggested these findings are in distinct opposition to anything currently present in the literature and that further investigation in this area is clearly warranted to address this unique perspective.

Learning Styles and Instructors' Evaluation

Student evaluation of instruction and how individual differences specifically influence students' perception of teacher performance and instructional quality is another focus of concern. Careful observation in the classroom leads to the conclusion that students react differently to class situations and learn in different ways (Grasha, 1972). Understanding the nature of these learners' differences and responding to them is becoming increasingly pressing with the changes we face in our student body (Cross, 1972). One of the questions related to these students' differences is the extent to which they affect students' satisfaction with instruction (Riechmann, 1980).

Research in this area has concentrated on student-faculty cognitive style match and mismatch using traditional-aged undergraduate students. Limited research has been found using older adult students. Experimental studies and syntheses of research on learning styles have provided specific and descriptive information on traditional-aged students and supports the findings that the achievement and perceptions of faculty are related to teacher

and student learning style match-mismatch. Limited research concerning the effects of student-teacher learning style mismatch upon older students' achievement and perception of faculty may be attributed to the predominant population in most colleges. An increasing number of older students are attending college for the first time or returning to college with more life experiences. It is expected that the predominant population in many colleges will soon be older students.

Learning Styles and Age

Some researchers, regarding the stability and consistency of learning style, maintained that the dominant qualities of the individual's style remain stable and unchangeable over time and throughout a variety of tasks. Fischer and Fischer (1979) stated that "in every field of endeavor, people can be identified with distinctive qualities of behavior that are consistent through time and carry over from situation to situation" (p. 245).

Dorsey and Pierson (1984) suggested that age and prior work experience influence learning style type. Of these two variables, age and age differences become an increasingly important index of student learning styles. Eison and Moore (1980) studied 272 students. These students were divided into three groups: traditional aged (17-22), young adults (23-31), and older adults (32-67). The researcher found that older adult students are more likely to be oriented toward the pursuit of knowledge while younger students were concerned with merely working for a course grade.

Kolb (1976) and Barbe and Milone (1981) have argued that learning styles change with age and that each learner has a unique learning style which has resulted from

heredity, equipment, maturation, and cultural upbringings. Gregorc (1979), from various research, stated that style appears to have both nature and nurture in its root.

Satterly (1976) suggested that people behave in a typical way across a variety of tasks; such personal consistencies remain comparatively stable over time (p. 42).

Thus, the questions of whether learning style is a pervasive quality in the behavior of an individual, a quality that persists through the content may change or whether learning style is affected by age and life experiences remain unresolved.

Problem Statement

Efforts to improve teaching and learning in American higher education have received widespread attention in recent years (MacNeil, 1980). The effects of learning style match and mismatch among traditional-aged college students has been documented. The problem of predicting learner academic achievement and identifying appropriate teaching styles that facilitate academic achievement for nontraditional-aged students clearly illustrates the importance of studying the relative effects of age and learning style mismatch which might have an impact on older adult students' academic achievement and perception of instructors.

Purpose

The purpose of this study was to investigate the effects of students' age, achievement and evaluation of the instructor and the match-mismatch of students' and instructors' learning styles.

Research Questions

The following questions guided this study;

1. What is the relationship between age, learning style mismatch, and grade?

2. What is the relationship between age, learning style mismatch, and evaluation?
3. Does the particular learning style of the instructor affect the relationship between learning style mismatch and grade?
4. Does the particular learning style of the instructor affect the relationship between learning style mismatch and evaluation?
5. Does the particular learning style of the student affect the relationship between learning style mismatch and grade?
6. Does the particular learning style of the student affect the relationship between learning style mismatch and evaluation?

Assumptions

The following assumptions were made in this study:

1. Individual learning styles differ and can be identified.
2. Students' learning styles and faculty's learning styles will interact in the classroom through the instructional process.

Limitations of the Study

The learning style instruments and categories, as developed by Kolb (1985) and Gregorc (1982) limit generalizations to the learning style categories isolated in the instruments and the population in this study. The findings may not be representative of other learning style models and should not be generalized to other populations.

Definitions of Terms

In order to establish a common language in this study, the following concepts were defined:

1. Cognitive style--individual variation in modes of perceiving, remembering, and thinking, or as distinctive ways of apprehending, storing, transforming, and utilizing information (Kogan, 1971).

2. Learning style--an individual difference associated with the learning process. Learning style consists of those characteristic cognitive, affective, and physiological behavior that serve as relatively stable indicators of how learners perceive, interact with, and respond to the learning environment (Keefe, 1979). This definition will be operationalized to the instruments.

3. Match--defined as a student and teacher having the same predominant learning style. A mismatch is defined as a student and teacher operating in total opposite bi-polar quadrants. An overlap is when a student shares at least one dimension of the instructor's learning style.

4. Teaching style--various identifiable sets of classroom behaviors by the instructor which are consistent even though the content that is being taught may change (Fischer & Fischer, 1979). Teaching style involves the means of presentation (Joyce, 1978) and the teacher's attitudes about learning (Menges, 1967).

Significance of the Study

The way in which characteristics of the teacher may enhance the teaching-learning process and the extent to which the learner may achieve the desired outcome has been a neglected area. Student evaluation of instruction has also been a growing concern in higher education because of increased awareness of faculty instructional quality (Trow, 1972). The adult students differ from the traditional students in that they come to class with skills developed from life and work-experience. Further study of the effects of

learning style match and mismatch on achievement among adult students is needed to provide a solid basis for developing the best academic program to meet the needs of the growing adult population (Dorsey & Pierson, 1984).

Organization of the Study

Chapter I has presented the introduction, statement of the problem, the purpose of this study, research questions, and assumptions. In addition, the researcher has identified the limitations of the study, defined a select group of terms that will be used in this study, and the significance of the study.

Chapter II presents a survey of the literature relevant to this study. Chapter III consists of the design of the study and outlines the procedures to be used in data collection. Chapter IV presents an analysis of the data and Chapter V presents the summary, conclusions, and discussions, as well as recommendations for further study and research.

Chapter II

Review of the Literature

Introduction

This chapter reviews literature related to the effects of learning styles and age on students' achievement, evaluation, and perception of instructors. It presents research on learning style, learning style models, instructor-student transaction and learning style, learning style mismatch and the relationship to achievement and evaluation, and age and learning style. Predicting learner academic achievement and identifying appropriate teaching styles that facilitate academic achievement for nontraditional students have been of continuous concern for higher education. Little empirical work has been reported that relates to the relative effects of age and learning style mismatch which might have an impact on older adult students' academic achievement.

Numerous theories exist to explain how persons differ in the way they learn. Some theories deal with cognitive processes; others focus on learning style, individual differences among learners or psychometric properties of instruments.

Literature relating to learning styles is reviewed to find differences and similarities among theories and to search for issues that relate to learning and achievement among older adult students. Additionally, two learning style models and related instruments are investigated in depth to determine their theoretical basis and potential for assessing and promoting understanding of adult learning styles.

Literature on instructor-student transaction is reviewed to determine if the instructor-student transaction influenced mutual perceptions and attitudes. Additionally, the literature is reviewed to see if students' evaluations of instructor and instruction yield

relevant information about the characteristics of instructors and the types of instruction that older students prefer. It also includes research relating to learning style match and mismatch and age to explore the effects of instructor-student learning style match-mismatch on older students' academic achievement.

Learning Style Research

There are a number of spheres of thought which relate to the subject of adult learning. One sphere of thought which has important implications for adult learning is that of learning styles (Ash, 1986).

One of the most promising movements in contemporary education is the attention being given to student learning style. The movement is based on the idea that students vary in their approach to learning, so no single instructional process provides optimal learning for all students (Barbe & Milone, 1981). Early education research looked for the one best teaching method for every learner but failed to get consistent results. In the 1960's, instructional improvement projects began to explore individual differences as the factor that decided the effectiveness of various teaching methods (Bonham, 1988). Instructional concerns prompted a shift of focus from the more laboratory-based concepts of cognitive style to concerns with the more practically oriented learning styles (Dunn & Dunn, 1978).

Research by E. L. Thorndike in the early 1900's indicated that a student's achievement was highly correlated with intelligence, a seemingly logical finding that has profoundly influenced educator's thinking about learning ever since. Yet the conditions set for these studies were such that all students were given the same type of instruction and the same amount of time to learn (Henson & Borthwich, 1984). Carroll (1963)

reported the results of his experiment in which he used a variety of teaching methods and students were able to have as much time as needed. "Under these conditions the findings were totally different. Students aptitude proved not to be a major factor in determining achievement" (p. 4).

The implications of such findings are extraordinary. "They can be interpreted to mean that given the needed time and the correct teaching methods, almost any student can learn or master the material set before them" (Henson & Borthwich, 1984, p. 4.). Claxton and Murrell (1988) stated that the research of Benjamin Bloom and others furthered this work, giving rise to the concept of mastery learning, in which students' achievement is held constant and teaching methods, materials, and time available are sufficiently flexible so that practically all learners are able to achieve at a high level. Clearly contained within this approach is a recognition "that individual learners have their own preferred learning styles and that teachers have some responsibility for gearing up their teaching style to 'fit' the preferred learning style of the learner" (Henson & Borthwich, 1984, p. 4).

People have preferred ways of expressing all that they see, remember, and think. Consistent individual differences in the ways of organizing and processing information and experience have come to be called styles of learning. The styles serve as stable attitudes, preferences, or habitual strategies that determine a person's typical modes of perceiving, remembering, thinking, and problem solving (Messick & Associates, 1976).

Hunt (1979) stated that the style of learning, applied to the amount of structure a learner needs, helps the learner to learn best. He assumed that individuals at different conceptual levels prefer different approaches to the same learning tasks. The lowest

conceptual level students prefer a high structured learning environment and the highest conceptual level students prefer a less structured environment.

Gregorc (1979) described learning style from a phenomenological point of view.

Learning style consists of distinctive behaviors which serve as indicators of how a person learns from and adapts to his environment. It also gives clues as to how a person's mind operates (p. 234).

Kolb (1976) considered cognitive styles from the standpoint of an individual's learning abilities. Using the term learning style rather than the term cognitive style, Kolb stated that learning style is the result of the individual's characteristic means of perceiving and processing information.

Loesch and Foley (1988) stated that while educators have long realized that individual differences exist among students, until recently, research focused primarily on differences in cognitive factors. Rosenshine and Furst (1973) stated that "almost all experimental and correlational studies have focused upon the relationship of teacher behavior to the class mean. Few investigations have focused on the personality or learning styles of learners" (p. 173).

Barbe and Milone (1981) in supporting the concept of learning style stated that:

One of the most promising movements in contemporary education is the attention being given to student learning styles. The movement is based on the idea that students vary in their approach to learning (p. 378).

Learning style is much more than just another innovation. It is a new way of looking at learning and instruction, a deeper and more profound view of the learner than known previously. It is a basic framework upon which a theory and practice of instruction can be built (Davidman, 1981).

Learning Style Models

The unprecedented increase in academically underprepared students entering universities and community colleges has prompted educators to search for teaching and assessment methods that will lead to more individualized instruction and subsequent student academic success (Green & Parker, 1989). Moreover, institutions are seeking strategies for attracting, retaining, and ensuring the success of students (Brown, 1986; Carey & Hopperstead, 1986).

The issue of whether the various contemporary learning style inventories actually measure the phenomena they were seeking, and if the inventories were all measuring the same construct was studied by Ferrell (1981). She compared the psychological and educational areas purportedly covered by the following inventories: A.F. Grasha--Student Learning Style Scales; R. Johnson--Decision Making Inventory; R. Dunn, K. Dunn, and G. Price--Learning Styles Inventory; D. A. Kolb--Learning Style Inventory.

The four instruments were administered in a single session, with each student completing all four. The order of administration was determined at random for each intact classroom group to control for effects of fatigue. The subjects' answer sheets were coded so that an individual's responses to one instrument could be compared to her or his responses on the others. Completion time for the four instruments was approximately 15 minutes, and all but a few of the subjects completed all four inventories in the allotted time.

The data obtained from each of the subjects for the four instruments were separately factor-analyzed using a common factor model. The results of these analyses were compared to the conceptualization of learning styles as outlined by each of the

authors. All four instruments measured either the cognitive, affective, or physical behavior outlined in the literature by Keefe (1979) as comprising learning style, but none of the instruments measure all the behaviors associated with learning style.

Bonham (1988) systematically described, compared, and contrasted selected cognitive and learning style theories with respect to their underlying theories, definitions of style elements, history, instrumentation, suggested uses, and efficacy in terms of learning enhancement. In reviewing Kolb's Learning Style Inventory and the experiential learning theory that it is based on, Bonham (1988) states that because of the developmental perspective, this theory is usually appropriate for use with adult learners. College academic major and occupation are seen as strong influences on style, and the theory is often used in these contexts. However, this theory has not been exposed to a systematic program of verification. Some uses of the Kolb LSI seem to depart from Kolb's intentions, especially as they fail to reflect a relationship to the concept of experiential learning.

Kolb's LSI

Sugarman (1985) stated that Kolb's 1984 model of experiential learning can be viewed as a model of effective teaching. Kolb (1984) wrote that the experiential learning model represents an integration of many of the intensive lines of research on cognitive development style. The result is a model of the learning process that is consistent with the structure of human cognition and the stages of human growth and development. It conceptualizes the learning process in such a way that differences in individual learning styles and corresponding learning environments can be identified. The learning model is a dialectical one, similar to Jung's (1923) concept of personality

types, according to which development is attained by higher-level integration and expression on nondominant modes of dealing with the world.

Kolb (1981) also stated that the theory is called experiential learning for two reasons. First, this term ties the theory historically to its intellectual origins in the social psychology of Kurt Lewin. Secondly, it emphasizes the important role that experience plays in the learning process, an emphasis that differentiates this approach from other cognitive theories of the learning process. The core of the model is a description of the learning cycle—how experience is translated into concepts, which, in turn, serves as guides in the choice of new experiences.

Learning is considered as a four-stage cycle. Immediate concrete experience is the basis for observation and reflection. An individual uses the observations to build an idea, generalizations or "theory" from which new implications for action can be deduced. These implications or hypotheses then serve as guides in action to create new experiences. The learners, if they are to be effective, need four different kinds of abilities with two dimensions of learning; grasping the experience and then transforming it. The grasping dimension of learning is made up of two adaptive models. The first is concrete experience in which learners grasp the experience through direct contact. The emphasis in this mode is on felt qualities and the drawing together of likenesses to recognize patterns. The second is abstract conceptualization, in which learners grasp the experience through conceptual interpretation and symbolic representation. The emphasis in this mode is the learner being analytical or thinking.

Similarly, the transformational dimension is made of two adaptive modes. The reflective observation learners transform the information through internal reflection. The

emphasis is on the information or experience as it is (watching) rather than on manipulating or changing it. In active experimentation, learners transform the information in action with an emphasis on manipulation of the information and the environment (doing) rather than on taking them in as they are. After the learner completes this cycle, they have another concrete experience and the cycle begins again; but this time the learner operates at a more complex level. Thus, the experiential learning theory is a cycle.

Kolb (1981) suggested that in early life, people are primarily engaged in acquiring information and the basic skills needed for effective functioning. By adolescence, people come to deal with situations in characteristic ways and develop certain preferences in terms of how they grasp experience and transform it. To determine people's learning preferences or styles, Kolb developed a Learning Style Inventory (Kolb, 1985) which identifies people's styles. Depending upon their developed learning style, students may be labeled "divergers," "assimilators," "convergers," or "accommodators." (See Appendix A for detailed description.)

The "divergers" prefer to grasp experience by concrete experience and transform it by reflective observation (CE,RO). They are often good at generating ideas and brainstorming. The "assimilators" prefer to grasp experience by abstract conceptualization and transform them by reflective observation (AC,RO). They, like the "convergers", prefer to grasp experience by abstract conceptualization and transform it by active experimentation (AC,AE). The "accommodators" prefer to grasp experience by concrete experience and transform it by active experimentation (CE,AE). A closer examination of the four-stage learning model indicates that learning requires abilities that

are polar opposites, and that the learner, as a result, must continually choose which set of learning abilities to bring to bear on various learning tasks.

Kolb (1984) stated that the experiential learning theory represents the major direction of cognitive development identified by Piaget. In his view, the course of individual cognitive development from birth to adolescence moves from a phenomenalistic (concrete) view of the world to a constructive (abstract) view and from an egocentric (active) view to a reflective internalized mode of learning. Many other studies have focused on one or the other of these two basic dimensions.

A chief source of dissension about the Kolb LSI centers on whether its lack of test-retest reliability is because it is a poor instrument or because styles are not stable and do change from one testing to another as the life situations of individuals change (Kolb, 1981; Stumpf & Freedman, 1980; Merritt & Marshall, 1984). Kolb (1981) indicated that stability varies with the length of time between testing and with amount of change in life situations between testings.

Gregg (1989) stated that the Kolb LSI is a promising measurement. It is a quick and reliable self-report instrument measuring learning style. However, further research investigating the usefulness of the inventory is needed.

Gregorc Style Delineator

Gregorc (1979, 1984) from extensive observation and evaluation of data on learning and teaching style concluded that school success was a significant property of the adaptive abilities of a student's learning style to match the instruction. He felt that this tendency placed subjective demands upon the students who may or may not have the abilities to adapt to various teaching styles. Therefore, he claimed that teachers were

only reaching the flexible students or those whose learning style fit the instruction. Radebaugh, Nicely-Leach, Morrill, Shreeve, and Statton (1988) stated that some professors are uncomfortable with a traditional approach, also, and these persons may offer students alternatives for learning and for demonstrating what they have learned.

Gregorc (1984) described learning style from a phenomenological point of view. The problem of identifying both how individuals learn and why they learn as they do necessitated an ideographic methodology which would encourage an individual to reflect on his or her learning experiences in order to identify the meaning of those experiences and their effects upon him. Gregorc focused on individual's actual experiences--specific verbal and nonverbal behaviors, specific mannerisms and situational characteristics--called noema. Next, he focused on individual's reflection on the experiences. Those reflections which addressed the questions of importance, impact, meanings and whys of the noema are called noeses. From an analysis of this data, primary "driving forces" of perception and ordering were identified, which in the judgment of Gregorc gave use to specific "frames of reference" and to the outer behavior and experiences of an individual.

The Gregorc Style Delineator (1982) is a product which represents the confluences of a specific concern and of several ideas. The concern was: why children and adults were not learning what they "should" learn. Gregorc combined the techniques of phenomenology and the "techniques of the psychological forces with the theory and research on styles to develop a means of addressing the questions of how, why, and what individuals can, will, and do learn" (p. 7).

The Gregorc Style Delineator (Gregorc, 1982) was developed as a self-analysis tool. It was specifically designed to aid an individual to recognize and identify the channels through which he or she receives and expresses information efficiently, economically, and effectively. The channels provide a person with "mediation abilities." The outward appearance of an individual's mediation abilities is what is popularly termed "style."

In assessing behavior, Gregorc (1979) found that people learn in combination of dualities. Gregorc considers each of these qualities as qualities that indicate how individuals relate to the world. Crossing the two main modes with each of the subdivisions produces a typology of patterns for learners preference. (See Appendix B for detailed description.)

Abstract Random--accept an abstract world of feeling and emotion; thinking is emotional, perceptive, and critical.

Abstract Sequential--accept a world of intellect (abstract) based on a material reality; thinking is intellectual, logical, and analytical.

Concrete Random--Accept a concrete world of activity in a world of intuition; thinking is intuitive, instinctive, and impulsive.

Concrete Sequential--accept a concrete world based on physical senses; organizes in a sequential step-by-step manner.

Kolb (1976) and Gregorc (1979) both used words to delineate two sets of dualities. Using experiential theory, Kolb addressed the dualities of abstraction/concreteness and impulsivity/reflection through a quaternary design to develop the LSI (Kolb, 1985). Building in part, on Kolb's initial four-column format

and design, the Gregorc Style Delineator (Gregorc, 1982) evolved into its present form (Gregorc, 1979, 1982).

Instructor-Student Transaction and Learning Style

Studies of instructor behavior are somewhat constrained by the fact that certain instructional methods and, thus instructor behaviors, are more commonly used with particular groups of students and in particular types of courses and subject matter (Darr, 1983). Abrami, Leventhal, and Perry (1982), using meta-analyses, found that instructor expressiveness had an impact on students' ratings of instruction but not in the amount of content acquired. Abrami, Perry, and Leventhal (1982) report that teachers' classroom behavior had much more effect on students' ratings of the instructor than upon actual achievement.

Witkin (1973) found that "persons matched in cognitive style tend to get along better, under conditions where this outcome has been observed" (p. 37). Three possible reasons are cited for favorable interaction: shared foci of interest, common personal characteristics, and similarity in communication modes. Cognitive characteristics of field-independent and field-dependent perceptual styles and personal characteristics associated with contrasting style indicate a relationship between students' development and academic achievement, teacher methodology, and student-teacher interactions.

Good and Stipek (1983) stated that there are higher level interactions between learner characteristics and instructional treatments. Thus, the effect of learning style on achievement is likely to be affected by the nature of the learning task, the relationship between teacher and student, the time of the year, and other local conditions. It is

difficult, therefore, to predict a simple linear connection between learning style and instructional dimensions.

Match-Mismatch and Evaluation

Copeland (1984) conducted a study to investigate whether students and instructors with matched cognitive styles would have a more positive interaction than students and instructors with mismatched cognitive styles. Seven groups of university students and their instructors were given the Group Embedded Figures Test to determine cognitive style—field independent, mid-field independent, field dependent, or mid-field dependent. The same group of students completed a standardized course and instructor evaluation questionnaire that assessed five subscales: general course attitude, instructor-student interaction, attitude toward teaching method, attitude toward evaluation, and attitude toward workload. The results of this study supported the hypothesis.

King (1982) administered pre-and-post tests along with course evaluation to eighty-one law enforcement trainees in four classes on supervision. Participants responded to twenty-one items on a course evaluation form, which were grouped into five categories: (1) teacher/student relationship, (2) course objectives and organization, (3) course content and lectures, (4) course difficulty and workload, and (5) overall ratings. The items were rated on a scale of one to four. Using Pearson Product Moment Correlation, responses on the course evaluation instrument were compared to post-test scores. No significant correlations were found. Dixon (1990) confirmed the findings of King. She conducted a study to determine if participant reaction forms provide adequate data to be used as a decision tool for revision and selection of training courses in business and industry. This study investigated the relationship between

responses on participant reaction forms and post-test achievement. The findings of the study were as follows:

1. There was no significant relationship between trainee perceptions of job relevance and their post-test scores.

2. There was no significant relationship between trainee perceptions of amount learned and their post-test scores.

3. There was no significant relationship between trainee perceptions of enjoyment and their post-test scores.

4. There was no significant relationship between the perceptions of instructor skillfulness and their post-test scores.

These findings support Kirkpatrick's (1975) observation that "a favorable reaction to a program does not assure learning" (p. 6).

DeYoung (1977) was concerned with how the whole classroom climate influenced undergraduate attitudes and success. He believed that student evaluation was a reflection of the classroom environment and not just dependent on the instructor's actions. His study, performed on 59 college social psychology students, measured whether student evaluation of the class was significantly influenced by the student's preference for various aspects of the classroom environment and instructor's presentation. DeYoung (1977) concluded that the more the instructor's behavior and class structure matched that which the student preferred, the higher was the evaluation by the student.

Marsh and Overall (1980) stated that the use of student's evaluations of teaching effectiveness as an index of teaching quality remains controversial. Carney, Isakson,

and Ellsworth (1979) addressed the concern of grade inflation as a result of student evaluation of instruction. It was found that there was a positive correlation between favorable faculty evaluation and earned grades of students in the College of Education. In a survey given to the faculty of the College of Education, they found that the faculty showed a strong concern for the outcome of student evaluation. The authors concluded that because student evaluation of faculty is grade related, then faculty will intentionally or unintentionally inflate grades to receive a favorable review by students.

Cohen (1981) conducted a meta-analysis of student evaluation factors. He found that student achievement and academic interest had the most influence on student evaluations, but the influence was insignificant compared to the accuracy of the evaluation. His study reflected the belief that student evaluation of instruction was inaccurate due to bias and the student's ignorance of what was proper instructional methodology.

Traditional student end-of-course evaluations of instructor and instruction have yielded considerable information about the characteristics of teachers and the types of instruction that students preferred. While student evaluation studies have traditionally been criticized as unreliable and invalid measures of students' affective and cognitive learning, studies have found that well-designed evaluation instruments can gain the desired information reliably and with considerable accuracy and that such data are often quite generalizable, Darr (1983). Marsh (1982), employing path analyses to predict students' end-of-course performance and their evaluation of instructor effectiveness, found the instruments used in the study to be valid in their assessment of teaching techniques employed in the class. Possibly, the reason why the use of students'

evaluations of teacher effectiveness remains controversial may be due to the different populations used in the studies and the various instructor and instructional characteristics that students in different age groups perceive as facilitating learning.

Learning Style Mismatch and the Relationship to Achievement and Evaluation

Educators and researchers have been concerned with maximizing academic achievement; however, little empirical work has been reported that attempts to systematically alter selected aspects of the college environment in an effort to directly influence academic achievement (Domino, 1971). Prior to the mid-70's, researchers experimented with cognitive style; their definitions were different but all were concerned with how the mind actually processed information or was affected by each individual's perception (Coop & Brown, 1970; Kagan, Moss & Sigel, 1963; Messick, 1974; Witkin, 1973).

The role of teacher's cognitive style in determining student achievement was studied by James (1973). His research supplied evidence that field independent high school teachers assigned higher grades to field independent students, while field dependent teachers assigned higher grades to field dependent students. It was concluded that the achievement and success of students may be dependent on whether individuals are given learning materials in the mode of their preference. He believed that teacher's feedback either encouraged or discouraged certain task approach.

Research confirmed that students with educational cognitive styles that matched their teacher received higher grades than those students whose cognitive style was unmatched (Wasser, 1969; Fragle, 1969). Campbell (1974) provided a similar finding

concerning student's success in obtaining a good grade. Using the Embedded Figure Test and the Matching Familiar Figure Test, he found that there was a significant difference in interaction between teachers whose cognitive styles were matched with students and those whose cognitive styles were not matched.

Robinson and Gray (1974) investigated the value of using cognitive style to predict school success. In a sample of 258 fifth graders, they compared cognitive style (categorical, descriptive, and relational thinkers) and intelligence quotient (IQ) to school success. They found that cognitive style was a significant indicator of school success, even taking into consideration the influence of IQ. They warned that cognitive style was only an additional variable for predicting school success, and should not be treated as an independent predictor.

Satterly (1976) criticized the importance given to the role of cognitive style to school learning and achievement. In Satterly's study on 210 boys, ages 10-11 years, he found that a considerable degree of overlap in variance existed between verbal intelligence and field independence. He commented that:

" . . .the analysis offers support for the existence of a small factor of cognitive style distinct from intelligence and spatial ability. This finding is in line with that of Witkin, et al. (1962), but the factor of cognitive style extracted is comparatively small. . ." (p. 40).

Coop and Brown (1970) categorized 80 college students as analytic and non-analytic and assigned each group to course material presented either as teacher-structured presentations or as an independent problem-solving exercise. They found that the teacher-structured presentation resulted in higher achievement among both categories of students. The cognitive style did not have any significant influence on performance in

either instructional situation. Possibly, one reason for the superiority of the teacher-structured presentation method may be that it is more nearly like the teaching methods to which college students have been exposed during their academic careers. The individual problem-solving method would appear to demand that the students furnish some type of internal motivation in that they are not compelled to attend class each day or even to meet with their instructor except on infrequent occasions. The individual problem-solving method is a relatively unstructured teaching technique, at least, in the sense that these students had experienced structure in other classes, and this lack of instructor structure may have created some conflict in the minds of the students in regard to the procedures and objectives of the course. Coop and Brown (1970) also concluded from these findings that cognitive style did not play a strong role in student achievement, but that teacher structured material resulted in more learning in contrast to student unstructured material. The authors contended that the teacher's knowledge of the subject matter allowed them to logically structure the content in a means easily comprehended by the students.

Davis (1988) investigated matching teaching approach with student learning style. Kolb Learning Style Inventory (LSI) was administered to all entering students ($n = 196$) enrolled in freshman English and to their instructors ($n = 7$) at a selective southern liberal arts college. Grades were collected at the end of the semester. A Kruskal-Wallis one-way analysis of variance by ranks indicated that there was no significant difference in student achievement as measured by grade between students who were matched, not matched, or partially matched with the teacher's learning style. This

analysis also indicated that learning style did not influence student grades. There was no significant difference in the mean ranks of the students' learning styles.

Davis (1988) stated that in an application of Kolb's theory to the classroom, matching the learning style of the teacher and student should make a difference in how well students do in that course. This did not prove to be the case in this study. She stated that this may have happened because the college has a rather selective admission policy and students probably are used to achieving high grades and adapting to the style of the teacher when necessary. In addition, the students are generally considered to be highly motivated and this motivation probably contributed to their adjustment to the teacher's learning style. A second major area which may have contributed to the lack of significant results may be in the relationship between the assessed learning style of the teacher and the actual teaching priorities and instructional methodology used in the classroom.

Thompson and O'Brien (1991) conducted a study to investigate the effects of teaching styles, student learning styles, matched and mismatched conditions, as well as student age and gender in relation to course grades in post-secondary education. The Gregorc Style Delineator was utilized to determine the dominant styles of both teachers and students. Resultant data were analyzed using analysis of variance (ANOVA). Findings from this study revealed that no significant main effects were observed for either student learning style or match/mismatch on course grade. The specific findings were particularly interesting in that they were manifested in a direction exactly opposite that implied by the related literature. Numerous authors have suggested that students whose learning style matches that of their teachers tend to attain higher grades. In this

study, that seemed to be true only for students exhibiting a CR style. Students exhibiting CS, AS, and AR styles and who were mismatched with the learning style of their instructors tended to receive higher grades.

Domino's (1971) findings conflicted with the conclusions of Coop and Brown. He conducted a study to examine the possibility that a significant correlation exists between success and matched learning style. He anticipated that when students were taught according to their achievement orientation; they would out perform students who were not matched to their preferred orientation. Achievement orientation was assessed by the Achievement via Independence (AI) and Achievement via Conformity (AC) scales of the California Personality Inventory (CPI). The test sample for the study consisted of fifty high conformity students placed in two different instructional formats, high lecture and high student discussion; fifty high independence students were placed in equivalent instructional formats. At the end of the semester, all students were given a 200 item multiple choice test in addition to six essay questions. Findings revealed a significant interaction between teaching methodology and student achievement orientations. The matched students scored significantly higher and evaluated their teacher more positively than did the unmatched students. Robertson (1977) conducted a study using the Canfield Learning Style Inventory. He found that students matched with content and modality of reading materials and their preferred learning style tend to earn higher reading post-test scores than those who were not matched with preferred learning styles and reading material.

Dunn and Dunn (1979), Fuhrmann (1978), McKnight (1978), and Magnam and Smith (1978) have concluded independently that there are numerous learning styles just

as there are numerous teaching styles, and that student learning will be optimized when the student's learning style is matched with the teaching style that is appropriate for his/her learning style in that particular situation.

Age and Learning Style

Dorsey and Pierson (1984) investigated the effectiveness of Kolb's Learning Style Inventory (LSI, 1985) to guide counselors and faculty in dealing with the adult learner. Profiles from 513 adult students were developed and analyzed for significance in instructional method, curriculum development and counseling. The profiles were developed by utilizing the Kolb LSI to determine dominant learning styles. The student also provided demographic information such as sex, race, age, and occupational clusters as defined by the dictionary of Occupational Titles. The student profile derived identified dominant adult learning styles that could serve as a framework for designing and implementing adult educational programs. Dorsey and Pierson (1984) found that age and prior work experience influence learning style type and of these two variables, age and age differences become an increasingly important index of student learning styles. Data indicated that the accommodator becomes predominant at about the age of thirty-three. At this point a student learns actively through trial and error and experience and the student will profit more from student-involved experiential learning than from pure lecturing. In other words the adult, especially after age thirty-three, learns better by doing. The student moves from merely assimilating facts as their younger counterparts did to understanding and using the interrelationship of information and ideas. The adult at or near the age of thirty-three begins to see the potential for

career obsolescence and may adopt a learning style to compensate for rapid environment changes.

Ommen, et al. (1979) conducted a study on 2824 community college students. After determining the learning styles of the subjects, they found significant differences between the learning styles of younger students and students 25 years and older. They believed this indicated that learning style changed over time, possibly due to the different social and task environments encountered by the different age groups. The research also indicated that learning style was related to the preferred mode of instruction.

Titus, Bergandi, and Shryock (1990) investigated learning style in adolescent population and how these styles differ from those of adults. Three hundred six high school students participated in the study. The sample consists of 163 females, 143 males, 128 slow-track and 178 fast-track learners. Learning style was measured by the Kolb Learning Style Inventory (LSI). Analysis of variance was used and the means of each of Kolb's four styles were computed from the sample and then converted to percentiles based on adult norms supplied by Kolb. The results suggest that adolescents are not nearly as abstract in their learning style as adults and that they prefer to learn in a more concrete way than adults. They do, however, appear to be similar to adults in the degree to which they are active and reflective in their learning. The fact that older adolescents (seniors) described themselves as more abstract than younger ones (freshman) suggests that movement toward greater abstraction is being made, but the highest level is not achieved until sometime in adulthood. The observation that senior male fast-track subjects came closest to the center of the adult sample and that the

opposite group, freshman female slow-track subjects were the farthest away, implies that age, gender and aptitude all are involved in the maturation of learning style.

Kolb (1986) stated that experiential learning emphasizes the important role that experience plays in the learning process. People grow and develop skills in four main dimensions of their lives. These areas are effective, symbolic, behavioral, and perceptual skills. Increased experience with each mode leads to increased complexity and sophistication in each set of skills. The more an individual acquires in each mode, the more movement is made toward integration. An effective learner is able to reply flexibly in these four learning modes in whatever combinations the situation requires.

Gleason (1986) and Snow (1986) concluded that much more research is needed to resolve the inconsistencies in research findings and conclusions dealing with learning style match-mismatch. Bonham (1988) stated that adult educators seem to have been later than children's educators in focusing on learning styles. Simpson (1980) identified learning style as one of the more exciting but minimally explored areas of research related to adult learning (p. 53).

Summary

This review has focused on literature related to learning style. It has reviewed the following areas: learning style concept, learning style models, instructor-student transaction and learning style, learning style mismatch and the relationship to achievement and evaluation, and age and learning style.

The concept of individual differences has been shown to be related to human behavior and as a viable construct for the study of learning style. Studies were presented which indicated that learning style models are useful in measuring people's

preferences for acquiring and using information. The interaction of student and teacher was shown to significantly influence mutual perceptions and attitudes.

The research studies considering effects of individual learning style upon academic achievement provided inconsistent results. Although the literature revealed that there was significant interaction between student learning style and instructor learning style (Campbell, 1974; Domino, 1971; Dunn and Dunn, 1979; Magnam and Smith, 1978), some researchers have not confirmed this finding (Coop and Brown, 1970; Satterly, 1976; Davis, 1988; Thompson, and O'Brien, 1991). There was also convincing evidence to suggest further investigations to clarify inconclusive results.

The effects of learning style match-mismatch among traditional-age college students has been documented. Few studies have addressed the problem of predicting learner academic achievement and identifying appropriate teaching styles that facilitates academic achievement for nontraditional-age students. This clearly illustrates the importance of studying the relative effects of age and learning style mismatch which might have an impact on older adult students' academic achievement and perception of instructors.

Chapter III

Research Design

The purpose of this chapter is to describe the research design. The research design consists of a description and selection of the population, description of the instruments, statistical technique and treatment of the data used to investigate the relationship between students' age, achievement, evaluation of the instructor, and the match-mismatch of students' and instructors' learning styles.

Population

Seventeen (17) business instructors teaching at a college in Washington, D.C. comprised the faculty population. The student population was composed of 302 business students attending this college. The students in the study were selected as intact groups enrolled in the participating faculty members class. The age range was between 18-60.

The college offers Bachelor and Master degree programs in Computer Information Science, Business Administration, Economics, Accounting, and Marketing in the Washington, D.C. area. This college is predominately a commuter campus. There are approximately 7100 students.

Instrumentation

The Gregorc Style Delineator (1982), The Learning Style Inventory (Kolb, 1985), and the college's Student Opinion Survey were used in this study. Both learning style instruments are widely used, although their reliability and validity have been subjected to questions. The Style Delineator is used primarily with teachers and high school students while the Learning Style Inventory is used primarily with adults in training environments. The two instruments also have different theoretical frameworks. There is no research

presently available to show which theoretical framework would be most useful in studying the impact of students' and faculty's learning styles match and mismatch upon students' achievement.

Previous research regarding the relationship of student-instructor learning style designated that relationship as a match or mismatch on a categorical basis (Mehdikhani, 1980, Shmaefsky, 1987). It is possible that some learning styles that were designated mismatch may share at least one element of the instructor's dominant learning style. This study will designate learning style as a match, mismatch, or overlap.

Gregorc Style Delineator

The Gregorc Style Delineator is a one page, ten-item learning style inventory designed to make the students and faculty aware of their dominant style or "mediation channel" as referred to by Gregorc. Gregorc stressed that the inventory can serve as a tool for increasing awareness of self, others, and the environment (Gregorc, 1982). The instrument was also designed to measure dominant, intermediate and low preference for the four delineated styles: Abstract Random (AR), Abstract Sequential (AS), Concrete Random (CR), and Concrete Sequential (CS). The learning styles of the subjects were determined by a word matrix divided into ten parts, with each part containing four words. The four words in each part are prescriptive of the learning style category. The students and faculty were asked to rank the words in ascending order of least (1) and most (4) descriptive of themselves. Gregorc (1982) reports that the style categories maintained the following test-retest reliabilities for a sample of 110 adults over an eight-week period: abstract random, 0.92; abstract sequential, 0.89; concrete random, 0.93; concrete sequential, 0.92; and predictive validity correlations ranging from .55 to .76.

O'Brien (1990) found reliability coefficients of .64 for the CS scale, .51 for the AS scale, .61 for the AR scale, and .63 for the CR scale. Confirmatory factor analysis indicated that while all of the separate items did not serve well as measures of their respective scales, jointly, they meet minimal standards for factor definition and provide adequate measurement scales for the four styles.

Learning Style Inventory (LSI, Kolb, 1985)

The Kolb LSI is a twelve-item learning style inventory based on the theory of experiential learning. Learning is seen as a four-step process and style is the preference for two adjoining steps. Each preference is for one end of a bi-polar dimension, Abstract Conceptualization (AC) versus Concrete Experience (CE) and Active Experimentation (AE) versus Reflective Observation (RO). The styles are Converger, Diverger, Assimilator, and Accommodator. The instrument consists of 12 items, each with four statements. The students and faculty were asked to rate the statements in terms of how well the statements described their learning pattern.

Kolb (1986) reported that the test-retest reliability of LSI, 1985, was as follows: Concrete Experience (CE), .82; Reflective Observation (RO), .73; Abstract Conceptualization (AC), .83; Active Experimentation (AE), .78. Wunderlich & Gjerde (1978) suggested the possibility of individual words used in the Learning Style Inventory being interpreted differently. Bonham (1987) stated that the new version (1985) of Kolb's Learning Style Inventory deals with the problems about numbers of items and item wording.

Other Instruments

A learning style perception questionnaire designed by the researcher was administered to the participants. This questionnaire was designed to gather data about students' perception of the learning experience in the classroom. Specifically, the questionnaire gathered data concerning whether students' perception of a mismatch is a better predictor of achievement than the measurements obtained from the actual learning style instrument.

The college's Student Opinion Survey was also administered to the participants. This survey has a rating scale for questions pertaining to the evaluation of instructors. The scale ranges from 5 (Outstanding) to 1 (Poor).

A demographic questionnaire designed by the researcher was also given to the participants for completion. This questionnaire gathered data about sex, race, age, education, and students' rating of the instructor.

Summary of Pilot Study

Five instructors and their classes consisting of 70 students were utilized for the pilot study. The Gregorc Style Delineator and Kolb's LSI were used to identify learning styles. The pilot study was implemented to determine the distribution of students whose learning styles matched, mismatched, or overlapped with their instructor and to ascertain if there was sufficient variance to further explore the research questions. The results of the pilot study are presented in Table 1. The only conclusion drawn from this pilot study

Table 1

Distribution of Match, Mismatch, and Overlap

<u>Gregorc Style Delineator</u>				
Class	Number in Class	Matched	Mismatched	Overlap
A	9	12.00%	44.00%	44.00%
B	12	58.00%	00.00%	42.00%
C	15	33.30%	13.30%	53.30%
D	18	33.30%	16.70%	50.00%
E	16	43.75%	18.75%	37.50%
Totals	70	n=26 37%	n=12 17%	n=32 46%

<u>Kolb's LSI</u>				
Class	Number in Class	Matched	Mismatched	Overlap
A	9	00%	44%	56%
B	12	67%	08%	25%
C	13	00%	54%	46%
D	17	12%	18%	70%
E	16	44%	06%	50%
Totals	67¹	n=17 25%	n=16 24%	n=34 51%

¹ Three were eliminated due to incomplete data.

was that there appears to be sufficient variance among the selected sample population to continue with this study.

Procedures

The participating college was contacted for written permission to conduct this study, within the Business Department, at its Washington, D.C. campus. A letter describing the study and confidentiality of the research was sent to faculty and students. The students and faculty were advised that they have the option of not participating without reprisal. During the fourth week in the quarter, the Gregorc Style Delineator and the Learning Style Inventory were administered during class and the students and instructors were asked to respond to the learning style instruments and a demographic data sheet. The students were asked for their permission to obtain their final grade for the course and to complete a student evaluation of instructor and learning style perception questionnaire.

The learning style instruments, faculty evaluations, student grades, and demographic and learning style perception questionnaires were handled in a manner to maintain confidentiality. Individual students' names or data were not made available to instructors or the college. The Gregorc Style Delineator, Learning Style Inventory, demographic questionnaire, learning style perception questionnaire, evaluation form, and grades were each coded using the student identification number and the course number. Information collected was destroyed immediately after being transferred to coded summary sheet. All information was held in strict confidence and was for research purposes only. Students were given the opportunity to share in the aggregate results at the completion of the study.

Scoring of the Instruments

Kolb's Learning Style Inventory (LSI)

A dominant learning style was determined by finding the difference of each polarity (AC-CE and AE-RO). The difference was plotted on the AC-CE and AE-RO axes of the Learning Style Type Grid and the quadrant in which the coordinates fall represents the dominant learning style.

An example of a mismatch is an instructor with a Converger learning style and a student with a Diverger learning style. An overlap is an instructor with a Converger learning style and a student with an Assimilator or an Accommodator learning style. Table 2 shows all possible combinations.

Gregorc Style Delineator

A dominant learning style was determined by finding the CS, AR, AS, and CR scores. The CS and AR scores were plotted on the CS, AR, vertical axis and the AS and CR scores were plotted on the CR, AS axis. Total of all scores must equal 100. This plotting gives a graphic representation of dominant, intermediate, and low learning styles.

An example of a mismatch is an instructor with a CS dominant learning style and a student with a AR learning style. An overlap is an instructor with a CS dominant learning style and a student with a CR or AS learning style. Table 3 shows all possible combinations.

Other Instruments

The grades were supplied as a letter grade (A, B, C, D, and F) as assigned by the instructor. The grade was converted to a scale in the following manner: A = 4, B = 3, C = 2, D = 1, and F = 0. Evaluation of instructors was done by students. The rating

scale for questions pertaining to the evaluation of instructors was assigned the following numerical value: 4 = outstanding; 3 = above average; 2 = average; 1 = below average; and 0 = poor. The instructor's overall rating was determined by adding the rating scale scores for the questions.

The learning style perception questions are representative of the learning styles that were used in this study. The items were grouped according to characteristics of each learning style. The learning style questionnaire responses were compared with the actual learning style as measured by the instrument.

Statistical Treatment of the Data

The possible match, mismatch, and overlap between instructor and student learning styles are presented in Tables 2 and 3.

A full analysis of each occupied cell was performed. All cells were not occupied. These possible combinations of match, mismatch, and overlap affected the number and type of analyses to be performed.

The main statistical treatment for this study was multiple regression. Supplementary analyses included, as necessary, One Way Analysis of Variance and Chi Square.

The following legend or coding schema were used in the explication of the various regression models corresponding to each of the research questions.

Match = M

Mismatch = MM

Overlap = O

Age = A

Table 2

Kolb's LSI Match, Mismatch, and Overlap

		Student			
		Acc	Assim	Div	Conv
Instructor	Acc	M	MM	0	0
	Assim	MM	M	0	0
	Div	0	0	M	MM
	Conv	0	0	MM	M

M = Match
 MM = Mismatch
 O = Overlap

Acc = Accommodator
 Assim = Assimilator
 Div = Diverger
 Con = Converger

Table 3

Gregorc's Style Delineator Match, Mismatch, and Overlap

		Student			
		Con Seq	Con Ran	Abs Seq	Abs Ran
Instructor	Con Seq	M	0	0	MM
	Con Ran	0	M	MM	0
	Abs Seq	0	MM	M	0
	Abs Ran	MM	0	0	M

Con Seq = Concrete Sequential Con Ran = Concrete Random
 Abs Seq = Abstract Sequential Abs Ran = Abstract Random

Race	=	R
Sex	=	S
Grades	=	G
Evaluation	=	E
Instructor Learning Style	=	IL
Student Learning Style	=	SL
Intercept Constant	=	a
Regression Coefficient	=	b

Prior to the testing of the regression model specifically formulated for each research question, basic preliminary data were assembled. These data facilitated the statistical decisions required in the implementation of each regression model.

The following preliminary steps were performed:

1. Each independent variable was forced into a regression equation to determine its contribution to the variance in the dependent variable.
2. A full model analysis was conducted with match, mismatch, and overlap (the theoretical predictors) and the demographic predictors (race, sex, and age).
3. Primary interactions, residuals, and correlational matrices were examined to aid the parsimony of the regression model for each research question.

The research questions were treated as follows:

1. What is the relationship between age, learning style mismatch, and grade?

$$G^1 = a + (bR + bS + IL + SL + M + MM + O) + A$$

This model tested the prediction that students' grades were unaffected by their age and learning style match or mismatch with the instructor. To diagnose, determine, and

neutralize the predictive contribution to grade, the variables of race, sex, instructor learning style, student learning style, match, mismatch, and overlap were forced into the equation in the first block, followed by age. Additionally, primary interactions (age and match, age and mismatch, and age and overlap) were examined to determine the significance of their contribution. As referenced in the foregoing literature review, only the pertinent first order interactions were included in the model.

2. What is the relationship between age, learning style mismatch, and students' evaluation of instructors?

$$E^1 = a + (bR + bS + IL + SL + M + MM + O) + A$$

This model tested the prediction that students' evaluations of instructors were unaffected by age, instructors' learning styles and students' learning styles match or mismatch with the instructor. To diagnose, determine, and neutralize the predictive contribution to evaluation, the variables of race, sex, instructor learning style, student learning style, match, mismatch, and overlap were forced into the equation in the first block, followed by age. Additionally, primary interactions (age and match, age and mismatch, and age and overlap) were examined to determine the significance of their contribution. As referenced in the foregoing literature review, only the pertinent first order interaction was included in the model.

3. Does the particular learning style of the instructor affect the relationship between learning style mismatch and grade?

$$G^1 = a + (bR + bS + SL + A + M + MM + O) + IL$$

This model tested the prediction that students' grades was unaffected by the learning style match or mismatch with the instructor. To diagnose, determine, and

neutralize the predictive contribution to grade, the variables of race, sex, student learning style, age, match, mismatch, and overlap were forced into the equation in the first block, followed by instructors' learning style. Additionally, the main model was reconfigured so that instructor learning style was included with the demographic variables and entered in the first block with match, mismatch, and overlap entered as individual equations in the second block.

4. Does the particular learning style of the instructor affect the relationship between learning style mismatch and evaluation?

$$E^1 = a + (bR + bS + SL + A + M + MM + O) + IL$$

This model tested the prediction that students' evaluations of instructors were unaffected by the learning style match or mismatch with the instructors. To diagnose, determine, and neutralize the predictive contribution to evaluation of instructors, the variables of race, sex, student learning style, age, match, mismatch, and overlap were forced into the equation in the first block, followed by instructors' learning style. Additionally, the main model was reconfigured so that instructor learning style was included with the demographic variables and entered in the first block with match, mismatch, and overlap entered as individual equations in the second block.

5. Does the particular learning style of the student affect the relationship between learning style mismatch and grade?

$$G^1 = a + (bR + bS + IL + A + M + MM + O) + SL$$

This model tested the prediction that students' grades were unaffected by the students' learning style. To diagnose, determine, and neutralize the predictive contribution to grade, the variables of race, sex, instructor learning style, age, match, mismatch, and

overlap were forced into the equation in the first block, followed by students' learning style. Additionally, the main model was reconfigured so that instructor learning style was included with the demographic variables and entered in the first block with match, mismatch, and overlap entered as individual equations in the second block.

6. Does the particular learning style of the student affect the relationship between learning style mismatch and evaluation?

$$E^1 = a + (bR + bS + IL + A + M + MM + O) + SL$$

This model tested the prediction that students' evaluations of instructors were unaffected by the students' learning style. To diagnose, determine, and neutralize the predictive contribution to evaluation, the variables of race, sex, instructor learning style, age, match, mismatch, and overlap were forced into the equation in the first block, followed by the students' learning style. Additionally, the main model was reconfigured so that instructor learning style was included with the demographic variables and entered in the first block with match, mismatch, and overlap entered in individual equations on the second block.

Additional secondary analyses related to the foregoing models included an examination of the relationship between the frequency of the instructor/student match, mismatch or overlap with the mean student grade point average and the mean student evaluation rating of the instructor. Coeval to these analyses was the identification of any learning style grouping phenomenon associated with specific courses taught. These analyses utilized the class as an intact group.

Summary

The population consisted of business instructors and business students at a college in Washington, D.C. The instruments used in this study were the Gregorc Style Delineator (1982), the Learning Style Inventory (1985), and the college's Student Opinion Survey.

A learning style questionnaire and a demographic questionnaire designed by the researcher was used to collect data. The main statistical method for treatment of data was multiple regression.

Chapter IV

Analysis of Data and Statements of Findings

The purpose of this study was to investigate the relative effects of age and learning style mismatch on adult students' academic achievement and perception of instructors. The following questions guided this study:

1. What is the relationship between age and learning style mismatch and grade?
2. What is the relationship between age and learning style mismatch and evaluation?
3. Does the particular learning style of the instructors affect the relationship between learning style mismatch and grade?
4. Does the particular learning style of the instructors affect the relationship between learning style mismatch and evaluation?
5. Does the particular learning style of the student affect the relationship between learning style mismatch and grade?
6. Does the particular learning style of the student affect the relationship between learning style mismatch and evaluation?

Prior to the testing of the regression model specifically formulated for each of the questions, basic preliminary data were assembled. These data facilitated the statistical decisions required in the implementation of each regression model. Tables 4 through 13 present preliminary and other meaningful data describing the demographics and important characteristics of the sample.

Table 4 presents demographic data for the test sample. Among instructors, more males are represented than females and among students, more females are represented.

Racial minorities comprised 87.5% of the sample. The mean age of the sample was 29.7 with 37.6% clustering in the 24-31 year-age group. All of the instructors were over 32. Fifty-three percent of the instructors were black, as were 62% of the students. Most learning style studies have not had such black participation rates. On sex, only 3 of 17 instructors (18%) were female, in contrast to 58% of the students. Twenty-five percent of the student population were Hispanic or Asian.

Table 5 shows data for learning styles for instructors and students. Diverger was the dominant learning style for instructors and students as measured by the Kolb LSI. The dominant learning style for instructors and students was concrete sequential as measured by Gregorc Style Delineator.

Data in Table 6 shows a crosstabulation of Kolb LSI learning styles by Gregorc Style Delineator for instructors and students. Using the Kolb LSI to measure style, diverger was the dominant style (13) among instructors. However, when compared with the Gregorc Style Delineator, 11 of those divergers were concrete sequential, one was abstract sequential and one was concrete random. Among students, the dominant learning style was diverger (144) using the Kolb LSI. When compared to the Gregorc Style Delineator, 55 of those divergers were concrete sequential, 27 were abstract sequential, 32 were abstract random, and 30 were concrete random. Using the Gregorc Style Delineator to measure style, concrete sequential was the dominant style (14) among instructors. When compared with the Kolb LSI, 11 of those concrete sequential were divergers, two were assimilators, and one was an accommodator. Among students, the dominant learning style was concrete sequential (108). When compared to the Kolb LSI,

Table 4

Ethnic, Gender, and Age Distribution of Sample

Demographic of Sample	Instructors		Student		% of Total
	Male	Female	Male	Female	
Black	7	2	60	127	61.4
White	7	--	19	14	12.5
Hispanic	--	--	4	--	1.3
Asian	--	--	40	32	22.6
Other	--	1	3	3	2.2
Young 23 or less	--	--	38	57	29.8
Mid Age Group 24-31	--	--	62	58	37.6
Older 32 and above	14	3	26	61	32.6

Table 5

Distribution of Sample by Learning Style - Kolb LSI and Gregorc Style Delineator

Learning Style	Instructors	Student	Total	% of Total
<u>Kolb LSI:</u>				
Accommodator	1	94	95	29.8
Diverger	13	144	157	49.2
Converger	1	21	22	6.9
Assimilator	2	43	45	14.1
<u>Gregorc Style Delineator:</u>				
Concrete Sequential	14	108	122	38.0
Abstract Sequential	2	56	58	18.1
Abstract Random	0	66	66	21.0
Concrete Random	1	72	73	22.9

Table 6

Crosstabulation of Kolb LSI Learning Style by Gregorc Style Delineator Learning Styles for Instructors and Students

Gregorc Style Delineator					
Instructors:					
Kolb LSI	Concrete Sequential	Abstract Sequential	Abstract Random	Concrete Random	Row Total
Accommodator	1	0	0	0	1
Diverger	11	1	0	1	13
Converger	0	1	0	0	1
Assimilator	2	0	0	0	2
Column Total	14	2	0	1	17

Gregorc Style Delineator					
Students:					
Kolb LSI	Concrete Sequential	Abstract Sequential	Abstract Random	Concrete Random	Row Total
Accommodator	45	25	10	14	94
Diverger	55	27	32	30	144
Converger	6	1	7	7	21
Assimilator	2	3	17	21	43
Column Total	108	56	66	72	302

55 of those concrete sequential were divergers, 45 were accommodators, six were convergers, and two were assimilators.

Table 7 presents a crosstabulation of age group by learning style of the sample. Using the Gregorc Style Delineator, the older age group represented the largest subgroup of the sample with the same learning style, concrete sequential. Additionally, using the Kolb LSI, the older age group also was the largest subgroup of the sample with the same learning style, diverger.

Table 8 presents a distribution of student match, mismatch, and overlap by students' and instructors' learning style using the Kolb LSI and Gregorc Style Delineator to measure style. Table 9 presents a summary distribution of this data.

Tables 10 and 11 present a crosstabulation of the dependent and independent variables. Several forms of analyses were conducted with the evaluation instrument in an attempt to determine the most meaningful configuration of the eleven-item scale. No singular item or small group of items were statistically meaningful in a series of one-way ANOVAs. Hence, the eleven-item additive scale was adopted in toto. A significant F ratio ($P < .05$) was obtained for gender with respect to grade and for race with respect to evaluation score. A one-way ANOVA of mean grades for match, mismatch, and overlap learning styles as determined by the Kolb LSI indicated that the mean grade of students whose learning style matched with their instructors did not differ significantly from those whose learning style mismatched or overlapped as shown in Table 11.

Table 12 shows data pertaining to the Mean Instructors Evaluation Scores assigned by students using the Gregorc Style Delineator and the Kolb LSI to determine

Table 7

Crosstabulation of Age Group by Learning Style of Sample

Gregorc Style Delineator Learning Style	Young Less than 23	Mid Age 24-31	Older 32+	Total
Concrete Sequential	30	46	55	131
Abstract Sequential	26	21	17	64
Abstract Random	23	25	12	60
Concrete Random	16	28	20	64
Total Instructors and Students	95	120	104	319
Kolb LSI Learning Style	Young Less than 23	Mid Age 24-31	Older 32+	Total
Accommodator	30	45	20	95
Diverger	51	45	61	157
Converger	4	10	8	22
Assimilator	10	20	15	45
Total Instructors and Students	95	120	104	319

Table 8

Distribution of Student Match, Mismatch, and Overlap by Students' and Instructors' Learning Style Using the Kolb LSI and Gregorc Style Delineator

Kolb LSI:		Student N=302				
		Acc	Assim	Div	Conv	Total
Instructors N=17	Acc 1	M 1	MM 5	O 16	O 1	23
	Assim 2	MM 13	M 5	O 17	O 3	38
	Div 13	O 80	O 33	M 111	MM 16	240
	Conv 1	O 0	O 0	MM 0	M 1	1
	Total 17	94	43	144	21	302

M=Match
MM=Mismatch
O=Overlap
Acc=Accommodator
Assim=Assimilator
Div=Diverger
Con=Converger

Gregorc Style Delineator:		Student N=302				
		Con Seq	Con Ran	Abs Seq	Abs Ran	Total
Instructors N=17	Con Seq 14	M 101	O 58	O 42	MM 51	252
	Con Ran 1	O 5	M 2	MM 8	O 3	18
	Abs Seq 2	O 2	MM 12	M 6	O 12	32
	Abs Ran 0	MM 0	O 0	O 0	M 0	0
	Total 17	108	72	56	66	302

M=Match
MM=Mismatch
O=Overlap
Con Seq=Concrete Sequential
Con Ran=Concrete Random
Abs Seq=Abstract Sequential
Abs Ran=Abstract Random

Table 9

Summary Distribution of Student Match, Mismatch, and Overlap with Instructors
Gregorc Style Delineator and Kolb LSI

Learning Style Instruments	M	MM	O	Totals
<u>Kolb</u> N= %=	118 39.1	52 17.2	132 43.7	302 100.0
<u>Gregorc</u> N= %=	109 36.1	71 23.5	122 40.4	302 100.0

M = Match
MM = Mismatch

Student N = 302
O = Overlap

Table 10

Crosstabulation of Gender, Ethnicity, and Age by Mean Grade and Evaluation Score

Demographics	N	Mean Grade	Mean Evaluation Score
<u>Gender</u>			
Male	126	3.13	39.8
Female	176	2.86	40.1
<u>Race</u>			
Black	187	2.97	41.2
White	33	3.18	39.8
Hispanic	4	2.50	35.8
Asian	72	2.86	36.8
Other	6	3.33	42.7
<u>Age</u>			
Young 23 or less	95	2.75	39.11
Mid 24-31	120	3.11	39.78
Older 32 and Older	87	3.02	41.16

Table 11

Crosstabulation of Grade and Evaluation by Learning Style and Match, Mismatch, and Overlap

Learning Styles	N	Mean Grade	Mean Evaluation Score
Subgroups:			
<u>Kolb LSI Style</u>			
Accommodator	94	2.94	39.4
Assimilator	43	2.98	39.5
Diverger	144	2.98	40.2
Converger	21	3.05	41.8
<u>Gregorc Style Delineator</u>			
Concrete Sequential	108	3.07	40.6
Concrete Random	72	2.94	38.9
Abstract Sequential	56	2.89	37.7
Abstract Random	66	2.90	42.1
<u>Kolb LSI</u>			
Match	118	2.89	39.1
Mismatch	52	2.98	40.4
Overlap	132	3.03	40.5
<u>Gregorc Style Delineator</u>			
Match	109	3.05	40.3
Mismatch	71	2.87	40.4
Overlap	122	2.94	39.4

Table 12

Mean Instructors Evaluation Scores Assigned by Students Using the Gregorc Style Delineator and the Kolb LSI to Determine Learning Style

No.	Evaluation Questions	Match		Mismatch		Overlap	
		Gregorc	Kolb LSI	Gregorc	Kolb LSI	Gregorc	Kolb LSI
1.	Comes to class prepared.	3.77	3.67	3.81	3.78	3.65	3.76
2.	Is knowledgeable of subject matter.	3.75	3.77	3.91	3.96	3.73	3.73
3.	Presents material in a clear concise manner.	3.52	3.46	3.65	3.62	3.52	3.58
4.	Encourages me to ask questions and express ideas.	3.74	3.58	3.71	3.60	3.52	3.70
5.	Makes good use of examples and illustrations.	3.63	3.54	3.65	3.69	3.57	3.64
6.	Encourages me to do my best work.	3.66	3.53	3.61	3.51	3.60	3.72
7.	Provides new viewpoints or attitudes.	3.48	3.31	3.63	3.69	3.37	3.51
8.	Tests reflect material covered in class.	3.70	3.58	3.68	3.62	3.59	3.70
9.	Is an able speaker.	3.72	3.59	3.65	3.56	3.60	3.73
10.	Begins and ends classes on schedule.	3.57	3.39	3.52	3.58	3.60	3.70
11.	Overall rating of instructors.	3.65	3.55	3.61	3.80	3.61	3.63
12.	Evaluation scores for all 11 questions.	40.18	39.97	40.42	40.40	39.35	40.38

Style. No significant relationship was found between match, mismatch and overlap using either instrument.

Table 13 presents a crosstabulation of age group by match, mismatch, and overlap.

A chi square analysis was conducted on match, mismatch, and overlap using Kolb LSI with age grouping of young, mid, and older. The Kolb LSI match, mismatch, and overlap with age grouping was significant at the .05 level ($\chi^2 = 9.871$, $df = 4$, and significant = .04). The chi square analysis on match, mismatch, and overlap using Gregorc Style Delineator with age grouping was not significant.

This concludes the presentation of preliminary and other meaningful data describing the demographics, and other important characteristics of the sample population.

Test of Research Questions

An a priori regression model was specifically formulated to examine each research question. The variables included in each model were used to predict students' grades or students' evaluation of instructors as appropriate to the specific research question.

Research question 1:

What is the relationship between age and learning style mismatch and grade?

Research question 1 was tested using the following regression model:

$$G^1 = a + (bR + bS + IL + SL + M + MM + O) + A$$

Regression analysis was used to determine the extent to which the variables in the main model contributed to grade, in the specific order of entry noted in the model.

Table 13

Crosstabulation of Age Group by Match, Mismatch, and Overlap

Learning Styles	Age Group			
	Young	Middle	Older	Total
<u>Kolb LSI</u>				
Match	40	30	37	107
Mismatch	14	21	10	45
Overlap	41	69	40	150
Total	95	120	87	302
<u>Gregorc Style Delineator</u>				
Match	36	43	36	115
Mismatch	23	27	12	62
Overlap	36	50	39	125
Total	95	120	87	302

The race, sex, instructors' learning styles, students' learning styles, match, mismatch and overlap variables were entered first as a set with the age variable entering next. The relationship between these variables and grade was not significant using the Kolb LSI. Race, sex, instructors' learning styles, students' learning styles, match, mismatch and overlap did not contribute significantly to grade. These variables had an F value of 1.775 with an associated P value of .091. Age was entered next and had an F value of 1.689 with an associated P value of .100. Only 4% of the variance in grade is explained by these two sets of variables with race, sex, instructors' learning styles, students' learning styles, match, mismatch and overlap contributing 4% and age contributing .003%.

When submodel analyses were performed using the Kolb LSI, race, sex, and age contributed 4% of the variance in grade. However, there was a significant relationship between race, sex, age, and grade and also with the primary interactions of age with match and age with overlap as shown in Table 14.

When using the Gregorc Style Delineator, the variables of race, sex, instructors' learning styles, students' learning styles, match, mismatch, and overlap did not contribute significantly to grade. These variables had an F value of 1.912 and an associated P value of .067. Additionally, the variables contributed only .043% of the variance in grade. Age had an F value of 1.783 with a P value of .079 associated with this F value.

A submodel analysis indicated that race, sex, and age had a significant relationship with grade ($p=.049$). Also the primary interaction of age with match had a significant relationship with grade ($p=.038$) as shown in Table 15.

Table 14

**Submodel Analysis:
Regression Model Source of Variation for the Dependent Variable Grade**

Kolb LSI					
	R²	R²chg	F	Beta	P
<u>Race, Sex, Age</u>	.041	.041	2.131		.049
Others				.047	
Hispanics				-.077	
White				.043	
Sex				-.060	
Asian				-.160	
<u>Interaction</u>					
Age x Match	.040	.002	2.073		.056
Others				.043	
Hispanics				-.082	
White				.040	
Sex				-.151	
Asian				-.087	
<u>Interaction</u>					
Age x Overlap	.044	.006	2.275		.036
Others				.048	
Hispanics				-.082	
White				.041	
Sex				-.147	
Asian				-.080	

Table 15

Submodel Analysis:

Regression Model Source of Variation for the Dependent Variable Grade

Gregorc Style Delineator					
	R²	R²chg	F	Beta	P
<u>Race, Sex, Age</u>	.041	.041	2.131		.049
Others				.047	
Hispanics				.077	
White				.043	
Sex				.060	
Asian				-.160	
<u>Interaction</u>					
Age x Match	.043	.006	2.252		.038
Others				.043	
Hispanics				-.082	
White				.045	
Sex				-.160	
Asian				-.078	

Research question 2:

What is the relationship between age and learning style mismatch and evaluation?

Research question 2 was tested using the following regression model:

$$E^1 = a + (bR + bS + IL + SL + M + MM + O) + A$$

The relationship between race, sex, instructors' learning styles, students' learning styles, match, mismatch, and overlap and evaluation was not significant using the Kolb LSI. An F value of 1.572 was obtained for these variables and the P value associated with this F value was .143. There was also no significant relationship found between age and evaluation using the LSI. An F value of 1.633 was obtained and the P value associated with the F value was .115. A submodel analysis revealed that the interactions of age with match, age with mismatch, and age with overlap did not contribute significantly to evaluation using the Kolb LSI.

The main model variables explained 4% of the variance in evaluation with race, sex, instructors' learning styles, students' learning styles, match, mismatch, and overlap contributing .036% of the variance and age contributing .007%.

The relationship between race, sex, instructors' learning styles, students' learning style, match, mismatch, and overlap and evaluation was not significant using the Gregorc Style Delineator. An F value of 1.457 was obtained for these variables and the P value associated with this F value was .182.

Age also did not contribute significantly with an F value of 1.542 and a P value of .142. The interactions of age with match, age with mismatch, and age with overlap did not contribute significantly to evaluation using the Gregorc Style Delineator in a sub-analysis. The main model variables explained 4% of the variance in evaluation.

Research question 3

Does the particular learning style of the instructors affect the relationship between learning style mismatch and grade?

Research question 3 was tested using the following regression model:

$$G^1 = a + (bR + bS + SL + A + M + MM + O) + IL$$

The regression analysis to determine if the particular learning style of the instructors affected learning style match and grade did not reveal a significant relationship. The variables of race, sex, students' learning styles, age, match, mismatch and overlap were entered as a set using Kolb LSI. The F value was 1.689 and the P value associated with this F value was .100. The instructors' learning styles (accommodator, diverger, converger, and assimilator) were entered next as a set. There was a significant relationship between the converger learning style and grade as shown in Table 16.

Submodel analysis of race, sex, and the instructors' learning styles diverger, assimilator, and accommodator, indicated no significant relationship with grade. However, this analysis indicated race, sex, and instructors' learning style converger, contributed to grade ($p = .015$). Additionally, when learning style converger matched ($p = .015$) and when converger learning style overlap ($p = .022$) there was a significant relationship with grade.

No significant relationship was found when race, sex, students' learning styles, age, match, mismatch, and overlap were entered into the main model ($F = 1.783$; $P = .079$) using Gregorc Style Delineator. When the particular learning styles of the

Table 16

Regression Model Source of Variation for the Dependent Variable Grade

Kolb LSI				
	R²	R²chg	F	P
Race, Sex, Student Learning Styles, Age, Match, Mismatch and Overlap	.044	.044	1.689	.100
Instructor Learning Style				
Accommodator	.044	.000	1.196	.149
Diverger	.046	.002	1.591	.117
Converger	.061	.017	2.131	.027
Assimilator	.045	.001	1.542	.133

instructors were entered, abstract sequential, ($F=1.877$; $P=.054$) and concrete random, ($F=2.410$; $P=.011$) did contribute to grade.

A submodel analysis indicated that instructors whose learning styles were abstract sequential and matched ($F=2.380$; $P=.029$) and abstract and overlap ($F=2.064$; $P=.047$) contributed to grade using Gregorc Style Delineator.

Table 17 presents the mean grades given by the instructors' particular learning style to match, mismatch and overlap students using the Kolb LSI and Gregorc Style Delineator to determine learning style.

Research question 4

Does the particular learning style of the instructors affect the relationship between learning style mismatch and evaluation?

Research question 4 was tested using the following regression model:

$$E^1 = a + (bR + bS + SL + A + M + MM + O) + IL$$

Using the main model to determine if the particular learning style of the instructors affected the relationship between learning style mismatch and evaluation using the Kolb LSI, there was no significant contribution of the variables race, sex, students' learning styles, age, match, mismatch and overlap to students' evaluation of instructors. These variables had an F value of 1.632 and a P value of .115. These variables contributed 4% of the variance in evaluation. When the instructors' learning styles were entered, no significant relationship was found. These variables contributed 1% of the variance in evaluation.

Table 17

Mean Grade Assigned by Instructors' Learning Style to Match, Mismatch, and Overlap Students

Kolb LSI			
Instructors' Learning Style	Student Mean Grade		
	M	MM	O
Accommodator	3.00	3.00	3.00
Diverger	2.93	3.00	3.05
Converger	3.00	2.82	2.11
Assimilator	2.00	3.08	3.35

Gregorc Style Delineator			
Instructors' Learning Style	Student Mean Grade		
	M	MM	O
Concrete Sequential	3.00	2.83	3.08
Abstract Sequential	3.06	2.91	2.97
Concrete Random	3.13	2.88	3.14

Note: There were no abstract random instructors.

The submodel analysis revealed that race, sex, and the particular instructors' learning style (accommodator) contributed to evaluation as shown in Tables 18 and 19. Race, sex, instructor learning style (accommodator) had an F value of 2.129 and a P value of .050. Race, sex, and instructor learning style (assimilator) also contributed to grade with an F value of 2.098 and a P value of .053 using Kolb LSI.

No significant relationship was found between race, sex, students' learning styles, age, match, mismatch, and overlap and evaluation of instructors using the Gregorc Style Delineator. The F value was 1.541 with a P value of .142 associated with this F value. When the particular instructors' learning styles were entered, no significant relationship was found. Additionally, when the sub-analysis was performed to include race, sex, and the particular instructors' learning styles, and match, mismatch, and overlap, no significant relationship emerged.

Table 20 presents the particular learning style of the instructors and the evaluation scores assigned by match, mismatch and overlap students using the Kolb LSI and Gregorc Style Delineator.

Research question 5

Does the particular learning style of the student affect the relationship between learning style mismatch and grade.

Research question 5 was tested using the following regression model:

$$G^1 = a + (bR + bS + IL + A + M + MM + O) + SL$$

An analysis of the regression model to determine if the particular learning style of the student affected the relationship between learning style mismatch and grade indicated that no significant relationship existed. When race, sex, instructors' learning

Table 18

Submodel Analysis:

Regression Model Source of Variation for the Dependent Variable Evaluation

Kolb LSI					
	R²	R²chg	F	Beta	P
<u>Race, Sex, Instructors' Learning Style</u> (Accommodator)	.041	.041	2.129		.050
Race					
Others				.019	
White				-.055	
Hispanics				-.058	
Sex				-.020	
Instructor Learning Style				.105	

Table 19

Submodel Analysis:

Regression Model Source of Variation for the Dependent Variable Evaluation

Kolb LSI					
	R ²	R ² chg	F	Beta	P
<u>Race, Sex, Instructors'</u> <u>Learning Style (Assimilator)</u>	.040	.040	2.098		.053
Race					
Others				.008	
Hispanics				-.056	
White				-.046	
Sex				-.026	
Instructor Learning Style				-.099	

Table 20
Mean Evaluation Scores Assigned by Match, Mismatch, and Overlap Students to Instructors

Kolb LSI			
Instructors' Learning Style	Student Mean Evaluation Score		
	M	MM	O
Accommodator	33.00	39.40	43.35
Diverger	39.11	42.31	39.98
Converger	33.00	37.18	30.33
Assimilator	40.80	41.15	45.15

Gregorc Style Delineator			
Instructors' Learning Style	Student Mean Evaluation Score		
	M	MM	O
Concrete Sequential	38.00	40.50	44.00
Abstract Sequential	40.26	40.73	38.72
Concrete Random	44.44	40.75	43.21

Note: There were no abstract random instructors

styles, age, match, mismatch, and overlap were entered as a set, the F value was 1.689 and the P value associated with this F value was .100 using the Kolb LSI. The students' learning styles (accommodator, diverger, converger, and assimilator) were entered next as a set. There was no significant relationship between the student's particular learning style and grade using the Kolb LSI.

The submodel analysis of race, sex, student learning style (accommodator) when matched indicated that these variables contributed to grade. These variables had an F value of 2.114 and a P value of .050. Additionally, the submodel analysis indicated that students whose learning style was diverger and who matched with instructors contributed to grade. The F value for this relationship was 2.09 and the P value was .044 using the Kolb LSI.

No significant relationship was found when race, sex, instructors' learning styles, age, match, mismatch, and overlap were entered as a set. The F value was 1.783 with an associated P value of .079 using the Gregorc Style Delineator. When the particular learning styles of the students were entered, no significant relationship was found between particular learning style and grade using the Gregorc Style Delineator.

The submodel analysis of race, sex, and particular students' learning styles indicate no significant relationship. No significant relationship existed between, race, sex, the particular learning style of students, and match, mismatch, and overlap with grade using Gregorc Style Delineator.

Research question 6

Does the particular learning style of the student affect the relationship between learning style mismatch and evaluation?

Research question 6 was tested using the following regression model:

$$E^1 = a + (bR + bS + IL + A + M + MM + O) + SL$$

An analysis of the regression model to determine if the particular learning style of the student affected the relationship between learning style mismatch and evaluation indicated that no significant relationship was found. When race, sex, instructor's learning style, age, match, mismatch, and overlap were entered as a set, the F value was 1.632 and the P value associated with this F value was .115 using the Kolb LSI. Students' learning styles (accommodator, diverger, converger, and assimilator) were entered next as a set. There was no significant relation between student's leaning style and evaluation using the Kolb LSI.

A submodel analysis of race, sex, and the particular students' learning styles (accommodator, converger, and assimilator) indicated no significant relationship was found with evaluation. However, the particular student's learning style (diverger) when matched indicated that these variables contributed to evaluation. The F value was 2.042 and the P value was .049 using the Kolb LSI.

No significant relationship was found when race, sex, instructor's learning style, age, match, mismatch, and overlap were entered were entered as a set using the Gregorc Style Delineator. The F value was 1.541 and the P value was .142. When the particular students' learning styles were entered, no significant relationship was found with evaluation.

The submodel analysis of race, sex, and the particular students' learning styles of abstract sequential, concrete sequential, abstract random and concrete random revealed no significant relationship with evaluation using Gregorc Style Delineator.

Summary of Results

1. The relationship between age and learning style mismatch and grade was not significant. Race, sex, instructors' learning styles, students' learning styles, match, mismatch, and overlap when using Kolb LSI had a P value of .091 and age had a P value of .100. A submodel analysis revealed that a significant relationship between race, sex, and age with grade existed ($p = .049$) and also the interaction of age with match ($p = .056$) using Kolb LSI.

When using Gregorc Style Delineator, race, sex, instructors' learning styles, students' learning styles match, mismatch, and overlap did not contribute significantly to grade ($p = .067$) nor did age ($p = .079$). A submodel analysis indicated that race, sex, and age ($p = .049$) and the interaction of age with match ($p = .038$) may have a significant relationship with grade using the Gregorc Style Delineator.

2. The relationship between age and learning style mismatch and evaluation was not significant using the Kolb LSI. Race, sex, instructors' learning styles, students' learning styles, match, mismatch, and overlap ($p = .143$) did not contribute significantly to evaluation nor did age ($p = .115$). When using Gregorc Style Delineator, race, sex, instructors' learning styles, students' leaning styles, match, mismatch and overlap ($p = .182$) and age ($p = .079$) did not contribute significantly to evaluation.

3. When using Kolb LSI, there was no significant relationship found between race, sex, students' learning styles, age, match, mismatch, and overlap and grade ($p = .100$). When the instructors' learning styles were entered into the equation, there was a significant relationship between converger learning style and grade ($p = .027$). A

submodel analysis showed a significant relationship may exist when converger learning style match ($p = .015$) and overlap ($p = .022$).

When using Gregorc Style Delineator, there was no significant relationship found between race, sex, students' learning styles, age, match, mismatch, and overlap and grade ($p = .079$). A significant relationship may exist between abstract sequential and grade ($p = .054$) and concrete random and grade ($p = .011$). A submodel analysis indicated a significant relationship between instructor's learning styles abstract sequential with match ($.028$) and abstract sequential with overlap ($p = .047$).

4. The particular learning style of the instructors did not significantly affect the relationship between learning style match and evaluation using Kolb LSI. The variables race, sex, students' learning styles, age, match, mismatch, and overlap did not contribute significantly ($p = .115$). However, the particular learning styles of accommodator ($p = .050$) and assimilator ($p = .053$) may contribute to evaluation scores as shown by the submodel analysis using Kolb LSI.

When using the Gregorc Style Delineator, no significant relationships were found. The submodel analysis revealed no significant relationship between the particular learning style of the instructors and evaluation.

5. The particular learning style of the student did not contribute significantly to the relationship between learning style mismatch and grade using the Kolb LSI. The variables of race, sex, instructors' learning styles, age, match, mismatch, and overlap were not significant contributors to grade ($p = .100$) nor was students' learning styles.

The submodel analysis revealed that race, sex, and the particular student style accommodator when matched may contribute significantly to grade ($p = .050$).

Additionally, this analysis indicated a significant relationship may exist between students with a diverger learning style when matched and grade ($p = .044$) using Kolb LSI.

No significant relationship was found between race, sex, instructors' learning styles, age, match, mismatch, and overlap and grade ($p = .079$) and race, sex, and the particular learning style of student and grade ($p = .062$) using the Gregorc Style Delineator.

6. In analyzing whether the particular learning style of the student affected the relationship between learning style mismatch and evaluation, the variables races, sex, instructors's learning style, age, match, mismatch, and overlap did not contribute significantly to evaluation ($p = .115$) nor did the particular students' learning styles. A submodel analysis of a diverger learning style and match indicated a significant relationship with evaluation ($p = .049$) using Kolb LSI.

No significant relationship was found using Gregorc Style Delineator when data from the mainmodel was analyzed. The submodel analysis indicated no significant relationship between students' particular learning styles and evaluation.

Chapter V

Summary, Discussion, and Recommendations

This chapter includes a summary, discussion, inferences, and recommendations derived from the investigation of the effects of students' age and learning style mismatch of adult students' academic achievement and perception of instructors.

Summary

The aim of education is to offer the individual learner an opportunity for a high level of achievement in life and to maximize learning for each individual (Cross, 1976). Learning styles have been the focus of considerable study, focusing on relationships between learning styles and other characteristics and conditions such as achievement, student age, and teaching style (Thompson & O'Brien, 1991). Brookfield (1986) stated that the search for characteristics unique to adult learners has become a quest for a professional identity for adult educators.

The literature on learning style and teaching style provides a large body of knowledge about instructors-students transaction. While some investigators have found significant results (Wasser, 1969; Dunn & Dunn, 1979; DeYoung, 1977; Domino, 1971) others have not (Davis, 1988; Thompson & O'Brien, 1991; Coop & Brown, 1970). These inconsistent research results provided the impetus for this investigation.

The purpose of this study was to investigate the relative effects of age and learning style mismatch on adult students' academic achievement and perception of instructors.

Students' and instructors' learning styles were determined by administering the Kolb LSI and Gregorc Style Delineator to 302 students and 17 instructors. Students also responded to a demographic and learning style perception questionnaire and a faculty

evaluation questionnaire. Students' final grades for the course were obtained with their permission. The data obtained from these instruments were used to test the research questions. A regression model designed specifically for each question, was used to predict students' grades or evaluation of the instructors.

Discussion

The concept of learning style includes the conditions under which each person begins to process and retain new or difficult information and skills. All students, regardless of age, achievement level, or socio-economic status, have learning styles which have developed both as an outgrowth from individual life experiences and as a result of biological functions (Dunn & Dunn, 1978).

Learning Style and Grade

The findings for question 1 revealed that when race, sex, instructors' learning styles, students' learning styles, match, mismatch, and overlap were entered in the regression model, there was no significant relationship between these variables and grade ($p = .091$) and between age and grade ($p = .100$). However, a submodel analysis revealed that the relationship between race, sex, and age with grade may be significant ($p = .049$) and also the interaction of age with match ($p = .056$) using Kolb LSI.

When using Gregorc Style Delineator, race, sex, instructors' learning styles, students' learning styles, match, mismatch, and overlap did not contribute significantly to grade ($p = .067$). Age also was not a significant contributor to grade ($p = .079$). Further analysis of race, sex, and age indicated that they may contribute significantly to grade ($p = .049$) and also the interaction of age with match ($p = .038$) when using the Gregorc Style Delineator.

While Kolb (1976) has presented some evidence suggesting that preference toward certain educational techniques are correlated with specific learning style abilities (e.g., lectures with reflective observation), some students may have been able to develop their nondominant learning style modes and use them when the task demanded it, thus adapting to the environment.

These conclusions support the findings of Davis (1988) that learning style did not influence student grades. Davis (1988) stated that in the application of Kolb's theory to the classroom, students matching the learning style of the teacher should make a difference in how well students did in that course. However, such was not the case in this study. Thompson and O'Brien (1991) revealed that match or mismatch between students' learning styles and those of their instructors were not associated with any significant main effects on course grade.

No clear pattern could be discerned in an analysis of mean grades assigned by instructors' learning style categories. This may be because of the skewed distribution of the instructors' learning styles. Most instructors were divergers (13) using the Kolb LSI and concrete sequential using the Gregorc Style Delineator (14). This distribution provided little variance. Additionally, students 24 years and older received higher grades. One possibility for this is that mid aged and older students may make adjustments to their instructors' teaching style. Instructors also may have presented materials to be learned in ways that were inconsistent with their preferred learning style. This may have obscured the match-mismatch relationship of interest in this study. It may be necessary to test to see if instructors actually present materials in their preferred style.

Research question 3 was tested to determine if the particular learning style of the instructors affected the relationship between learning style mismatch and grade. The results of this analysis indicated that the relationship between race, sex, students' learning style, age, match, mismatch, & overlap was not significant ($p = .100$) using the Kolb LSI and the Gregorc Style Delineator ($p = .079$). Using Kolb LSI to determine particular learning style, there was a significant relationship between converger learning style and grade ($p = .027$), converger and match ($p = .015$), and converger with overlap ($p = .022$) and grade. This may have occurred because of the skewed distribution of instructors and students who had a converger learning style.

When using Gregorc Style Delineator to determine learning style, no significant relationship was found using the main model. When the particular instructor's learning style was entered into the equation, there appeared to be some relationship between abstract sequential ($p = .054$) and concrete random and grade ($p = .011$) and grade. The instructors with a concrete random learning style gave the highest mean grade to overlap students. Again, the skewed instructors' distribution may have contributed to this.

In examining question 5, the particular learning style of the student did not contribute significantly to the relationship between learning style mismatch and grade using Kolb LSI. The variables of race, sex, instructors' learning styles, age, match, mismatch, and overlap were not significant contributors to grade ($p = .100$) nor was students' learning style. However, further analyses indicated that student learning style of accommodator when matched ($p = .050$) and diverger when matched ($p = .044$) may contribute to grade using the Kolb LSI. No significant relationships were found using Gregorc Style Delineator.

Learning Style and Instructors' Evaluation

Research question 2 tested the prediction that students' evaluations of instructors were unaffected by instructors' learning style match or mismatch with the instructors. The analysis of data indicated that there was not a significant relationship between age, learning style mismatch and evaluation using either the Kolb LSI or Gregorc Style Delineator. Race, sex, instructors' learning styles, students' learning styles, match, mismatch, and overlap was not significant ($p = .143$) when using Kolb LSI and ($p = .182$) when using Gregorc Style Delineator. It was expected that those students whose learning style matched their instructors' learning style would give higher ratings to their instructors than those students whose learning style was not matched. This finding failed to support the results of James (1973), Blanzky (1970) and Riechmann (1980) who found that where there is a learning style match between students and instructors, they perceived each other more positively and where students and instructors were mismatched they perceived each other less positively.

The results indicated that using the Kolb LSI to determine learning style, those students with learning styles that overlap with their instructors, evaluated their instructors higher. Additionally, when the Gregorc Style Delineator was used to determine learning style, students whose learning styles mismatched with their instructors evaluated the instructors higher. Again, this is contrary to the literature.

Research question 4 was analyzed to determine whether the particular learning style of the instructors affected the relationship between learning style mismatch and evaluation. The particular learning style of the instructors did not significantly affect the relationship between learning style match and evaluation using Kolb LSI. The variables race, sex,

students' learning styles, age, match, mismatch, and overlap did not contribute significantly ($p = .115$). However, the particular learning styles of instructors, accommodator ($p = .050$) and assimilator ($p = .053$) may contribute to evaluation scores as shown by the submodel analyses using Kolb LSI. However, diverger instructors whose learning styles overlap with assimilator students received the highest evaluation scores. This may have been caused by the reflective overlap of the two styles. The instructors may have had a reflective delivery or asked questions that may have required inductive reasoning or other reflective characteristics.

When using the Gregorc Style Delineator, no significant relationships were found. The submodel analysis revealed no significant relationship between the particular learning style of the instructors and evaluation.

Research question 6 finally examined whether the particular learning style of the student affected the relationship between learning style mismatch and evaluation. The results using the Kolb LSI indicated no significant relationship. Further analysis of the particular student's learning style (diverger) and match indicated a significant relationship may exist ($p = .049$).

In using the Gregorc Style Delineator, no significant relationships were found in analyzing the main model. The submodel analysis indicated no significant relationship.

The findings from questions 4 and 6 support Thompson and O'Brien's (1991) conclusion that the learning styles of students were not associated with any significant main effect on course evaluation by students.

A host of possible interactions between selection biases and other known and unknown factors are likely clouding the results of this study. For example, students often

enter a learning situation with a perceived concept of a teaching style that is best for them. In some cases extra effort may be exerted by a learner if he or she is reinforced by a teaching style that is perceived to be preferred. Another possibility is that students, who believe they are learning, attribute their beliefs to the teaching style being received. This could have influenced the rating of instructors and students' achievement.

The reliability and validity of the evaluation instrument, a crucial dependent variable, has not been established. The evaluation instrument had historically been used by the college to allow students to assess their instructors. The results of this study may have been affected due to a lack of the instrument's ability to measure what it was suppose to measure. Several forms of analyses were conducted with the instrument in an attempt to determine the most meaningful configuration of the eleven-item scale. No singular item or small group of items were statistically meaningful in a series of one-way ANOVAs. Hence, the eleven-item additive scale was adopted in toto. Additionally, the instrument was administered after students had received midterm grades. The mean evaluation scores were high and the variance was small. Since instructors rating was high, this may have affected the perception of instructors by the students. The high rating may represent superior student achievement, grading leniency or superior instruction. Theoretically, the distribution of grades could be expected to be normally distributed across a five point continuum representing A (4) through F (0). In actuality the grade distributions for the 302 students were as follows: A's -- 33%; B's -- 40%; C's -- 21%; D's -- 4%; and F's -- 3%. The average grade was 3.1. The average grades given by instructors to their classes ranged from a high of 3.8 to a low of 2.3. In nine of the seventeen class groupings the class average was 3.0 (B) or higher, leaving little room for the needed variability to

distinguish the impact of learning style match or mismatch. Perhaps, a subtle flaw, in this study, and in other studies which employ grades as dependent variables is the hidden conceptual expectation that grades are somewhat normally distributed.

Other factors that may have impacted the findings are no control for prior knowledge of the instructors and control for time at which ratings were administered. The fact that students know or did not know which instructors were teaching a particular course prior to their enrollment and whether rating data was collected before or after students knew their midterm grades or examination scores could have affected the match-match and instructors' evaluation findings.

Methods and Analysis

In a study of this magnitude and complexity many possible reasons for the lack of significant findings using the Kolb LSI and the Gregorc Style Delineator may be posited.

While selection biases are usually considered in the context of selection of subjects to comparison groups, in the instance of this study, the selection of the overall population can be called to question for several reasons. One possible reason is that the distribution of learning styles within the instructors' sample did not provide much variance among styles. When using the Kolb LSI to determine learning style, 76 percent of the instructors were divergers. When using the Gregorc Style Delineator to determine learning style, 82 percent of the instructors had a concrete sequential style. This lack of variance may have prevented real differences to emerge related to the impact of learning style.

Another possible reason, that is more difficult to attribute, is the confounding of race, sex, and foreign-born status with learning styles and the selection of the studied population. The Hispanic or Asian students had no same race counterpart within the

instructors pool. Many of this latter group were also foreign born, and the learning style literature, as it relates to cross-cultural manifestations, is non-existent.

The Kolb LSI asks questions about specific situations thus establishing a subject's average placement (overall tendency) and ability to shift styles on the basis of the situation.

Gregorc (1982) suggests that all individuals possess some level of ability in the four mediation channels or learning styles as delineated in his Style Delineator and thus exhibits a natural predisposition toward one or two of the styles. The constructs of these instruments may focus on certain variables and sacrifice other possibilities. A determination of a true dominant style may not be possible.

Learning style in form, function, and construct must not be immutable to have real-World meaning and application. The need to calibrate a singular discrete learning style score and to ascribe to each individual a dominant style may have obscured the true utility to learning style constructs. A multi-dimensional learning style score, while methodologically more difficult to manipulate, may have provided more grist for the analysis.

The decision to use a single learning style score had its limitations. In many cases there were more than one learning style preferred (learning style scores were very close). Only the highest score was chosen to place instructors and students in a particular learning style.

There is no one method for selecting or building a regression model. The regression model employed in this study was based on the substantive knowledge of learning styles of the researcher and his committee. Weisberg (1985) posits that the single most useful tool for selecting variables in a model is the investigators' knowledge in the

area and familiarity with predictors. Another common model building technique using sequential ordering such as forward, stepwise, and backward were partially explored, but only for comparison's sake to the designated model. The task of building a relevant regression model can not only be complex, but almost philosophical. As Myers (1990) noted, there may be several models of nearly equal effectiveness, thus the problem is one of selecting one model from a pool of candidate models.

It is clear that further investigation in this area is warranted to address the match-mismatch effect on adult learning. This appears to be an important direction for future research.

Recommendations for Future Study

Research on adult learning styles has revealed that students whose learning style matches that of their instructors tend to attain higher grades and evaluate their instructors more favorably. Most research only considered the match-mismatch interaction and did not consider the impact of overlap learning styles.

The findings of this study were generally contrary to research and in some cases the Kolb LSI and Gregorc Style Delineator revealed contrasting results for the same research question. These findings have implications for further research:

1. This study could be replicated using the same procedures but using another method to determine students' achievement in business courses.
2. An experimental study to monitor the instructional modality and classroom situation. This will reveal whether the instructor is actually presenting material consistent with her or his learning style.

3. This study could be replicated using the same procedures and investigating for sex and race differences.

4. The data revealed that more than one style was preferred in some cases. This study could be replicated using a more sensitive instrument to measure learning styles, and instructors' teaching styles. This may help to provide appropriate student learning and teaching-style preference.

5. The population for this study was business majors and business instructors. This study could be replicated with revisions using the same procedures but with students and instructors in different subject areas.

Further research in these areas is important for the adult student-teacher transaction. It may provide additional information concerning the unique characteristics of adult learners and provide guidance to colleges and universities in designing and implementing appropriate programs to enhance learning among the adult students.

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Appendix A

**DESCRIPTION OF LEARNING STYLES IN KOLB'S
LEARNING STYLE INVENTORY**

Learning Style Inventory (LSI, Kolb, 1985)

The LSI is a one-page learning style inventory based on the theory of experiential learning. Learning is seen as a four-step process and style is the preference for two adjoining steps. Each preference is for one end of a bipolar dimension, Abstract Conceptualization versus Concrete Experience and Active Experimentation versus Reflective Observation. The styles are Converger, Diverger, Assimilator, and Accommodator. Kolb (1985), pp. 5-6, describes the styles in this way:

The Converger's dominant learning abilities are abstract Conceptualization (AC) and Active Experimentation (AE). His greatest strength lies in the practical application of ideas. We call individuals who have this learning style "Convergers" because a person with this style seems to do best in situations such as conventional intelligence tests, where there is a single correct answer or solution to a question or problem. . . Convergers are relatively unemotional, preferring to deal with things rather than people. They tend to have narrow interests, and choose to specialize in the physical sciences. . .

The Diverger has learning strengths opposite to those of the Converger. He is best at Concrete Experience (CE) and Reflective Observation (RO). His greatest strength lies in his imaginative ability. He excels in the ability to view concrete situations from many perspectives and to organize many relationships into a meaningful "gestalt." We call a person who has this style a "Diverger" because he performs better in situations (such as "brainstorming" idea session) that call for generation of ideas. Divergers are interested in people and tend to be imaginative and emotional. They have broad cultural interests and tend to specialize in the arts. . .

The Assimilator's dominant learning abilities are Abstract Conceptualization (AC) and Reflective Observation (RO). His greatest strength lies in his ability to create theoretical models. He excels in inductive reasoning, in assimilating disparate observations into an integrated explanation. . .He, like the Converger, is less interested in people and more concerned with abstract concepts, but he is less concerned with the practical use of theories. For him it is more important that the theory be logically sound and precise. As a result, this learning style is more characteristic of the basic sciences and mathematics rather than the applied sciences...

The Accommodator has strengths opposite to those of the Assimilator. He is best at Concrete Experience (CE) and Active Experimentation (AE). His greatest strength lies in doing things, in carrying out plans and experiments and involving himself in new experiences. He tends to be more of a risk-taker than people with the other three learning styles. We

call someone having this style an "Accommodator" because he stands to excel in those situations where he must adapt himself to specific immediate circumstances. In situations where the theory or plans do not fit the facts he will most likely discard the plan or theory. (His opposite type, the Assimilator, would be more likely to disregard or reexamine the facts.) He tends to solve problems in an intuitive trail and error manner. .replying heavily on other people for information rather than on his own analytic ability. .The Accommodator is at ease with people but is sometimes seen as impatient and "pushy".

Appendix B

DESCRIPTION OF LEARNING STYLES IN GREGORC STYLE DELINEATOR

Gregorc Style Delineator

The Gregorc Style Delineator is a one-page learning style inventory designed to measure dominate, intermediate and low preference for the four delineated styles: abstract random (AR), abstract sequential (AS), creative random (CR), and concrete sequential (CS). Gregorc (1982), pp. 6-7, describes the characteristics of each style.

Abstract Random--Accept an abstract world of feeling and emotion; order randomly, with many dimensions; thinking is emotional, perceptive, and critical; focus on attachments and memories; prefer a rich and active environment with physical freedom.

Abstract Sequential--Accept a world of intellect (abstract) based on a material reality; thinking is intellectual, logical, analytical, and correlative; focus on knowledge, facts, and documentation; prefer a mentally stimulating, ordered, quiet, and nonauthoritative environment.

Concrete Random--Accept a concrete world of activity in a world of intuition order in random three-dimensional patterns; thinking is intuitive, instinctive, and impulsive; focus on applications, processes, and ideas; prefer a stimulus rich environment, that is competitive and free from restriction.

Concrete Sequential--Accept a concrete world, based on physical senses; organizes in a sequential step-by-step manner; thinking is instinctive, methodical, and deliberate; focus on material reality; the referred environment is ordered, practical, quiet, and stable.

Appendix C
CORRESPONDENCE



VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

COLLEGE OF EDUCATION — NORTHERN VIRGINIA GRADUATE CENTER

January 21, 1992

Ron K. Bailey, President
Strayer College
1025 15th Street N.W.
Washington, D. C. 20005

Dear Mr. Bailey:

I am requesting your permission to gather data for an educational research project at Strayer College. The project is for my dissertation in the Ed. D. program at Virginia Polytechnic Institute and State University-Northern Virginia Graduate Center. This study will explore the relationship among students' learning style preferences, students' evaluations of instructors, and faculty learning styles. The intent of this study is to evaluate the factors associated with student evaluation and not for assessing instructional quality.

I am asking your approval to contact various faculty members who teach courses in business. I will then ask their approval for me to administer a brief learning style inventory and a perception questionnaire in class. The instructors will also be asked to complete a brief learning style inventory and submit the class grades. Specific procedures to gather data and obtain evaluations and grades will be cleared by your office with the approval of students and instructors. All the personal information will be held strictly confidential, and this will be emphasized in letters to the students and faculty as well as the Human Subjects Committee at Virginia Polytechnic Institute and State University.

2990 Telear Court, Falls Church, Virginia 22042

I will be happy to furnish you with the results of this study. Thank you very much for your time and cooperation. Please feel free to contact me for further information and any comments. My phone number is 703-379-7940. Dr. Bert Wiswell can be contacted at 703-698-6049.

Sincerely,

Clayton W. Garrett

Clayton W. Garrett

Bert K. Wiswell

Dr. Bert Wiswell,
Major Professor



Washington Campus • 1025 15th Street, NW • Washington, DC 20005 • (202) 408-2400 • FAX (202) 289-1831

February 12, 1992

Dr. Bert Wiswell
Major Professor
Virginia Polytechnic Institute
Northern Virginia Graduate Center
2990 Telestar Court
Falls Church, Virginia 22042

Dear Dr. Wiswell:

I have had an opportunity to discuss on a preliminary basis this re-search project being proposed by Professor Garrett. I feel the project is exciting and I look forward to receiving a copy of the results. As I discussed with Clayton Garrett, he needs to receive individual approval from the individual professors in the classes with which he wishes to inter-face. Please accept this letter as my approval and I wish you and Professor Garrett well on this project.

Sincerely,

Ron K. Bailey
President

RKB/gsh

✓cc: Clayton W. Garrett

To: Business Faculty, Strayer College
From: Clayton W. Garrett
Subject: Dissertation Research Participation

You are asked to participate in a study at Strayer College. The project is an integral part of my dissertation for the Ed.D degree in Adult Education at Virginia Polytechnic Institute and State University. This study will explore the impact of students' and faculty learning styles upon students' achievement and evaluation of faculty. The intent of this study is to evaluate the factors associated with student evaluation and not for assessing instructional quality. Your participation is strictly voluntary but will be greatly appreciated. All personal and individual information you supply will be kept strictly confidential. Additionally, there will be no reprisal for your refusal to participate.

As part of this study, you will be asked to do the following:

1. Complete two brief learning style inventories to determine the means by which you process learned information (Gregorc Style Delineator and Kolb's Learning Style Inventory) and a demographic questionnaire.
2. Permit the researcher to administer the Gregorc Style Delineator and Kolb's Learning Style Inventory and have students complete a demographic questionnaire, a learning style perception questionnaire, and an instructor evaluation. This should take no more than fifteen minutes of class time. Students' participation is strictly voluntary.
3. I will need your social security numbers and the course number on the Learning Style inventories, and demographic questionnaire.

The information will be handled in a confidential manner and no individual will be associated with any information or conclusions. I will contact you within the next week to make arrangements for me to administer the instruments.

I will be happy to share aggregate results when the study is completed. Thank you for your time and consideration. If you have any questions please contact me at (703) 379-7940 or 202 408-2431.

Strayer College
Washington, D.C. 20005

Dear Student:

You are asked to participate in a study at Strayer College. This project is an integral part of my dissertation for the Ed.D. degree in Adult Education at Virginia Polytechnic Institute and State University. This study will explore the impact of students' and faculty learning styles upon students' achievement and evaluation of faculty. Your participation is strictly voluntary but will be greatly appreciated. You may refuse to participate in this study without prejudice, question, or reprimand. All the personal and individual information that you supply will be kept strictly confidential.

The study entails a measure of your learning style - a means by which you process learned information as measured by the Gregorc Style Delineator and Kolb's Learning Styles Inventory and the completion of a demographic and learning style perception questionnaire. Please put student identification number on the learning style instruments, the demographic questionnaire, and the learning style perception questionnaire when you complete them.

Thank you very much for your cooperation and participation in this important research. If you have any questions, please contact me at (703) 379-7940 or (202) 408-2431 or contact Dr. Bert Wiswell at VPI (703) 698-6049.

Clayton W. Garrett

PERMISSION TO OBTAIN GRADE

ID Number _____

You have my permission to obtain my final grade for this course, Bus.
_____, Section _____.

You also have my permission to gather questionnaire information and I understand that all information gathered will be held confidential and only group data will be reported. No one at Strayer College will be informed of my individual responses.

Signature

Date

Appendix D
RESEARCH INSTRUMENTS

Directions for Completing Demographics Information

There are the directions for completing the demographic section of the survey and the NCS answer sheet for the Learning Styles Study. As with all computer answer sheets, you must darken bubbles completely and make sure all erasures are total. Use a number 2 pencil and do not make any stray marks on the answer sheet.

- Name** - One side one of the answer sheet, enter your name (last, first, and middle initial) in the blocks at the top of the name grip, then darken the corresponding letter in each column. Leave a space between names.
- Sex** - To the right of the name grid, darken the circle that identifies your sex.
- Education** - Find the heading Grade or Educ. Enter one of the following codes to identify your educational level.
1 = Freshman 2 = Sophomore
3 = Junior 4 = Senior
- Identification Number** - Enter your social security number or your student identification number in the Identification Number grid, columns A-J. You must use a nine-digit number.
- Course Number** - Under the Special Codes grid, columns "K", "L", and "M", enter the course number. (i.e. BUS 200 = 200).
- Age** - Under the Special Codes grid, columns "N" and "O", enter your age.
- Race** - Under the Special Codes grid, column "P", use the following code to enter your race.
1 = Black 2 = White 5 = Other
3 = Hispanic 4 = Asian
- Learning Style Perception Questionnaire** - Begin answering the questionnaire by moving to the general answer sheet section. Respond to questions 1-17 of the questionnaire in the area reserved for questions 1-17 on the answer sheet.
- Course Identification** - In the area reserved for question 18 on the answer sheet, use the following code to indicate course identification.
1 = BUS 2 = ACC 3 = ECO
- Evaluation of Instructor** - In the area reserved for questions 19 through 29 on the answer sheet, respond to Instructor Evaluation questions. (i.e. question 1 of instructor evaluation equals number 19 on the answer sheet, etc.).

DEMOGRAPHIC DATA AND FACULTY EVALUATION

Course Number _____ Identification Number _____
 Section Number _____ Major _____ Age _____

Education Level

Freshman _____ Junior _____
 Sophomore _____ Senior _____

Sex

Male _____ Female _____

Race

Black _____ Hispanic _____ Asian _____
 White _____ Other _____

Evaluation of Instructor

4 = Outstanding 3 = Above Average 2 = Average
 1 = Below Average 0 = Poor

Using the code above, circle the number to indicate your response.

No.	Statements	Outstanding	Above Average	Average	Below Average	Poor
1.	Comes to class prepared.	4	3	2	1	0
2.	Is knowledgeable of subject matter.	4	3	2	1	0
3.	Presents material in a clear and concise manner.	4	3	2	1	0
4.	Encourages me to ask questions and express ideas.	4	3	2	1	0
5.	Makes good use of examples and illustrations.	4	3	2	1	0
6.	Encourages me to do my best work.	4	3	2	1	0
7.	Provides new viewpoints or attitudes.	4	3	2	1	0
8.	Tests reflect material covered in class.	4	3	2	1	0
9.	Is an able speaker.	4	3	2	1	0
10.	Begins and ends classes on schedule.	4	3	2	1	0
11.	Overall rating of instructor.	4	3	2	1	0

Comments:

LEARNING STYLE PERCEPTION QUESTIONNAIRE

Please indicate how much you agree with each of the following statements. Circle your response for each item.

No.	Statements	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1.	My instructor provides an opportunity for me to do individual projects and self-paced learning activities.	1	2	3	4	5
2.	My instructor provides an opportunity for me to use deductive reasoning to solve specific problems.	1	2	3	4	5
3.	My instructor provides an opportunity for me to learn from practical application of ideas.	1	2	3	4	5
4.	My instructor provides questions or problems where there is a single solution.	1	2	3	4	5
5.	My instructor provides an opportunity for class discussion and student feedback.	1	2	3	4	5
6.	My instructor provides an opportunity for different perspectives on issues.	1	2	3	4	5
7.	My instructor stimulates me to use my imagination.	1	2	3	4	5
8.	My instructor allows group interaction.	1	2	3	4	5
9.	My instructor utilizes a variety of teaching methods.	1	2	3	4	5
10.	My instructor presents clear, well structured ideas.	1	2	3	4	5
11.	My instructor demonstrates problem solving by logical analyses.	1	2	3	4	5
12.	My instructor uses lectures as the main teaching method.	1	2	3	4	5
13.	My instructor uses abstract concepts.	1	2	3	4	5
14.	My instructor demonstrates problem solving by trial and error.	1	2	3	4	5
15.	My instructor provides an opportunity to participate in problem solving.	1	2	3	4	5
16.	My instructor provides an opportunity to learn from new experiences.	1	2	3	4	5
17.	My instructor provides an opportunity for individualized activities.	1	2	3	4	5

NAME (Last, First, MI)

Grid for name entry with columns for last name, first name, and middle initial, each containing 26 circles for letter selection.

SEX () M () F ()

GRADE 3M 4M 5M 6M 7M 8M 9M 10M 11M 12M

GENERAL PURPOSE - NCS® - ANSWER SHEET
FOR USE WITH ALL NCS SENTRY - OPTICAL MARK READING SYSTEMS
SEE IMPORTANT MARKING INSTRUCTIONS ON SIDE 2

SIDE 1

Vertical column of answer bubbles for items 1 through 47, each with five options (A, B, C, D, E).

Form fields for BIRTH DATE (MO., DAY, YR.), IDENTIFICATION NUMBER (A-P), and SPECIAL CODES (A-P).

Vertical column of answer bubbles for items 48 through 100, each with five options (A, B, C, D, E).

LSI

LEARNING-STYLE INVENTORY

McBER & COMPANY

Name: _____

Position: _____

Organization: _____

Date: _____

SAMPLE

**Self-Scoring Inventory
and Interpretation
Booklet**

**McBer & Company
Training Resources Group
116 Huntington Avenue
Boston, Massachusetts 02116
(617) 437-7080**

GREGORC STYLE DELINEATOR™ RESEARCH INSTRUMENT

DIRECTIONS

Before starting with the word matrix on the next page, carefully read all seven of the following directions and suggestions:

1. **Reference Point.** You must assess the relative value of the words in each group using your SELF as a reference point; that is, who you are deep down. NOT who you are at home, at work, at school or who you would like to be or feel you ought to be. **THE REAL YOU MUST BE THE REFERENCE POINT.**

2. **Words.** The words used in the *Gregorc Style Delineator* matrix are not parallel in construction nor are they all adjectives or all nouns. This was done on purpose. Just react to the words as they are presented.

3. **Rank.** Rank in order the ten sets of four words. Put a "4" in the box above the word in each set which is the best and most powerful descriptor of your SELF. Give a "3" to the word which is the next most like you, a "2" to the next and a "1" to the word which is the least descriptive of your SELF. Each word in a set must have a ranking of 4, 3, 2 or 1. No two words in a set can have the same rank.

4 = MOST descriptive of you
1 = LEAST descriptive of you

4. **React.** To rank the words in a set, react to your *first impression*. There are no "right" or "wrong" answers. The real, deep-down you is best revealed through a first impression. Go with it. Analyzing each group will obscure the qualities of SELF sought by the Delineator.

5. **Proceed.** Continue to rank all ten vertical columns of words, one set at a time.

6. **Time.** Recommended time for word ranking: 4 minutes.

7. **Start.** Turn the page and start now.

Example

	x
a.	4 sun
b.	2 moon
c.	3 stars
d.	1 clouds

~~SAMPLE~~

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VITA

Clayton W. Garrett received a Bachelor of Science in Management from Park College in 1982. In 1984, he earned a Master of Business Administration in Management and Marketing from Golden Gate University.

Clayton has thirty years experience in teaching high school, college, instructional design and development, and management. He has been active in civic, educational, and professional associations.

Clayton was born on June 1, 1939.