ARE LEARNING STYLES SUBJECT-AREA SENSITIVE?

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CHAPTER I

INTRODUCTION

This study examined community college students' learning style preferences across four different subject-area disciplines to determine if learning styles vary by subject-area, gender, and academic performance. This chapter provides a brief overview of the study including introductory background information relative to community college teaching and learning, a statement of purpose, along with research questions, significance of the study and limitations.

During the past two decades, community college reform has been concerned with the changing educational needs of community college students and the students' abilities to adapt to different subject-area disciplines' learning environments (Anderson & Adams, 1992; Kolb, 1984; Schroeder, 1993; Sims & Sims, 1995b). In the past, community college education has been primarily a traditional lecture environment teaching analytical ideas and concepts (Howard, 1990; Kolb, 1984; McCarthy, 1980) for a majority population of white male students, 18-24 years of age (Anderson, 1995; Anderson & Adams; Purkiss, 1995). Now, not only have women become a major population on most community college campuses, but also groups of nontraditional, minority, immigrant, low income, and high school dropouts that were under-prepared for higher education have entered the community colleges through the open-door policy that has provided

educational accessibility to all people (Anderson & Adams; Clinton, 1997; Kolb 1984; Kolodny, 1991; Neilsen, 1991; Purkiss, 1995). Community college students of the past were primarily abstract learners that preferred working with concepts and ideas. The majority of students that have been enrolled recently in community colleges have been found to be oriented toward concrete learning experiences with a preference for dealing personally with human experiences and feelings instead of abstract thinking. Concrete experience happens to be the opposite of the present traditional analytical academic environment learning style of logical thinking about concepts and ideas (Kolb, 1984; Schroeder, 1993). According to Adams (1992) many of these more recent enrollees have not been academically socialized by previous schooling, home, or community cultures into the traditional academic community college culture. Because of a lack of traditional academic cultural socialization, many students find it difficult to adapt to the various learning environments that, in some situations, have conflicted with the students' cultures, values, and belief systems.

In the past, high school students who were successful in secondary education and comfortable in academic environments were more likely to aim for a college degree. These college bound students usually had learning strategies necessary for academic success, or they learned through educational socialization how to adapt to the learning strategy demands of the various learning environments in order to be successful learners. Presently, many community college students have not been academically socialized into the traditional academic culture of the community college, yet more community college students are enrolled and attend college than ever before (Feemster, 1999).

According to Feemster, as the student enrollment rate increases, the student dropout rate also increases. It may be possible that this increased attrition rate might be attributed in part to these community college students' under-preparedness for college and their inabilities to adapt their learning styles to the learning strategies characteristic of various disciplines in the academic environment (Adams, 1992). Feemster reported that, "In a survey of 2, 525 institutions, the American College Testing Service (ACT) found that the dropout rate between freshmen and sophomore years was 45.7 % at schools with open enrollment" (p. 61). From 1983 to 1999 only 51.7% of the students graduated from four year colleges according to Feemster. It has been estimated that of all college students, excluding ethnic background, approximately 50% do not attain a college degree (Levine, 1983). Even though the community colleges' open door policy was designed to allow access to everyone, many students drop out of the community colleges before achieving their educational goals. Have the students failed to succeed academically because community college students' freshmen and sophomore years were usually spent completing general-core required classes in English, math, science, and social studies before beginning classes in their chosen majors? It is possible that these students' inabilities to adapt to the learning strategy demands of different disciplines may have contributed to the high attrition rate.

Because of increased attrition, the presence of under-prepared students, and the growing number of students who prefer concrete learning environments, community college reformers have been concerned about whether these students have acquired the learning strategies necessary to meet the demands of subject-area disciplines through learning style subject sensitive strategies that facilitate adapting to various learning

situations and contribute to successful learning. For the purpose of this study, learning was defined as the process of a permanent change through experience involving changes in attitudes and behaviors, unlearning as well as learning, memorizing, acquiring or improving skills, and obtaining knowledge (Kidd, 1973; Kolb, 1984; Sims & Sims, 1995b).

Learning success was indicated by the process of applying the knowledge or information learned to different situations through repeated behavior or application (Sims & Sims, 1995b). Successful learning was measured on the basis of a passing cumulative GPA of 2.5.

In recent years, there has been a growing concern regarding the effectiveness of community college education in meeting the needs of its demographically diverse students. The belief was that the "Community College of the 21st Century" would need to revamp its curriculum, teaching strategies, student learning environments, and empower students by teaching them "how to learn" (Johnson & Lobello, 1996). It was believed that by teaching students about their preferred learning styles, their learning strengths and weaknesses, and the learning strategies characteristic of different disciplines (Kolb, 1984), that learning for individual students would be facilitated. If learning styles are subject-area sensitive, then students could be taught how to successfully adapt in various learning situations.

Extensive studies have been conducted by learning style researchers to better understand the learning process (Kolb, 1984; McCarthy, 1980; Sims & Sims, 1995a). As a result, various theories have emerged that share commonality with some variation in terminology. Each of the theories identified the characteristics of different types of

learners as they engaged in the learning process. One of the better known learning style theorists, Kolb, based his learning style research and theory of experiential learning on the works of Dewey, Lewin, Piaget, and Jung. Kolb's (1984) learning style theory identifies the characteristics of learners into four types: diverger, assimilator, converger, or accomodator. Kolb (1984) further stated that college students usually choose college majors and career paths that have been synonymous with their learning styles and their learning style characteristics because of their academic success in those particular areas of interest.

In recent years, many research studies have been conducted to test Kolb's (1984) premise that certain learning styles and identifiable learning style characteristics were associated with definite college academic disciplines (Dyrud, 1997; Fox & Roberts, 1993; Guestine & Keim, 1996; Harb, Durrant & Terry, 1993). The results of these studies usually confirmed Kolb's premise. Therefore, Kolb's theories could offer one explanation as to why some students have difficulty learning in general-core required classes that were not related to their particular discipline of study and their learning style preferences. Kolb (1984) and other researchers (Cornett, 1983; Entwistle, 1981) also recognized the ability of some learners to successfully adapt or style-flex to the demands of learning environments that differed from their own learning style preferences.

Statement of the Problem

Due to the changing student demographics, diverse learning needs of the new community college students, and the high attrition rate between freshmen and sophomore academic years, community college reformers have been concerned with how to

effectively educate these students. Although much research has focused on students' learning styles and the match between college majors and careers sharing common learning strategy characteristics (Kolb, 1984), little research has been published on students' perceptions of learning style characteristics that contributed to success in different learning environments, where the students were able to adapt their learning style abilities to meet the learning strategy requirements.

If institutions surveyed by ACT indicated that one out of every three students was not returning after the freshmen year, then what was the reason for these students dropping out (Feemster, 1999)? Could it have been that these community college students with diverse learning needs were unable to evaluate different learning situations and identify learning strategies necessary for their success? Then as a result, were these students unable to adapt their learning styles to meet the skill requirements of these disciplines? Furthermore, were these students' inabilities to adapt to different learning situations contributing to the high attrition rate between the freshmen and sophomore years?

Purpose of the Study

The purpose of this study was to determine if community college students' learning styles vary by subject-area, gender, and academic performance. Specifically, the following research questions were examined.

1. Do community college students' learning styles vary across four different subject-area disciplines: English, math, science, and social studies?
2. Do community college students' learning styles vary by gender?

3. Do community college students' learning styles vary by academic performance?

Significance of the Study

For most of the twentieth century, educational researchers have analyzed how students learn; however, the information has primarily been used to improve education for grades K through 12. It has only been in the last twenty to thirty years that community colleges have started to take a serious look at the quality of learning community college students have been experiencing. One reason for this change of focus has been due in part to the diversity present on the community college campuses. The community college has continued as primarily a traditional classroom lecture environment dealing with analytical concepts and ideas. Schroeder (1993), in identifying the new community college student, emphasized that approximately 60% of these new students preferred a more concrete personal experience in their approach to learning, the opposite of abstract learning. Learning style research has indicated that students succeed academically in learning environments that match their learning styles (Border & Chism, 1992; Entwistle, 1981; Kolb, 1984, McCarthy, 1980; Sims & Sims, 1995b), but little research has been conducted on students' abilities to identify learning style characteristics of disciplines that do not match their learning styles and adapt their learning styles to meet the demands of those disciplines (Entwistle; Kolb, 1984). Community college reformers believe that teaching students how to learn will result in improved learning and increased graduation rates (Johnson & Lobello, 1996). Therefore, this study was designed to determine if

learning styles of community college students vary by subject-areas, gender, and academic performance.

Definition of Terms

The following definitions pertain to key terms which have been used extensively throughout the study.

Academically Socialized – "Students that have been socialized into the traditional classroom culture by previous schooling or a congruent home or community culture" (Adams, 1992, p. 5).

Diverse Educational Needs – Students differ "in information processing, memory, problem solving, and thinking" (Anderson & Adams, 1992, p. 21).

Hemispheric Specialization – The specialized skills preformed by the right or left side of the brain (McCarthy, 1980).

Learning Styles – The manner in which a person perceives and processes information (Kolb, 1984).

Style-Flex – "The process of adapting," according to Cornett (1983) is a learning styles' term "used to describe how to increase the strategies in one's style repertoire . . . because people and tasks demand different styles" (p.43).

Successful Learning – The process of a permanent change through experience involving changes in attitudes and behaviors, unlearning as well as learning, memorizing, acquiring or improving skills, and obtaining knowledge (Kidd, 1973; Kolb, 1984; Sims & Sims, 1995b).

Limitations of the Study

1. This study was limited to freshmen and sophomore students enrolled in English Composition II classes during the Spring 2000 semester at one small rural, Midwestern community college.
2. The subjects' learning styles were measured by one specific learning style inventory-Kolb LSI IIa.
3. To ascertain whether the subjects' learning styles can be subject sensitive, the Kolb instrument used was adapted to meet the specific needs of the study.

Organization of the Study

This study was organized in the following manner:

Chapter I provides an overview of the study, including introductory background information, a statement of purpose, research questions, significance of the study and limitations.

Chapter II reviews the literature pertaining to the development of learning style theories, hemispheric specialization and brain-based learning as it relates to learning styles, experiential learning, and an overview of relevant learning style research.

Chapter III presents the method used in the study including a description of participants, instructional setting, instrumentation, data collection, and research design.

Chapter IV presents the results obtained relative to the key research questions posed in the study.

Chapter V discusses the main research findings in light of what is known about learning styles, and concludes with a few recommendations for future research and instruction. A reference list and relevant appendixes follow this chapter.

CHAPTER II

REVIEW OF THE LITERATURE

Community college educators have been concerned with the "Community College of the 21st Century" and the colleges' ability to meet the diverse learning needs of a changing student body. These educators have been calling for a change of focus from teaching to learning (O'Banion, 1996) by creating a "learning culture" for the students. Educators want to instill in the community college students a desire for learning and empower students by teaching them how to learn in different learning situations (Oblinger, 1996; Williams, 1983). Educational reformers believe teaching students about their own learning styles strengths and weaknesses and the learning strategy characteristics of different learning situations will facilitate students' successful learning. Therefore, learning styles have been considered as a major element in the restructuring of the community college learning environment. This literature review provides information on the historical development of the theories of learning style, the effect of hemispheric specialization and brain-based learning on learning styles, and experiential learning. Learning style research studies are reviewed. The chapter focuses on the changes and developments in learning that have influenced this study. A brief summary concludes the chapter.

Learning Theories

Understanding how people learn was important even to ancient Grecian and Roman philosophers. Their ideas have influenced education and helped to form the historical basis of learning as it has evolved throughout the years. As researchers have continued to become more aware of how people learn, educators have searched for the best manner in which to provide opportunities for all students to learn.

Learning Styles

As researchers throughout the decades have examined "how people learn," the concept of learning styles has continued to influence change. Because of the inherent diversity of the learning styles approach to education, learning style design has helped meet the individual educational needs of the student by focusing on the process of how the person learns (Border & Chism, 1992; Hickcox, 1995: Kolb, 1984; Wooldridge, 1995). There have been two different schools of research on how people learn: the first school comprised Pavlov's approach based in classical conditioning and Skinner's research involving operant conditioning. The cognitive approach was the basis for the second school and the research of the Gestaltists and Piaget (Sims & Sims, 1995b). Kolb credited Piaget's work on the process of cognitive-development to have been on the same level as Freud's developmental theory of the socioemotional process. Piaget's theory explained the importance of experience and action to intelligence, and the person's interaction with the environment (Kolb, 1984).

Kolb emphasizes the important work of Dewey, Lewin, and Piaget in the area of the experiential learning theory, although they approached the theory from different fields of study: Dewey's pragmatic philosophical perspective, Lewin's Gestalt psychology, and Piaget's process of cognitive-development. Even though Piaget's work was in the 1920s, Kolb stated that it was not until the 1960s that Piaget's research was recognized in the United States. This recognition was primarily due to the parallel work of the cognitive psychologist Bruner and his instruction theory of designing curricula for any stage or age of human development in any discipline.

Dewey's (1910,1938) work on human development and learning research spanned from 1887 to 1949, and some of his greatest work was accomplished through observation and experimentation in his lab school that was established in 1896 at the University of Chicago Department of Pedagogy. Dewey's revolutionary philosophy of how students learn and the place of the instructor in the classroom has had a great impact upon education (Hickman, 1997). Many of Dewey's observations on learning compliment learning style research, by suggesting variations or combining of methods. Recognized as the most influential educational theorist of the twentieth century, Dewey's ideas have continued to influence educational change (Hickman; Kolb, 1984). However Dewey's focus was on children rather than adults.

Malcolm Knowles's (1970) theory of adult learning developed in 1970 has drawn attention to the idea that adults learn differently than children. Somewhere during maturity, traditional students' learning styles change and move more toward the characteristics recognized by Knowles' theory. Knowles referred to the process of adult learning as "andragogy." Knowles' (1970) andragogy identifies adult learners as more

self-directed, problem centered, problem solvers who want a reason for learning something, goal orientated, aware of their own learning responsibility, and considers peers and instructors as resources. With the changed demographics and diversity of college students, Knowles's theory has been carefully examined by educational researchers and in some situations the information has been applied to the college classroom environment (Sim & Sims, 1995b).

Learning style and personality theories continued to develop with researchers such as Myers and Briggs' personality types in 1962; Dunn, Dunn, and Price's 1978 theory of adult productivity and learning; Kolb's models of four personality types and theory of experiential learning in 1976; and McCarthy's 4MAT theory and circle of learning in 1979. Gardner's 1983 theory of Multiple Intelligences began to examine intelligence from a different perspective (Gardner, 1983). It was the combined works by Silver and Hanson (1995) and Silver, Strong, and Perine (1997) that began to experiment with integrating the learning style research of Kolb and McCarthy, and the theory of Gardner's Multiple Intelligences into comprehensive learning strategies

From 1960 to the present, how people learn has continued to interest educators and researchers. Cornett (1983) considered this time period as, "An explosion of new information about the brain, resulting in fascinating theories, some supporting and others refuting what we have long thought or intuited about how we learn" (p.8). But as with any study on learning styles that intended to benefit education at the community college level, the research on brain functions and thinking styles also had to be examined as a vital link in the process (Sims & Sims, 1995b).

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Hemispheric Specialization and Brain-Based Learning

In the 1950s, Sperry began research on right/left brain functions (Sperry, 1973). In these early studies, Sperry split the brains of monkeys and cats in order to study the two hemispheres. There was no great change until the monkeys and cats were trained in specific tasks. It was then that Sperry discovered that the two different halves of the brain performed independently of each other. Similar operations were conducted on humans in the 1960s by neurosurgeons Vogel and Bogen (Bogen, 1975). Research showed that the two hemispheres were able to process different types of information, utilizing different modes of thinking, and each was equally valid. In the 1960s, Zaidel and Sperry (Sperry) found that in testing split-brain patients, the hemispheres that continued to be connected showed a definite improvement in memory tasks over one hemisphere working independently of the other.

But what does hemispheric specialization and brain-based mean to education? First, each hemisphere of the brain is specialized with specific brain functions that cannot be performed by the other hemisphere (Sims & Sims, 1995b). Second, where both hemispheres are used simultaneously, memory improves. Therefore, according to brain-based education, information should be presented in a manner that would demand the use of the specialized hemisphere and provide the opportunity not only to develop both sides of the brain, but to also use both sides of the brain to enhance memory and benefit learning (Williams, 1983).

Ornstein (1977) believed that his research indicated that learning styles are definitely effected by the individual's specialized brain hemisphere. According to

Ornstein, the holistic right hemisphere produces divergent thinkers that use conceptual categories and thematic links to connect concepts. The serialistic left hemisphere produces more convergent abstract thinkers. He described versatile learners as being more cognitively complex learners with the ability to vary strategies to fit the skills characteristic of a particular task. Versatile learners are what some researchers call balanced brained because of the ability to move between hemispheres as needed. This integrated learner is more flexible in approaching different learning situations. Ornstein suggested that there should be a move toward more non-traditional education that integrates the functions of the two sides of the brain.

McCarthy (1980), in developing the 4MAT circle of learning theory, incorporates into Kolb's cycle of learning both a right and left brain approach in each learning quadrant. Kolb (1984) believes his learning modes, recognized in his theory of learning, represent the cycle of the learning process. According to Kolb, movement through this cycle constitutes learning. McCarthy's approach to including both a left and right experience in each quadrant would provide for each learners' speciality while stretching the learning abilities of other learners (McCarthy). Therefore, the study of brain hemisphere specialization, brain-based learning, and learning styles should provide a better understanding of students' learning differences and the effects on the process of learning (Sims & Sims, 1995b).

Experiential Learning

Learning theories cannot be discussed without the contributions of Dewey, Lewin, Piaget, and Jung to Kolb's theory of experiential learning. Dewey's mixture of traditional

and experiential learning techniques suggested an integration of various techniques would create better approaches to learning (Halliburton, 1997; Hickman, 1997). Dewey (1910, 1938) believed in order for a student to learn, the student had to be stimulated to want to learn. Before learning could actually take place, however, the student had to experience learning. Dewey pointed out that true education occurred when learning was accompanied by direct participation on the part of the learner. The action of the physical participation of the student unified learning; therefore, when activities that involved movement or construction were integrated into the educational process, the activities played a vital function in learning. He further argued that children learn by doing and by trying out ideas, not just by merely repeating memorized information. Dewey (1938) encouraged educational reform, but cautioned against the "either/or" approach, and recommended a variety of approaches to increase and insure learning through experiential learning (Faust, 1996; Kolb, 1984). Dewey's contribution to experiential learning has influenced higher education and education in general, whereas Kurt Lewin has influenced experiential learning in organizational development and training.

Lewin, the founder of American social psychology and organizational behavior, provided research on group dynamics, action research methodology, laboratory training, and the combination of theory with practice (Kolb, 1984). This encounter of the concrete with the analytic was discovered to be an important element in the experiential learning process, thus the encounter produced an environment of energy and creativity that benefitted learning. This interaction brought about cognitive development as identified by Piaget (1970). Basically, Piaget's idea of cognitive development was about how experience affects intelligence. Piaget believed intelligence was a result of the interaction

between a person and environment through the various stages of child development and on into adulthood. With the proper environment, Piaget believed learning and intelligence would be improved (Kolb, 1984).

Although the theories of Dewey, Lewin, and Piaget contributed to the idea of experiential learning for adults, it was Jung's theory of psychological types and developmental theory of individuation that provided the understanding of experience that facilitated learning (Kolb, 1984). Kolb took the concepts presented by each of these theorists and, by building upon Jung's (1977) individual personality types (extrovert-introvert, judging-perceiving, sensing-intuition, and thinking-feeling), created his own model of experiential learning and learning styles.

Kolb's experiential learning theory and learning styles can best be explained as providing:

> A model of learning consistent with the structure of human cognition and the stages of human growth and development. It conceptualizes the learning process in a way that allows users to identify differences among individual learning styles and corresponding learning environments. The learning model is a dialectic one, founded on the Jungian concept of styles or types, which states that fulfillment in adult development is accomplished by higher-level integration and expression of non-dominant modes of dealing with the world. (1995, p. 1)

Kolb's modes of learning for dealing with the world are viewed as two intersecting continum.

In 1971, Kolb's (1984) model of experiential learning combined the horizontal axis of perceiving with the vertical axis of processing and by placing the axes inside a

circle created four distinct learning modes that represent the stages of the learning cycle: concrete experience, reflective observation, abstract conceptualization, and active experimentation (Kolb, 1984; Rainey & Kolb, 1995). The learning modes represent four different types of learning: learning from feeling, watching and listening, thinking, and doing. The axes also created four quadrants of learners and their particular learning style types (Kolb, 1984).

The four learning style quadrant types of learners are the diverger, assimilator, converger, and accomodator (Kolb, 1984; 1995). According to Kolb, diverger learns by combining concrete experience with reflective observation to create a learning style that can view concrete situations from various view points. This learning style would rather watch than act. An assimilator thrives by reflecting on abstract concepts and putting the information into a logical form. Convergers take abstract ideas and actively experiment to find practical uses for the information by finding solutions to problems. The accommodator is an action orientated learning that takes concrete experiences mixed with active experimentation in a hands-on experience. Acccomodators enjoy challenging experiences and like to ask, what if. Kolb's model was important because of the parameters it established for classifying the different styles of learning.

The model also provided a sequence for learning from experience to reflection to conceptualization to experimentation. For example, if an instructor visualized the circle as a clock and moved around the clock face in a clockwise direction during the learning process, beginning with the 12 o'clock, the student would be exposed to each type of learning technique. Not only would the student have the chance to learn in the most comfortable mode for that particular student, but the student would also have the

opportunity to develop the skills in which they were deficient by being exposed to the techniques and steps in the learning processes that were in each of the other quadrants. Kolb's model of experiential learning theory addressed the issue of students' differences in learning styles in attempting to meet the needs of diverse students.

Kolb's research advanced into the area of identifying learning styles in order to gain a better understanding of the factors that facilitate learning. According to Kolb, learning was not an identical process for all humans, but rather stable patterns of how humans react with their environment individually. His research led him to create his own learning style inventory.

Through Kolb's continued research with his learning style inventory, he established the basis for the matching of learning style preferences, academic disciplines, and career choices. He believed that the manner in which a person reacts to the environment establishes a preference toward a particular learning orientation. As a result, learners are drawn into an academic discipline and career choice that matches their learning style preference. Kolb (1984) provides information as to the career choices present in the various quadrants.

In support of his research, Kolb referred to the Carnegie Commission on Higher Education. In the 1969 study, 32, 963 graduate students from 158 institutions completed questionnaires and faculty from 303 institutions completed 60, 028 questionnaires that were used to identify 45 different academic disciplines (Feldman, 1974). The Carnegie study and Kolb's academic disciplines are almost identical, since both studies used the same continua of abstract conceptualization/concrete experience and active experimentation/reflective observation and the learning quadrants created by each. Kolb

(1984) believes that disciplines differ from each other because of different learning demands resulting from "variations among their primary tasks, technologies, and products, criteria for academic excellence and productivity, teaching methods, research methods, and methods for recording and portraying knowledge" (p. 162). He discusses the idea that different disciplines are characterized by different learning strategies and people choose academic disciplines because of the match between their learning style preference and the learning strategies of that discipline. Disciplines also show differences in sociocultural variations in faculty, student demographics, as well as, personality, aptitude, values, and group norms (Kolb, 1984). Some studies have used the Learning Style Inventory to test Kolb's premise of different learning styles being characteristic of certain disciplines and career choices (Gusentine & Keim, 1996; Harb, Durrant, & Terry, 1993; McNeal & Dwyer, 1999; Robinson, 1981).

Kolb Learning Style Inventory (LSI) IIa

The Kolb Learning Style Inventory (LSI) IIa, based upon Kolb's experiential learning theory and model was developed in the early 1970s The inventory focuses on processing information and assessing an individual's preferred style of learning. The inventory takes approximately 10 minutes for the respondent to complete 12 questions that attempt to identify learning style: diverger, assimilator, converger, or accomodator. The respondent rank orders the responses from 4 to 1, according to the situation most like the participant's learning preference. There are four endings for each question that correspond to the four learning mode orientations: concrete experience, reflective observation, abstract conceptualization, and active experimentation. Questions provide

data that are placed on a grid of two continua: concrete experience and abstract conceptualization, and active experimentation and reflective observation. Each of the learning styles occupy a quadrant on the grid. The purpose of this inventory is to discover how a person takes in information and how it is internalized: information that would be useful for preparing curriculum and classroom presentations of material.

Reliability is rated as strong, and validity is fair for this inventory (Hickcox, 1995). In 1995, LSI was updated to LSI-IIa. Gregg (1989) stated that the inventory is a promising, quick, and reliable measurement. Hughes (1990) recommends LSI IIa for testing learning styles due to the construct validity of the measurement. The Kolb is also credited with being the only learning style inventory that has provided the basis for development of four other inventories: McKenney and Keen, 1974; Honey and Mumford, 1982; Marshall and Merritt, 1985; and Gregoric and Ward, 1977 (Hickcox). Detailed information is also provided for interpretation and implementation of data.

The Kolb LSI IIa is recognized as an excellent inventory for assessing learning styles. Due to the small number of questions, the completion time of approximately ten minutes is a real advantage for the teacher or researcher and for the respondent. The time element is a plus for hand scoring of the inventory. The Kolb was updated in 1995. Information is available to improve the individual's learning, identify strengths and weaknesses, and provide career planning information.

A disadvantage may be that the Kolb Learning Style Inventory is not available in software format for computer administering and scoring. The scoring results must also be transferred by hand to the learning style grid. Hand scoring the inventory and grid could be a time-consuming task for a teacher or researcher, if the class or sample group were

very large. Teacher or researcher error would also be a factor to consider in hand scoring the inventory and transferring data to the grid.

But regardless of the negatives, the Kolb is widely utilized as an indicator of student learning style and preferred method of processing information. The Kolb Learning Style Inventory IIa is the assessment tool chosen for this research study.

Learning Styles Research

Learning style research has primarily been concerned with three basic issues:

1. A comparison of students' learning styles by gender, preference for abstract or concrete, types of instruction preferred, and a comparison of instructors' teaching strategies to students' preferred classroom environments (Enns, 1993; Howard, 1990; Hunter & McCants, 1977; Kolb,1984; McCarthy, 1980; McKinnon, 1992; Philbin, Meier, Huffman, & Boverie, 1995; Purkiss, 1995). Gender differences are usually indicated by abstract preference for males and concrete for females; preference for abstract or concrete is usually evenly distributed among the college population, but studies that compared preference by age, traditional age college students prefer a more concrete setting and nontraditional preferred reflective and abstract; males usually prefer traditional instruction where females do not; instructors usually prefer traditional classroom settings, where many students do not;
2. Matched or mismatched students' learning styles and instructors' teaching strategies and the effect on classroom achievement. (Anderson, 1994;

Coker, 1996; DeCoux, 1987; Kolb, 1984; McCarthy, 1980; Raines, 1976; Sims, 1993; Sims & Sims, 1995b; Woolridge, 1995); most research indicates that there is a definite correlation between matched or mismatched students' learning styles and instructor's teaching strategies and classroom achievement; matched styles and strategies usually result in improved classroom achievement;

3. The effect of learning styles on students' overall academic success (Bushnell, 1990; Dyrud, 1997; Johanson, 1987; Matthews, 1996; Purkiss, 1994, 1995; Vondrell, 1987). In most studies, assimilators usually experience higher academic success across curriculum, followed by convergers, divergers and accomodators.

Studies dealing with researching these three issues at the community college level have been provided when possible, although until recently, learning style research was more prevalent at the elementary and secondary school levels (Purkiss, 1995) or much of the research at the community college level was not considered recent.

The following research deals with the issues examined in this study: (a) students' abilities to adapt to different learning strategies other than their own learning style preferences through adaptability, flexibility, versatility, and/or style-flexing, (b) different academic disciplines require variations in learning strategies, (c) teaching to meet diverse educational needs, (d) gender differences in learning style research, and (e) academic achievement associated with learning style.

Cornett (1983), Entwistle (1981), Kolb (1984), and Ornstein (1977) address the issue of student adaptability, flexibility, versatility, and/or style-flexing in their research,

but the following are more recent studies on this issue. Banner and Rayner (1997) conducted a three year study on the effect of teacher style-flexing (adapting teaching methods) to meet the learning needs of students. The results of their study indicated that teacher style-flexing could maximize student potential. Wasson (1997) believes that by developing materials for adaptive learning in complex subjects such as math, physics, programming languages, and other disciplines makes the learner central to the classroom environment. In order to facilitate the learning process, McCaslin and Good (1996) endorse teaching student how to develop adaptive learning for abstract and analytical curricula. New learning environments for international students was the area of study for Lee and Lodewijks (1995) to examine the flexibility of students' learning styles and the ability to adapt to a new context of learning. Lee and Lodewijks discussed the importance of identifying effective strategies for the context of the learning situation before the learning style could change. The study also attributed the adapting of the learning style to an improvement in grades. Adaptive learning in classroom programs of intervention have been found by Elliott and Shapiro (1990) to be effective in improving academic performance. Each of these studies supports the concept of adapting, flexing, or style-flexing to meet the educational needs of students.

Learning strategies differ according to academic disciplines is the topic of concern in these studies. According to Kalous (1992) in order to study learning styles and academic majors, he conducted a study of 151 undergraduate students in four different disciplines. His findings report that different disciplines do require specific types of learning and studying. Students' perceptions are influenced by content areas, explains Vahala (1990) and different disciplines appear to create very different classroom learning

environments. Data for this study was collected from five institutions ranging from a public university, two private colleges, and two public two-year colleges in three content areas: English composition, laboratory science, and behavioral science. Yount (1988) investigated learning styles by academic discipline to discover that the 148 students did not produce any significant differences for learning style by gender or class level for total population or by discipline, but there were significant differences for learning styles by discipline and total population. Dinmore (1997) maintains that interdisciplinary studies are more appropriate for meeting adult learning needs and recommends that disciplinary studies make needed changes to provide for adult learners in the area of learning styles. Beaty (1994) states that there was no significant correlation between learning styles in correspondence courses and academic discipline. These studies do indicate that there is a possible correlation between learning style differences and academic disciplines.

Research in diversity issues raise the question of learning styles meeting the educational needs of diverse learners. Wang and Zollers (1990) maintain that adaptive instruction can meet the needs of diverse students and learning can be maximized by incorporating the model of the adaptive learning environment into the regular classroom. Allen-Sommerville (1996) verbalizes in her study that instructors should integrate learning-preference diversity into learning styles, classroom curriculum, and customize teaching styles to provide for ethnic and cultural backgrounds of students. A study in learning styles (Park, 1997) of 1,283 students in 10 high schools in 4 school districts in the Los Angeles area demonstrated a difference in preferred learning styles of ethnically diverse students and recommended expanding students' learning preferences. Latham (1997) promotes assimilating different learning styles into the classroom culture to

recognize and capitalize on teaching and learning possibilities. Meeting the diverse learning style needs of students can enrich the classroom curriculum.

Gender difference are usually associated with most learning style research. Enns (1993) calls for classroom activities that provide for gender-balanced approaches to teaching to meet both the male abstract/reflection and the female concrete/active experimentation learning styles. Men and women have different learning styles (Philbin, Meier, Huffman, & Boverie, 1995) affirms this study and men usually prefer traditional education as assimilators. Women rated high in the diverger and converger quadrants and do not prefer traditional education. Knight, Elfenbein, and Martin (1997) examined the relationship of learning styles to connected knowing and separate knowing in reasoning and intelligence to determine gender differences and the effect in the classroom exchange of ideas. Learning styles are not gender-balanced and differences in learning are evident in many studies.

The following research studies examine the association between learning styles and academic achievement. A study conducted by Matthews and Hamby (1995) show differences by gender, race, and differences between high school and college for the same groups. "A meta-analysis of forty-two experimental studies conducted with the Dunn and Dunn model between 1980 and 1990 by thirteen different institutions of higher education revealed that students whose" learning styles were accommodated could be expected to achieve higher (Dunn, Griggs, Olson, & Beasley,1995, p. 353). A study by Boyle and Dunn (1998) regarding learning styles of law students confirmed that students achieve higher when the strategies used in the classroom match students' styles. Many factors effect the learning of at-risk learners, but this study reiterates that students will achieve

more if taught learning strategies and when their learning styles are accommodated in the classroom (Johnson, 1998).Utilizing multiple learning styles in the classroom will increase students' academic achievement.

Changes and Developments in Learning

While much of the research literature suggested a major revamping of the community college curriculum, changes in the instructors' presentations of materials in the classrooms, and the overall restructuring of the learning environments' activities, projects, and assignments, change takes time to be implemented (Anderson & Adams, 1992; O'Banion, 1996; Sims & Sims, 1995a). Many of the new diverse community college students may need to be academically socialized into the learning culture before they can experience successful learning (Adams, 1992; O'Banion; Oblinger, 1996). High dropout rates in community colleges seemed to occurred the most often between the freshmen and sophomore years (Feemster, 1999) when most students were meeting the requirements of the general-core classes before entering into their major field of study where they would probably experience academic success.

A goal of the "Community College of the 21st Century" is to make the necessary changes to accommodate the new community college students (Johnson & Lobello, 1996). All of the changes that are being discussed could possibly revolutionize education at the community college level from the traditional lecture-analytical environment to a more student-centered, student-friendly learning environment. But there are several inherent problems that could accompany change. First, change would take time, and many students trying to obtain a college education would be unable to wait for the needed

changes in curriculum, teaching strategies, and classroom learning environments (O'Banion, 1996). Second, not all educators have agreed that accommodating learning styles would be the best approach in meeting diverse needs of these new students (Brainard & Ommen, 1977; Bruer, 1999; Sims & Sims, 1995a). Third, some educators are not willing to make the necessary changes (Adams, 1992; Brainard & Ommen; Oblinger, 1996; Sims & Sims, 1995a). But in order to reduce the attrition rate, community colleges need to provide for the students both environmentally and educationally (Oblinger).

Research has continued to show that a majority of community college instructors use traditional analytical approaches teaching their classes which is the opposite learning style of over 50% of the student body that is made up of concrete learners. Research has also indicated that analytical learners are typically more successful in the academic arena than concrete learners and as a result attain higher grades academically. A match of students' learning styles and instructors' teaching strategies resulted in higher achievement as opposed to the students that were mismatched with their instructors. But until the necessary improvements to community college education can be accomplished, the students can be taught how to perceive the skills necessary for academic success in various disciplines and be instructed in how to adapt their learning styles to meet the demands of their academic environment (Cornett, 1983; Entwistle, 1981; Kolb, 1984; McCarthy, 1980; Sims & Sims, 1995b; Williams, 1983).

Many different terms were used to describe the phenomenon of students adapting their learning styles to meet the learning strategy requirements of other learning environments different than their own. Cornett (1983) stated that there were three aspects

of learning style: cognitive, affective, and physiological. According to James and Blank (1991), "Perceptual learning style is a variation of the physiological category of learning styles [that] focuses on the manner in which an individual extracts information from the environment by the senses" (p.12). In a study conducted by James and Blank in 1991 on perceptual learning style, findings indicated that educational levels definitely influenced the adult's ability to use the senses to extract the necessary information from various environments. The more educated the adult happened to be, the higher the perceptual ability. This study seemed to indicate that the educated adult was more experienced at extracting the information needed, possibly due to adapting in the classroom learning environment.

The process of adapting to different learning situations, according to Cornett (1983) may be referred to as:

> Style-flexing, augmenting one's map, increasing the options, becoming be-cognitive, switch-hitting, using both sides of your brain, and stretching are a few of the terms presently being used to describe how to increase the strategies in one's style repertoire . . . because people and tasks demand different styles. (p. 43)

Cornett further suggested that individuals have a range of variability and that adjustments are made continually to fit the task. She pointed out that in the classroom, students' learning styles interacted influencing each other. Learning styles did change and would continue to change over time, just as the learning styles changed in daily interactions. Cornett summarized by commenting that once students learn how to "become more adept at adjusting learning styles to teaching styles and tasks . . . they can transfer this ability to

all learning situations" (pp. 19-20). Entwistle (1981) agreed that versatility and integration were vital to the student's ability to adapt to the learning environment. According to Entwistle's research, 65% of a person's learning was influenced by genetic make-up, 23% the environment, and an additional 12% by the interaction between the genetic make-up and the learning environment. Sims and Sims (1995b) encouraged this versatility, integration, and flexibility by stating that students should be taught to become "other brained" in order to develop weaker learning skills.

A student's ability to adapt, flex, or adjust to meet the demand of a task was considered a process of development:

> In the experiential learning model of development, there are three distinct levels of adaptation, representing successively higher-order forms of learning: performance, learning, and development. In the acquisition phase of development, adaptation takes the form of performance governed by a simple registrative consciousness. In the specialization phrase of development, adaptation occurs via a learning process governed by a consciousness that is increasingly interpretative. The integrative phase of development marks the achievement of a holistic developmental adaptive process governed by a consciousness that is integrative in its structure. Thus each developmental stage of maturation is characterized by acquisition of a higher-level structure of consciousness than the stage preceding it, although earlier levels of consciousness remain: that is, adults can display all three levels of consciousness: registrative, interpretative, and integrative. These consciousness structures govern the process of

> learning from experience through the selection and definition of that experience. (Kolb, 1984, pp. 145-146)

According to Kolb (1984), individuals had the adaptive flexibility to adjust to their world, but it was a process of development, whether learned or taught. Therefore, if students were taught how to adapt to various learning style demands, academic success would probably improve. Cornett (1983) called the process of a student learning strategies "learning to learn" and indicated that the process could instill in students, the "lifelong habit of teaching themselves" (p. 43).

This research study was designed to simulate learning in four different subject-area disciplines, to determine if students perceive that different disciplines invoke different learning strategies to be successful, and if students are able to adapt or style-flex to meet those learning style strategy requirements? The intent of this study was to determine if community college students' learning styles vary by subject-area, gender, and academic performance.

CHAPTER III

METHOD

This chapter describes the method used to carry out the study. It includes a description of the participants, the instructional setting, the instruments used, the procedures, and data analysis. As stated in chapter one, the purpose of this study was to determine if community college students' learning styles vary by subject-area, gender, and academic performance. The key research questions were stated as follows:

1. Do community college students' learning styles vary across four different subject-area disciplines: English, math, science, and social studies?
2. Do community college students' learning styles vary by gender?
3. Do community college students' learning styles vary by academic performance?

Participants

The participants involved in this study were 105 students enrolled in four sections of English Composition II classes during Spring Semester 2000 at a small rural, Midwestern community college. There were ninety-one freshmen, one concurrent (a high school student) freshman, and thirteen sophomore students. Seventy-three students were

Caucasian, seven were African-American, seventeen were Native-American, two were Asian American, two were other ethnic groups that were not specified, three were international students (two from Africa and one from Ireland). One student included in the research data answered all questions on the survey except ethnicity. She is identified as the missing results in Table 1 that describes the students by gender and ethnicity. Table 2 describes the demographic makeup of the student participants. Five students did not complete the survey, but chose to provide ethnicity and gender information. These five students are identified as missing in all categories in Table 2.

Different participant totals appear in various data throughout the study. The total number of student participants involved in the study was 105. Only 104 participants completed gender information on the Student Demographic Survey. Only 100 participants completed the entire survey with five participants choosing to complete only the gender and ethnicity questions. In reference to the Adapted LSI IIa and the Kolb LSI IIa, a total of 103 participants were included in the data. One student's inventory results were eliminated due to student error in answering the questions on all five administrations of the learning style inventories. Another student was eliminated due to continuous absence during the data collection period.

Table 1

Description of Participants by Gender and Ethnicity

Variable	Male	Female	Total	Percent
Gender	47 (44.8%)	58 (55.2%)	105	100.0
Ethnicity				
Caucasian	37	36	73	69.5
African American	4	3	7	6.7
Native American	5	12	17	16.2
Asian American	0	2	2	1.9
Other	0	2	2	1.9
International Students	1	2	3	2.9
Missing Results	0	1	1	1.0

*International Students' ethnicities represented two African and one Irish.

Table 2

Student Demographic Data

Variable	Frequency	Percent
Age		
18-21	82	86.1
23-25	5	5.2
35-45	4	4.2
Enrollment		
Full-time	100	95.2
Part-time	0	0
Resident		
On campus	52	49.5
Commuters	48	45.7

Table 2 – Continued

Variable	Frequency	Percent
Employment		
Unemployed	34	32.4
Employed	66	62.9
Marital Status		
Single	95	90.5
Married	5	4.8
Diploma		
High School	97	92.4
GED	3	2.9
First in the family to attend college		
Yes	28	26.7
No	72	68.6
Major		
Declared	91	86.7
Undecided	9	8.6
Educational plan		
Certificate program	9	8.6
Associate degree	86	81.9
Both	4	3.8
Future plans		
No further educational plans	12	11.4
Transfer	88	83.8
* Missing in all categories	5	4.8

*Five students completed only the gender and ethnicity section of the survey.

These students were selected for three reasons:

1. English Composition II classes were part of the general-core curriculum that was required for all students, and the second class of the two English composition required classes, the first required class being English Composition I.
2. All the participants had attended college for at least one full semester before taking English Composition II; some of the students were sophomores.
3. According to the literature review, the highest number of dropouts usually occurred between the freshmen and sophomore years (Feemster, 1999); therefore, by studying this group of students during this critical time period, this study may indicate some factors that have contributed to the high attrition rate.

Instructional Setting

The study was conducted at a small rural, Midwestern community college and the only post-secondary college in the area. Its service area is comprised of more than 85,000 residents in three counties that covers more than 3,000 square miles. The community in which the institution is located is the largest town in the county with 13,000 residents. Primarily a junior college in its aim, it emphasizes certificate programs and academic degrees for traditional student transfer.

This study took place in four different classrooms that are located in the same building. The building is the original classroom building for the campus and one of two

original buildings that were built in 1929. The building now houses classrooms for general-core classes and offices for instructors in English, math, and social studies.

The student population of the campus was 2,131 students with the following ethnic distribution: Caucasian, 67.76 %; Native-American, 20.92%; African-American, 8.54%; Latino-American, 1.07%; Asian, 0.37%; and international students 1.3%. The male population was 44.8% and female population 54.3%. The single population was 76% (which included single parents) and 24% were married. The campus population was comprised of traditional students ages 17-21(63%) and non-traditional students more than 22 years of age (37%). The mean age was 25. Many of the traditional students were parents of small children and a large number were single parents, unprepared academically, economically disadvantaged, and many were first generation college students. The students were enrolled as full-time students with 12 or more hours (68%) and part-time students with less than 12 hours (32%). The student body population was 43.8% freshmen students and 38.5% sophomore students. Only 25% of the students were residents of the local community in which the community college was located, 45% were area students that commuted daily to campus, and 30% were campus residents. The students were either new entering freshmen, returning students, or transfers from post secondary institutions. Some students that were unsuccessful at four year colleges and universities transferred from the four-year schools to the community college to obtain the necessary skills for completing a college education.

The student participants reflected the instructional setting student profile in the following manner (see Tables 1 and 2): Caucasian, 69.5%; Native-American, 16.2%; African-American, 6.7%; Asian-American, 1.9%; and 1.9% as unidentified other. The

male population was 43% and female population was 52.4%. The single population was 90.5% and 4.8% were married. The majority of the students were of traditional student age 18-21 (86.1%). The number of students from 22-25 (5.2%) and 35-45 (4.2%) was small in number in comparison. The mean age was 20. All the students were enrolled full-time (100%). Residency was divided almost equally between on campus living (49.5%) and (45.7%) off campus living. Most students worked (62.9%) with only about a third (32.4%) refraining from employment either on or off campus. The majority were high school graduates (92.4%) with a small number of GED diplomas (2.9%). Most of the students were not the first in their families to attend college (68.6%), but approximately a fourth (26.7%) were. A large number of the students declare majors (86.7%), but 8.6% did not declare majors. Many of the students expressed plans to obtain an associate degree (81.9%) or complete a certificate program (8.6%). After completing their associate degrees, most of the students (83.8%) indicated plans to transfer to a four college or university. Only 11.4% of the students considered the completion of their educational plans terminal. One hundred five students participated in the study with five students' surveys missing from the demographic survey results. The Student Demographic Survey was reflective of the campus student profile in most categories with very similar percentages.

Instruments

Data collection for this study consisted of a quantitative approach using a triangulation of instrumentation: four Adapted LSI IIa simulating learning in English, math, science, and social studies; the Kolb Learning Style Inventory IIa; a Student

Demographic Survey; and examination of pertinent academic documents to obtain cumulative GPA. Permission was given by the institution's administration to assess the students on a volunteer basis and to examine any pertinent academic documents.

The Kolb Learning Style Inventory (LSI) IIa

The Kolb Learning Style Inventory IIa was developed by Kolb in 1985, revised in September of 1986, and based upon Jung's learning theory (Kolb, 1995). Kolb studied Jung's research that dealt with the different approaches that people use in perceiving and processing information. Kolb (1984) then took learning style research and formulated a model of styles or types based on the Jungian concept of adult development in dealing with integration at a higher level and non-dominant modes of expression. He further analyzed the different learning styles of the types of learners.

The inventory Kolb developed consisted of a twelve-item questionnaire with the participant completing in rank order four sentence endings that corresponded to four learning mode orientations: concrete experience, abstract conceptualization, active experimentation, or reflective observation. Two combinations of ranking scores were plotted on a grid to identify the intersection of the scores and thus indicated the learner's learning styles quadrant: diverger, assimilator, converger, or accommodator. This inventory was designed for adult use, and assessment time was estimated at ten minutes.

Even though the inventory scoring was estimated at five to ten minutes per inventory, it would have been too time consuming for me to score one hundred and five inventories for five different inventory administration sessions; therefore, I decided to train my students to score their own inventories. During the first inventory administration

session, I spent approximately twenty to thirty minutes explaining to the students how to score the inventory. I also demonstrated the process on the chalkboard. A handout was given to each student with the scoring procedure to remind the students of the steps in the scoring process. Calculators were provided for student use in totaling inventory results. I also moved about the classroom assisting students in the scoring process. In all other sessions, approximately fifteen minutes were spent reviewing the scoring directions.

The purpose of this study was to determine if community college students' learning styles vary by subject-area, gender, and academic performance. Kolb bases the LSI IIa and the theory of experiential learning on peoples' different approaches to perceiving and processing information, and information integration and non-dominant modes of expression. Kolb believes that different disciplines require various strategies to learn successfully in those academic areas. According to Kolb's research, people have varying degrees of ability to perceive the information differences and varying degrees of ability to adapt to meet those learning strategy requirements for successful learning. Therefore, in order to study Kolb's premise that people have the ability to perceive learning strategy differences and are able to adapt to meet those different requirements, I decided that the Kolb LSI IIa would have to be adapted to simulate learning in other disciplines. This adaptation could possibly determine if learning styles were subject-area sensitive.

In order to simulate learning in different disciplines, I decided to insert the name of the discipline into each of the twelve sentence items in the Kolb LSI IIa and adapt the inventory for each of the four disciplines: English, math, science, and social studies. The instrument is essentially identical except for the added word in each sentence. Instead of

the sentence reading, "When I learn." the adapted sentence reads, "When I learn in English" (substituting the name of each discipline on one of the four inventories). Each of the twelve sentence items was rewritten to mention the name of the discipline that was going to be studied in that particular session. At the beginning of each session, participants were informed that they were to simulate learning in English, or math or whichever discipline was being assessed that week. A sample of an Adapted LSI IIa follows (Figure 1).

1. When I learn in English:	I like to deal with my feelings	I like to think about ideas	I like to be doing things	I like to watch and listen
2. I learn best in English when:	I listen and watch carefully	I rely on logical thinking	I trust my hunches and feelings	I work hard to get things done

Figure 1. Adapted LSI IIa Sample.

In order to determine the overall learning style and to study the effect of different disciplines on learning styles, the Adapted LSI IIa was administered in sessions one through four and the Kolb LSI IIa was administered in the fifth inventory assessment session.

In choosing my instrumentation, I wanted an inventory that I could adapt to create four new learning style assessment instruments, and I wanted an instrument that had strong internal reliability, validity of learning styles and career choices, test/retest reliability, and the reputation as an excellent assessment measurement. Reading critiques

of various learning style inventories, I found the Kolb LSI IIa to be one of the most highly recommended. The Kolb was also one of the more popular learning style inventories for community college research. I felt that if my primary instrument was recognized as a reliable tool, then my adapted inventories, even though modified from the original, should be judged to have retained reliability and validity of the initial instrument. In the technical manual for the inventory, Kolb (1995) reported that the scores generated by the inventory showed a moderately high internal reliability when measured by Cronbach's alpha and that reliability coefficients ranged from .73 to .88, split-half reliability coefficients were from .87 to .93.

I created the Student Demographic Survey to solicit information in the following areas: race, ethnicity, international student; age; gender; full or a part-time student; resident or commuter; unemployed or employed; material status; completion of high school or a GED program; major; transfer degree candidate, certificate program, or an associate degree candidate (see Appendix A). There were eleven questions that required checking the appropriate response or writing-in the correct response. The survey was completed at the end of the first inventory assessment class session. The demographic information was examined after all five inventories were completed and the results compiled for analysis. The demographic survey information indicated variables that may have influenced the research study results, such as learning style differences by gender.

The college administration approved the examination of pertinent academic documents for the purpose of this research study. The academic documents examined were students' transcripts in order to identify and clarify students' cumulative GPAs. The documents supported or refuted student participants' abilities to succeed. Students were

considered to have meet minimal requirements to succeed if a cumulative GPA was 2.5 or above. This minimal requirement was selected, even though the financial aid policy for this particular community college required that recipients maintain at least a 2.0 in order to continue receiving financial aid benefits. The 2.5 cumulative GPA was considered a better indicator for succeeding academically. Succeeding academically would be accomplished by a student completing all classes in which the student was enrolled with a passing grade of 2.5 or above, continued enrollment, and accomplishing the educational goals set by the student. The academic documents provided a cumulative GPA for all participants and allowed learning styles to be examined by academic performance (GPA) to determine if a generalization could be made about certain learning styles and academic success.

Data Collection

Several days prior to beginning the study, I explained the purpose of the research and the administration of the five learning style inventories. The participants were told that the process would take five-weeks to complete the inventory assessment period, and they would also be asked to complete the Student Demographic Survey during the first session. I wanted to clarify any concerns such as the purpose, voluntary participation, and confidentiality. Students were also informed that they had the option of refusing to participate at any point during the study: one special need's student did decline to participate. I explained the benefits of identifying students' learning styles and how the information could be used to improve their learning. They were also informed that an Oral Consent Script and a Consent Form would be read aloud to them. I also explained

that they would be asked to sign the Consent Form giving their voluntary consent to participate in the study.

The first data collection session, I read the Oral Consent Script and the Consent Form aloud to the students. The participants were asked to sign the form and a copy of the Consent Form was given to each student to keep. At the conclusion of the last session, participants were given a handout about learning styles and learning tips.

The data for this study were collected over a six-week period. The procedure for collecting data included six steps:

Week 1 – The Adapted LSI IIa-English version identified the participants' learning styles for English. After completing the inventory, the students were told how to score the inventory and record the data. After the participants recorded the data, they were asked to complete the Student Demographic Survey. Completing the inventory, scoring and recording the results, and answering the survey took approximately 20 minutes.

Week 2 – The Adapted LSI IIa-Math version identified the participants' learning styles for math. After completing the inventory, the students scored the inventory and recorded the data. Completing the inventory, scoring and recording the results took approximately 15 minutes.

Week 3 – The Adapted LSI IIa-Science version identified the participants' learning styles for science. After completing the inventory, the students scored the inventory and recorded the data. Completing the inventory, scoring and recording the results took approximately 15 minutes.

Week 4 – The Adapted LSI IIa-Social Studies version identified the participants' learning style for social studies. After completing the inventory, the students scored the inventory and recorded the data. Completing the inventory, scoring and recording the results took approximately 15 minutes.

Week 5 – The Kolb LSI IIa identified the participants' overall learning style preferences. After completing the inventory, the students scored the inventory and recorded the data. Completing the inventory, scoring and recording the results took approximately 15 minutes.

Week 6 – After all the data were compiled and recorded, each student participant was given a copy of his/her inventory results and a handout on the interpretation of the learning style information and how to use the information to increase perception, adaptability, and improve learning. The academic documents were examined to determine a cumulative GPA for all participants.

Research Design and Data Analysis

This study used intact groups of community college students enrolled in sections of English Composition II classes taught by the researcher. The goal was to study the extent to which students' learning styles vary by subject-area, gender, and academic performance. The independent variables in this study were gender and subject area. The dependent variables were the Adapted LSI IIa and the Kolb LSI IIa total scores for each learning mode: active experimentation; reflective observation; abstract conceptualization; and concrete experience. The subject area variable was a repeated measure, as each

participant took the Adapted LSI IIa for each subject area and the Kolb LSI IIa for overall learning style, with five levels: English; math; science; social studies; and overall.

A series of mixed model ANOVAs were conducted, with gender as a nested independent variable, subject area as a repeated independent variable, and Adapted LSI IIa and Kolb LSI IIa scores as dependent variables. These analyze were used to address research questions #1 and #2. To address research question #3, student academic success (GPA) served as the dependent variable, and the overall Kolb LSI IIa learning style quadrant (diverger, assimilator, converger, and accomodator) was the independent variable. This was analyzed by a one-way ANOVA.

CHAPTER IV

RESULTS

The purpose of this study was to determine if community college students' learning styles vary by subject-area, gender, and academic performance. The original non-adapted Kolb LSI IIa instrument was administered once to identify the students' preferred learning styles. The adapted version was designed to simulate learning in four different disciplines and was administered four times to assess whether students' learning styles vary across four different subject-area disciplines. It was the intent of this study to determine if students perceive that different disciplines require different learning strategies, and if students are able to adapt or style-flex to meet the learning strategy requirements.

The Adapted LSI IIa and the Kolb LSI IIa results were analyzed to determine if students demonstrated style-flexing from one learning style quadrant to another during any of the five inventory assessment sessions. Kolb's (1984) research indicates that various disciplines are localized in different learning style quadrants and require specific learning strategies in order to be a successful learner in that discipline. In the present study, it was found that the students' moved from one learning style quadrant to another across disciplines resulting in the use of different learning strategies. This finding suggests that students adapt their learning strategies depending on the discipline in which they are

learning. The results in Tables 3 through 16 show significant differences by subject-area and academic performance, but not by gender.

Research Question One: Do community college students' learning styles vary across four different subject-area disciplines: English, math, science, and social studies? The Kolb LSI IIa indicated each student's overall learning style which is considered the students' preferred learning style. Some learning style researchers (Entwistle, 1981; Kolb, 1984; Sims & Sims, 1995b) define preferred learning style as the manner in which the student prefers to learn. When students style-flex, they are using learning strategies other than the strategies characteristic of their own preferred learning styles to adapt to the discipline or task (Cornett, 1983; Entwistle, 1981; Kolb, 1984; Sims & Sims, 1995b). If community college students' preferred learning styles are utilized when learning in different disciplines, then the students' preferred learning styles will be reflected across subject-area discipline. For example, if a student's preferred learning style is assimilator and he uses the assimilator learning style across subject-area disciplines, he is using his preferred learning style. But if he changes to another learning style when completing tasks in other disciplines, he is style-flexing.

The Adapted LSI IIa (English, math, science, and social studies) and the Kolb LSI IIa were analyzed by grouping the data by subject disciplines under the learning mode orientation variables: active experimentation, reflective observation, abstract conceptualization, and concrete experience. According to the learning mode differences

subjects table (Table 3), each learning mode orientation demonstrated differences by subjects.

In active experimentation, science had the highest mean score (M = 36.07; SD = 6.30). Social studies had the highest mean score for both reflective observation

Table 3

Learning Mode Differences by Subjects

Variable	Mean	SD
Active Experimentation		
English	32.34	6.20
Math	33.86	5.13
Science	36.07	6.30
Social Sciences	30.01	7.47
Overall	35.10	7.38
Reflective Observation		
English	33.49	6.86
Math	34.79	6.43
Science	32.47	6.40
Social Sciences	34.99	6.69
Overall	33.90	6.76
Abstract Conceptualization		
English	29.53	6.53
Math	30.99	5.99
Science	30.08	6.52
Social Sciences	31.58	6.54
Overall	29.21	6.32
Concrete Experience		
English	25.43	6.53
Math	20.45	4.29
Science	21.61	4.63
Social Sciences	24.00	7.05
Overall	21.79	6.07

(M=34.99; SD=6.69) and for abstract conceptualization (M=31.58; SD=6.54). The highest mean score for concrete experience was English (M=25.43; SD=6.53).

The highest and lowest mean subject discipline scores changed from one learning mode orientation to another, except for the social studies mean scores which were the highest for both reflective observation and abstract conceptualization. The lowest mean scores in those two learning modes did change disciplines. The mean scores for the disciplines were close together, and the standard deviation scores were similar.

It appeared that the changing rank order positions of the disciplines within each learning mode orientation demonstrated student style-flexing from one learning style quadrant to another. Learning in four different disciplines (English, math, science, and social studies), as simulated in the Adapted LSI IIa inventories and compared to the Kolb LSI IIa overall learning style preferences, did appear to demonstrate style-flexing from one learning style quadrant to another.

Since the learning mode orientation results suggested differences by subjects, a series of analysis of variance (ANOVA) tests were conducted to determine if the differences by subjects were significant enough to verify style-flexing by the students from one learning style quadrant to another as suggested by Table 3. The alpha (probability) level for the entire study was set at alpha = .05. Since there were four dependent variables, each was analyzed and no significant interactions between gender and subject were found. No significant differences were demonstrated between males and females for any of the four learning mode orientation variables. Because subject-area was a repeated measure, probability was adjusted in the ANOVA summary tables by the Huynh-Feldt correction for sphericity.

The ANOVA summary table for active experimentation showed an F (4,292) = 17.59. As Table 4 shows, the probability that this observed value of F was due to chance was p = .0001. Since this value was less than alpha = .05, the conclusion was that there was a significant difference in the active experimentation scores by subject-area.

Table 4

ANOVA Summary Table

Active Experimentation Scores Across Subject-Areas by Gender

Sources	DF	SS	MS	F	P
Gender	1	195.47	195.47	1.55	.2174
Error	73	9217.53	9217.53		
**Subject	4	1562.15	390.54	17.59	*.0001
**G X Subj.	4	56.16	14.03	.63	.6381
Error	292	6481.94	22.20		

Note: * Significant at alpha = .05; **Probability has been adjusted by the Huynh-Feldt correction for sphericity.

The ANOVA summary table for reflective observation showed an F (4.292) = 2.68. As Table 5 shows, the probability that this observed value of F was due to chance was p = .0334. Since this value was less than alpha = .05, the conclusion was that there was a significant difference in the reflective observation scores for subject-area.

Table 5

ANOVA Summary Table

Reflective Observation Scores Across Subject-Areas by Gender

Sources	DF	SS	MS	F	P
Gender	1	289.96	289.96	2.55	.1147
Error	73	8303.43	113.75		
**Subject	4	265.03	66.26	2.68	*.0334
**G X Subj.	4	92.12	23.03	.93	.4435
Error	292	7213.60	24.70		

Note: * Significant at alpha = .05; **Probability has been adjusted by the Huynh-Feldt correction for sphericity.

The ANOVA summary table for abstract conceptualization showed an F (4,292) = 2.86. As Table 6 shows, the probability that this observed value of F was due to chance was p = .0238. Since this value was less than alpha = .05, the conclusion was that there was a significant difference in the abstract conceptualization scores for subject-area.

Table 6

ANOVA Summary Table

Abstract Conceptualization Scores Across Subject-Areas by Gender

Sources	DF	SS	MS	F	P
Gender	1	85.44	85.44	.71	.4000
Error	73	8815.49	120.76		
**Subject	4	202.62	50.65	2.86	*.0238
**G X Subj.	4	65.29	16.32	.92	.4516
Error	292	5170.82	17.71		

Note: * Significant at alpha = .05; **Probability has been adjusted by the Huynh-Feldt correction for sphericity.

The ANOVA summary table for concrete experimentation showed an F (4,292) = 16.21. As Table 7 shows, the probability that this observed value of F was due to chance was p = .0001. Since this value was less than alpha = .05, the conclusion was that there was a significant difference in concrete experimentation scores for subject-area.

Table 7

ANOVA Summary Table

Concrete Experience Scores Across Subject-Areas by Gender

Sources	DF	SS	MS	F	P
Gender	1	22.72	22.72	.30	.5878
Error	73	5594.95	76.64		
**Subject	4	1417.21	354.30	16.21	*.0001
**G X Subj.	4	158.89	39.72	1.82	.1379
Error	292	6382.88	21.86		

Note: * Significant at alpha = .05; **Probability has been adjusted by the Huynh-Feldt correction for sphericity.

Each learning mode ANOVA summary table (Tables 4-7) showed that there were significant differences within subject disciplines: English, math, science, social studies, and overall for each of the learning style modes. The purpose of the ANOVA was to decide if the observed differences within subjects represented a chance occurrence or a systematic effect. It was determined in each mode that the significant difference was not by chance. Each mode was paired with the discipline that was the closest match in learning strategy

characteristics (Kolb, 1984); therefore, it was assumed since scores changed by disciplines for each of the learning style modes, students were demonstrating style-flexing from one learning style quadrant to another in each of the different inventories.

In order to discover where the mean differences lie, post-hoc comparisons were conducted. The post-hoc comparisons determined that several differences were significant in each of the four post-hoc summary tables (Tables 8-11), therefore, these pairwise differences should be explored in future studies to determine the cause for the differences. The post-hoc comparison data seems to emphasize that significant differences exist between disciplines that are matches or mismatches for the four learning style modes. If this premise is correct, then these tables possibly demonstrate quadrant style-flexing and students' abilities to perceive that different disciplines require various learning strategies and the students' abilities to adapt to meet those learning strategy requirements.

The post-hoc summary table for active experimentation (Table 8) showed a significant difference pairwise for 8 of the 10 paired disciplines in learning mode active experimentation, with significant alpha levels ranging from .0249 to .0001. Students used active experimentation strategies more often for science than for English, math, or social studies. Students used active experimentation strategies less for social studies than for any other discipline or their overall learning style.

Table 8

Post-Hoc Summary Table

Comparisons for Active Experimentation Across Subject-Areas

Variable	DF	SS	MS	F	P
English vs. Math	1	249.28	249.28	5.38	*.0232
English vs. Science	1	934.61	934.61	23.29	*.0001
English vs. Social Studies	1	365.78	365.78	8.00	*.0060
English vs. Overall	1	507.92	507.92	14.65	*.0003
Math vs. Science	1	218.54	218.54	5.24	*.0249
Math vs. Social Studies	1	1218.98	1218.98	20.52	*.0001
Math vs. Overall	1	45.54	45.54	1.35	.2493
Science vs. Social Studies	1	2469.78	2469.78	47.29	*.0001
Science vs. Overall	1	64.55	64.55	1.76	.1890
Social Studies vs. Overall	1	1735.78	1735.78	32.57	*.0001

Note: *Significant at alpha = .05

The reflective observation post-hoc summary table (Table 9) showed a significant difference pairwise for only 3 of the 10 paired disciplines with significant alpha levels ranging from .0218 to .0106. Students used this type of learning strategy less in science than in math, social studies, or overall (no specific subject).

Table 9

Post-Hoc Summary Table

Comparisons for Reflective Observation Across Subject-Areas

Variable	DF	SS	MS	F	P
English vs. Math	1	129.52	129.52	1.84	.1789
English vs. Science	1	40.01	40.01	.82	.3676
English vs. Social Studies	1	165.76	165.76	3.02	.0863
English vs. Overall	1	64.60	64.60	1.58	.2126
Math vs. Science	1	313.50	313.50	5.50	*.0218
Math vs. Social Studies	1	2.23	2.23	.04	.8414
Math vs. Overall	1	11.17	11.17	.25	.6166
Science vs. Social Studies	1	368.65	368.65	6.89	*.0106
Science vs. Overall	1	206.29	206.29	5.58	*.0208
Social Studies vs. Overall	1	23.40	23.40	.72	.3980

Note: *Significant at alpha = .05

The abstract conceptualization post-hoc summary table (Table 10) showed a significant difference pairwise for 3 of 10 different comparison paired disciplines, than the reflective observation table. Significant levels ranged from .0228 to .0084. Students used abstract conceptualization strategies more in social studies than in English or overall; and more in math than overall.

Table 10

Post-Hoc Summary Table

Comparisons for Abstract Conceptualization Across Subject-Areas

Variable	DF	SS	MS	F	P
English vs. Math	1	148.90	148.90	3.64	.0604
English vs. Science	1	82.17	82.17	2.00	.1618
English vs. Social Studies	1	250.55	250.55	7.17	*.0091
English vs. Overall	1	.07	.07	.00	.9626
Math vs. Science	1	9.84	9.84	.27	.6017
Math vs. Social Studies	1	13.15	13.15	.31	.5787
Math vs. Overall	1	142.66	142.66	5.41	*.0228
Science vs. Social Studies	1	45.76	45.76	1.16	.2859
Science vs. Overall	1	77.55	77.55	2.59	.1118
Social Studies vs. Overall	1	242.44	242.44	7.33	*.0084

Note: *Significant at alpha = .05

The post-hoc summary table for concrete experience (Table 11) showed a significant difference pairwise for 6 out of 10 pair comparisons for concrete experience with significance levels ranging from .0002 to .0001. Students used concrete experience strategies more in English than in math, science or overall. Students used concrete experience strategies more in social studies than in math, science, or overall.

Table 11

Post-Hoc Summary Table

Comparisons for Concrete Experience Across Subject-Areas

Variable	DF	SS	MS	F	P
English vs. Math	1	2044.34	2044.34	35.43	*.0001
English vs. Science	1	1338.50	1338.50	22.98	*.0001
English vs. Social Studies	1	194.39	194.39	3.23	.0764
English vs. Overall	1	1351.51	1351.51	23.55	*.0001
Math vs. Science	1	74.45	74.45	3.09	.0831
Math vs. Social Studies	1	977.93	977.93	17.62	*.0001
Math vs. Overall	1	71.43	71.43	1.97	.1648
Science vs. Social Studies	1	512.70	512.70	15.93	*.0002
Science vs. Overall	1	.03	.30	.00	.9729
Social Studies vs. Overall	1	520.77	520.77	18.22	*.0001

Note: *Significant at alpha = .05

The various tables (Tables 3-11) do suggest possible style-flexing from one learning style quadrant (diverger, assimilator, converger, or accomodator) to another. Therefore, I wanted to know the dominant learning style in each of the four disciplines and overall, and the total number of students in each learning style by subject and overall. These data are provided in learning styles by subject discipline and overall (Table 12).

Table 12

Learning Styles by Subject Discipline and Overall

	English	Math	Science	Social Studies	Overall
Diverger	44	12	24	39	23
Assimilator	36	61	35	45	41
Converger	11	23	28	9	24
Accomodator	12	7	16	10	15

The total number of participants in each learning style quadrant by subject-area discipline (English, math, science, and social studies) and overall (Table 12) changed from one discipline to another including overall. The assimilator learning style had the largest number of participants for the subject-area disciplines math (61 total, 59%), science (35 total, 34%), and social studies (45 total, 44%), and for the overall (41 total, 40%) learning style. Diverger had the largest number of participants for English (44 total, 43%). English was the only discipline that indicated a larger total number of participants in a category other than assimilator. This table (Table 12) does seem to demonstrate style-flexing between quadrants.

Table 13 demonstrates that students are able to style-flex from one learning style quadrant to another. It also indicates that students do perceive that different learning strategies are required for various learning situations, and students are able to adapt or style-flex to meet the learning strategy requirements of the different disciplines. The style-flexing summary (Table 13) indicates that 103 student participants demonstrated the following fixed positions or quadrant style-flexing as shown by the results of the four

Adapted LSI IIa: English, math, science, social studies, and the Kolb LSI IIa overall. Only 20 (19%) students stayed within the same learning style quadrant throughout each of the five inventory assessments, 46 (45%) students were in two different learning style quadrants, 30 (29%) students were in three different learning style quadrants, and 7 (7%) students were in four different learning style quadrants during the five inventory assessments.

Table 13

Style-Flexing Summary Table

Number of Learning Style Quadrants	Number of Students
One learning style quadrant	20 students
Two learning style quadrants	46 students
Three learning style quadrants	30 students
Four learning style quadrants	7 students

Of the 20 students that demonstrated a fixed learning style that did not style-flex, there were 13 assimilators (65%), 3 divergers (15%), 2 convergers (10%), and 2 accomodators (10%). Gender distribution in the group reflected 12 males (60%) and 8 females (40%). In the assimilator learning styles, 7 were males (54%) and 6 were females (46%).

Research question one dealt with whether community college students' learning style preferences, as identified by Kolb LSI IIa overall, stayed the same when learning in different disciplines was simulated by the Adapted LSI IIa for English, math, science, and social studies. Tables 3 through 11 showed differences by subject-areas to be significant enough to indicate style-flexing and differences were not by chance. Tables 12 and 13 demonstrated style-flexing by total number of participants in each learning style quadrant by subject-area discipline and the number of participants that style-flexed from one, two, three, and four different learning style quadrants during the five learning style inventory assessments. The data showed that 81% (83 students) of the participants did style-flex.

Research Question Two: Do community college students' learning styles vary by gender? The data collected from the Student Demographic Survey (Tables 1 and 2) did not yield any statistically significant differences between the results of the four Adapted LSI IIa inventories (Tables 4-7), and the Kolb LSI IIa results (Tables 8-11) by subject-area or learning style for gender. There were no significant differences for learning style preferences by gender in this group.

Research Question Three: Do community college students' learning styles vary by academic performance? The mean GPA by learning styles quadrant table (Table 14) demonstrates differences in GPA by learning style preferences as indicated by the Kolb LSI IIa overall learning style preference. The data collection included obtaining the cumulative GPA for each participant from college transcripts. The following table provides the mean for GPA scores by learning style preferences. Assimilators (3.40) had

the highest GPAs, followed by convergers (3.21), divergers (2.94), and accomodators (2.67).

Table 14

Mean GPA by Learning Style Quadrant

Quadrant	N	Mean	SD
Accomodator	15	2.67	.84
Assimilator	41	3.40	.51
Converger	24	3.21	.58
Diverger	23	2.94	.67

The ANOVA table for GPA, (Table 15), showed an $F(3, 99) = 6.25$ for overall GPA. The probability that this observed value of F was due to chance was $p < .0006$. Since this was less than alpha = .05, the conclusion was that there was a significant difference by GPA. To accomplish a pairwise comparison of the GPA means, a post-hoc was conducted.

Table 15

ANOVA Table for GPA

Source	DF	SS
Overall	3	7.16
Error	99	37.89

Note: * Significant at alpha = .05

The post-hoc for effect of learning style quadrant on GPA table, (Table 16), indicated a significant difference between GPA for assimilator and diverger, assimilator and accomodator, and converger and accomodator. Assimilators had significantly higher GPAs than either divergers or accomodators, and convergers had significantly higher GPAs than accomodators.

Table 16

Post-Hoc for Effect of Learning Style Quadrant on GPA

Quadrants	Assimilator	Converger	Diverger	Accomodator
Assimilator	~	n.s.	*	*
Converger	~	~	n.s.	*
Diverger	~	~	~	n.s.
Accomodator	~	~	~	~

Note: * Significant at .05; n.s. = Not significant.

Research question three analyzed community college students' learning style preferences to determine if academic performance (GPA) varied by learning style. Mean GPA by learning style quadrant (Table 14) indicated that the learning style preferences identified by Kolb LSI IIa showed a difference for academic performance (GPA) by learning style. The mean GPA scores were assimilator 3.40, converger 3.21, diverger 2.94, and accomodator 2.67. ANOVA table for GPA (Table 15) indicated a significant difference in overall academic performance by learning styles and the difference was not by chance. The post-hoc comparison for effect of learning style quadrants on GPA table (Table 16) showed a significant difference in pairwise comparison for GPA mean by learning style preference (Kolb LSI IIa). A significant difference existed in academic performance (GPA) for pairwise comparisons for learning styles between assimilators and divergers, assimilators and accomodators, and between convergers and accomodators. The assimilator academic performance (GPA) mean score 3.40 was significantly higher than the mean scores for diverger 2.94 and accomodator 2.67. The converger academic performance (GPA) mean score 3.21 was significantly higher than accomodator 2.6 mean score.

Summary

The analysis showed that throughout the study the results were consistent. The majority of the student participants (81%) did demonstrate some learning style quadrant style-flexing from one quadrant to another, whereas, only 19% of the participants remained in one learning style quadrant during all five inventory assessments. It was determined by mean, ANOVA, and post-hoc pairwise comparisons, that there were

significant differences demonstrated by subject-areas. The results indicated that learning style does appear to be subject-area sensitive and that the majority of the students did possibly perceive that different disciplines required various learning strategies in order to be successful academically. The results also indicated that the majority of the students were able to demonstrate some style-flexing from one learning style quadrant to another, and were able to adapt or style-flex, in order to meet the requirement of the various disciplines' learning strategies.

The research findings did not show that the community college students varied by gender for subject-area, learning style preference, or academic performance. These findings are contrary to most learning styles research, which indicates a strong learning style preference by gender.

The mean, ANOVA, and post-hoc comparisons of GPA by learning style quadrants did reflect the results of research data: assimilator and converger academic performance is significantly higher than diverger and accomodator. Assimilators' academic performance was higher in the community college academic setting than the other learning style quadrant participants.

The learning styles for the majority of the community college students did not reflect the participants' learning style preference across four different subject-area disciplines. The learning styles did not vary by gender, but the learning styles did vary by academic performance.

CHAPTER V

DISCUSSION, CONCLUSIONS, AND RECOMMENDATIONS

The purpose of this study was to determine if community college students' learning styles vary by subject-area, gender, and academic performance. The research was designed to simulate learning in four different subject-area disciplines, to determine if students perceive that different disciplines invoke different learning strategies, and if students are able to adapt or style-flex to meet the learning strategy requirements. The results showed that learning styles are subject-area sensitive. The participants' learning styles did vary by academic performance, but not by gender.

One of the reasons for conducting the present study stemmed from our college's need to improve student academic performance and retention. In order to plan for the future of our community college campus, some administration and faculty had been reading and discussing *The 21st Century Community College* (Johnson & Lobello, 1996). Through our research, we had discovered that nation wide other campuses were also experiencing an influx of under-prepared students that had diverse learning needs (Feemster, 1999; Schroeder, 1993). These campuses were also experiencing high attrition rates (Feemster). Since the problems we were experiencing weren't unique to us, we formed a committee to examine what other campuses were doing to remedy the situation.

Hopefully we would find information that would provide possible solutions to help correct our problems.

One of the situations our college was experiencing was a slight drop in enrollment between fall and spring semester each year, but primarily, the highest decline in enrollment seemed to occur between the freshmen and sophomore years. Trying to understand the reason for the drop in fall enrollment, I realized that many students did not return to campus because of poor grades. I began to ask myself, "What was it about freshmen classes that would contribute to poor academic achievement?" Usually the freshmen and sophomore school years were spent taking required classes in the general-core. Once requirements were met, students would then be allowed to take classes in their major academic disciplines. Some students would experience an improvement in their cumulative GPA because they were now taking classes that were of interest to them.

Trying to find a way to make required classes more applicable to the students, I turned to learning style research as a possible solution. Learning styles were also being discussed in the literature of *The 21st Century Community College* (Johnson & Lobello, 1996) in an attempt to meet some of the learning needs of these new enrollees. I knew that learning styles weren't a panacea, but maybe one aspect that when combined with other ideas would contribute to making a difference on our campus and in the students' educational endeavors.

Since I wanted to discover what was happening to students in general-core classes, I decided to explore students' learning styles and the effect different disciplines had on learning styles, if any. To begin, I wanted to select a learning style inventory that was highly respected among community college researchers and had established reliability and

validity, particularly in the area of test/retest reliability. In order to simulate learning in other disciplines, I would have to adapt my learning style instrument. Choosing an inventory that had proven test/retest reliability, the instrument would establish one of two results: (1) If the adapted learning style inventories for the different disciplines indicated no changes in students' learning styles, then the test/retest reliability of the original instrument was valid; (2) But if the adapted learning style inventories for the different disciplines did indicate change in the students' learning styles, then the differences must be due to the effect of the discipline because of the test/retest reliability and validity of the original instrument. Therefore, I choose the Kolb Learning Style Inventory IIa for my research study.

Four disciplines were chosen from the general-core required classes representing differences in subject-areas by content, approaches to learning (abstract concepts or concrete experience), and methods used in classroom delivery and assessment of knowledge acquisition. English, math, science, and social studies were selected. In order to simulate learning in the four disciplines, the twelve sentence items were adapted by placing the name of the discipline in each of the twelve sentences listed on the inventory. An inventory was prepared for each of the four disciplines. After receiving permission from my administration to assess my English Composition II classes on a voluntary basis, I began administering the inventories one a week for four weeks.

In the beginning, I intended to have my students complete four inventories. I assumed very little flexing would take place and that most of the flexing would be within the same learning style quadrant (diverger, assimilator, converger, accomodator). When I began to examine the results and discovered that many students were demonstrating

multiple flexing from one learning style quadrant to another, I realized that I didn't have an established overall learning style preference for individual students. At the beginning of the assessment sessions, I had assumed each students' overall learning style would be evident when I compared the inventory results. Therefore, after completing the four adapted inventories, I administered the Kolb Learning Style Inventory IIa to obtain an overall learning style preference for each student. I would now have a fixed point of reference in which to compare the results.

In his theory of experiential learning, Kolb (1984) maintained that different learning situations required various learning strategies and that many students are able to adapt or flex (style-flex) to meet the learning strategy requirement for that particular learning situation. The Kolb LSI IIa would indicate an individual's preferred learning style, or in other words, the learning style preferred by that individual. Even though every learner has a preferred learning style, many learners are able to adapt or flex their learning style by utilizing other learning strategies to complete a learning task that requires a different approach. Learning styles are considered stable, but learning strategies vary (Kolb, 1984). This is the phenomenon observed in this study: the ability of some students to adapt or style-flex from one learning style quadrant to another and the inability or lack of necessity of other students to adapt or style-flex.

The results of this study indicated that most community college students' learning style preferences did vary significantly across four different subject-area disciplines: English, math, science, and social studies. The post-hoc pairwise comparisons identified differences for disciplines that matched or mismatched the learning strategies of the learning mode orientations (Tables 8-11). When the total number of participants for each

learning style by subject-area and overall were compared, multiple style-flexing was evident by the changing totals (Table 12). But the style-flexing were confirmed (Table 15) when 83 (81%) of the 103 participants were in two or more quadrants during the inventory assessments. Only 20 (19%) students demonstrated fixed learning style positions and did not style-flex. These findings do confirm that learning styles are subject-area sensitive, that many students' can perceive different disciplines require different learning strategies, and many students' are able to adapt or style-flex to meet the requirements of the learning task. But some students did not style-flex. Does this mean these students couldn't adapt or style-flex, or that these students didn't need to style-flex to complete the task? This question will be addressed later in this chapter.

According to this study, community college students' learning styles do not vary by gender? The Student Demographic Survey, the results of the five inventories, and the ANOVA tables (Tables 4-7) did not yield any significant statistical differences by gender. Most learning style research does indicate learning style differences by gender. Usually males prefer traditional-analytical learning and classroom environments and are the most prevalent in the assimilator learning style quadrant (Philbin, Meyer, Huffman, & Boverie, 1995). Females, on the other hand, prefer more non-traditional learning and classroom environments in the concrete experience learning mode (Philbin, et al.). Females are more likely to be in the diverger or accomodator learning style quadrants (Philbin, et al.). That doesn't mean that males and females are not represented in the other quadrants, it just means that males usually prefer abstract thinking about concepts and ideas where as females usually prefer a more personal, practical approach to learning. One assumption as to why this study did not demonstrate learning style differences by gender was that the

sample size, represented by 55 females and 45 males, may have been too small to detect any significant differences. A larger sample size could have possibly been more indicative of such variations.

The results in this study showed that community college students' learning styles do vary by academic performance. Since the community college learning environment is primarily a traditional-lecture-analytical learning environment, the assimilator learning style is usually the largest group on campus and the group with the highest cumulative GPA (Kolb, 1984). The order of the other learning styles, converger, diverger, and accomodator represents the usual order according to academic performance and learning style research (Kolb, 1984).

Earlier when I noticed that some students did not demonstrate style-flexing, I asked the question: Does this mean these students couldn't adapt or style-flex, or that these students didn't need to style-flex to complete the task? In reference to Table 13, I assumed when 20 students out of 103 did not adapt or style-flex, that those students would probably represent lower cumulative GPAs and the inability to adapt or style-flex. But when I examined the cumulative GPA for the group, the results were a GPA of 3.05. I also noticed that 65% of the group (13 students) were assimilators. Table 14 shows that the assimilators were the largest learning style group for each discipline and overall, except English which indicated the diverger learning style to be the largest group. Therefore, it wasn't that these 20 students couldn't style-flex, but it was that they didn't need to style-flex. These students were capable of completing the task without flexing outside their quadrants.

If 20 students didn't style-flex, yet they were capable of completing the task anyway, what about the 15 students that were below 2.5 in their cumulative GPAs. As a combined group, these 15 students' (six males and nine females) cumulative GPA was 1.94. The largest learning style quadrant was the assimilator which represented six students or 40% of the group, five of which were female. Each of the other quadrants had three students (20%). Only two (females) of the 15 students had fixed learning styles, so 13 of the students did style-flex two or three times, except for one male that flexed four times. Why are these students able to style-flex, yet their academic performance is low? One answer to this question could be that even though some students can style-flex, their learning strategy performance may be lacking. Entwistle (1981) identified two different levels of approaches to learning and studying: deep approach and surface approach. Even though 13 of these students were able to style-flex, their approaches may have been inadequate to accomplish the task. Do these students need to be taught learning strategies that will empower them to be more successful students? Or are there other factors that are influencing academic success such as class attendance, completing and turning-in homework, and/or performance on tests, not to mention personal factors such as family problems and employment? This last question should be examined in future research studies.

So what has this study revealed about students' preferred learning styles and how can the data be utilized? According to research, students' preferred learning styles are stable, consistent patterns with a range of variability that is uniquely individualized (Cornett, 1983; Entwistle, 1981; Kolb, 1984; McCarthy). Kolb (1984) has stated that early in the developmental process students acquire the ability to perceive that different

learning situations require various learning strategies to accomplish the task. Many learning style researchers confirm that students do have the ability to style-flex from their preferred learning styles to meet the learning strategy requirements of other learning situations (Cornett, 1983; Entwistle, 1981; Kolb, 1984; Ornstein, 1977). Entwistle's research has affirmed that some students are surface approach learners, and even though these surface approach learners have the ability to perceive the need to style-flex and are capable of style-flexing, these students do not perform as well academically as they should. It is possible that these students need to be taught specific learning strategies for different learning situations, so that they will be able to develop a deeper approach to learning?

This study has shown that learning styles are dynamic aspects of a person's ability to learn and perform academically with potential capabilities too further develop and increase learning success. Therefore, if students are taught about their own learning strengths, helped to improve their learning weaknesses, and basically taught "how to learn," academic performance should improve (Cornett, 1983). If teachers could learn to style-flex in their teaching strategies, both in the classroom and in designing assignments, they would be able to provide a variety of learning situations that would enhance the learning environment (Banner & Rayner, 1997; Cornett). Changes in teaching strategies could influence the learning potential of diverse learners with learning styles other than abstract orientations.

Many changes are taking place on our community college campus as we try to provide for improved academic achievement for our students and increase retention. In the fall of 2000, a new class offering will be available for all students, but will be required of students with academic deficiencies in the English, reading, math, science, and social

studies areas. This new class will be providing students with information about their own learning styles through identification and teaching them learning strategies to increase understanding and performance in different learning situations. Basically, these students will be taught "how to learn."

The new text book selected for fall English Composition I classes involves the teaching and learning of skills and strategies to improve learning. The text includes a learning styles test and provides the students with assignment choices that allows them to select the activity that best suits their learning style requirements or to choose a strategy that stretches or expands their learning potential.

Our campus has also applied for a grant that would center around teaching to students' learning styles. Over several years, pilot programs would be conducted in each of the deficiency areas to test the application of learning styles in the classroom and the effect on students' learning in those academic areas. There would be one pilot program per year that would involve 100 student participants. After completion of the pilot program, the course would be returned to the general-core teaching faculty in that academic area to continue with the learning strategies that had proven to be successful for that discipline. In-services would be provided to educate faculty in utilizing learning style strategies in the classroom.

Other areas of concern are also being examined for possible solutions to decreasing student attrition and improving academic performance. We are trying to provide for the many changes that are facing our community college as we move into the 21st century.

Recommendations for Educators

How can these findings be applied to community college education? First, students who can perceive and adapt will continue to be successful learners, but students that are unable to perceive and or adapt will have difficulty learning. These students are usually divergers and accomodators (Kolb, 1984; McCarthy, 1980). The cumulative GPA data supported the findings of learning style research, (Kolb, 1984; McCarthy, 1980) that divergers and accomodators have approximately one grade point below assimilator and convergers. Secondly, this study seems to indicate that in order to reduce attrition and educate these students with diverse learning style needs, that changes need to be made to facilitate their successful learning. Students that have been able to perceive and adapt will continue to be able to adjust to the changes in the classroom learning environments.

These research findings do appear to indicate that a significant difference does exist between academic performance (GPA) of students with different learning styles across various subject-area disciplines. Administrators and institutions that are experiencing declining enrollment due to attrition may wish to investigate further the importance of students' learning styles in reference to continued student enrollment and academic success. Instructors may find that slight changes in classroom delivery of material and assignments may contribute to higher performance of students with learning styles other than assimilator. Students can possibly be empowered by teaching them "how to learn" through identification of individual learning styles and developing student awareness that different characteristics are common skill requirements for improved learning success in various disciplines. Learning styles may help provide one possible

solutions to improving the educations of demographically diverse students of the "Community College of the 21st Century."

Suggestions for Further Research

Additional learning style research needs to be conducted at the community college level in order to explore the effectiveness of educating the changing student body. Since many of these students are not academically socialized into traditional educational environments, many are not attaining their educational goals. Exploratory research should be conducted on how to best accommodate the leaning style requirements of these students. According to Dewey, (1910, 1938) education should not be an "either or" but a combination of many ideas and approaches. Variety in educational methods and learning strategies will be more likely to provide educationally for these demographically diverse students.

Since community colleges are concerned with attrition specifically between the freshmen and sophomore years (Feemster, 1999), more studies should be conducted in this area, not only to help identify the problems, but to also experiment with various educational approaches. Empowering students by identifying their learning styles and teaching learning strategies required for different disciplines could possibly contribute to improved academic success for students struggling to obtain an education.

In reference to this study, additional research should be conducted to further explore students' learning styles sensitivity across subject-areas and students' abilities to adapt or style-flex. The Post-Hoc Comparison for this study determined that several differences were significant in the four Post-Hoc summary tables (Tables 7-11). These

pairwise differences should be scrutinized in future studies in order to possibly identify the causes for the differences.

Regardless of the answers to the research questions included in this study, learning style research continues to be one aspect of interest to educators' concerned with student academic achievement. Due to the changing educational demands of these students, educational reformers are concerned with better methods for educating and improving retention, so more students will be able to attain their educational goals.

REFERENCES

Adams, M. (1992). Cultural inclusion in the American college classroom. In L. L. B. Border & N. V. N. Chism (Eds.), Teaching for diversity (pp. 5-17). San Francisco, CA: Jossey-Bass.

Allen-Sommerville, L. (1996). Capitalizing on diversity: Strategies for customizing your curriculum to meet the needs of all students. The Science Teacher, 63(2), 20-24.

Anderson, J. A. (1994). Examining teaching styles and student learning styles in science and math classrooms. In M. M. Atwater (Ed..), Multicultural education: Inclusion of all (pp. 99-100). Athens, GA: University of Georgia Press.

Anderson, J. A. (1995). Toward a framework for matching teaching and learning styles for diverse populations. In R. R. Sims & S. J. Sims (Eds.), The importance of learning styles: Understanding the implications for learning, course design, and education (pp. 69-78). Westport, CT: Greenwood.

Anderson, J. A., & Adams, M. (1992). Acknowledging the learning styles of diverse students populations: Implications for instructional design. In L. L. B. Border & N. V. N. Chism (Eds.), Teaching for diversity (pp. 19-33). San Francisco, CA: Jossey-Bass.

Banner, G. , & Rayner, S. (1997). Teaching in style: Are you making the difference in the classroom? Support for Learning, 12(1), 15-18.

Beaty, V. C. (1994). Relationship of learning style and academic discipline to corresponding course attrition (Doctoral dissertation, 1994). Dissertation Abstracts International, 5601A, 0516.

Bogen, J. E. (1975). Some Educational aspects of hemispheric specialization. USCA Educator, 17, 24-32.

Border, L. L. B., & Chism, N. V. N. (Eds.). (1992). Teaching for diversity. San Francisco, CA: Jossey-Bass.

Boyle, R. A., & Dunn, R. (1998). Teaching law students through individual learning styles. Albany Law Review, 62(1), 213.

Brainard, S. R. & Ommen, J. L. (1977). Men, women, and learning styles. Community College Frontiers, 5(3), 32-36.

Bruer, J. T. (1999). In search of . . . brain-based education. Phi Delta Kappan, 80(9), 648-657.

Bushnell, J. R. (1990). Quanta, a learning community at Daytona Beach Community College and the use of the Myers-Briggs Type Inventory. (ERIC Document Reproduction Service No. ED327227).

Clinton, B. (1997). Opening college doors to all Americans. Journal of Chemical Education, 74(12),1392-1393.

Coker, C. A. (1996). Accommodating students' learning styles in physical education. The Journal of Physical Education, Recreation & Dance, 67(9), 66-69.

Cornett, C. E. (1983). What you should know about teaching and learning styles. Fastback 191. Bloomington, IN: Phi Delta Kappa Educational Foundation.

DeCoux, V. M. (1987). The relationship of academic achievement to the variables of learning styles, intellectual development, age, and abstract conceptual T scores among associate degree nursing students Dissertation Abstracts International, 49(124).

Dewey, J. (1910). How we learn. Amherst, NJ: Prometheus Books.

Dewey, J. (1938). Experience & education. New York, NY: Simon & Schuster.

Dinmore, I. (1997). Interdisciplinarity and integrative learning: An imperative for adult education. Education, 117(3), 452-468.

Dunn, R., Griggs, S. A., Olson, J. & Beasley, M. (1995). A meta-analytic validation of the Dunn and Dunn model of learning-style preferences. The Journal of Educational Research, 88(6), 353-362.

Dyrud, M. A. (1997). Focus on teaching. Business Communication Quarterly, 60 (2),124-135.

Elliott, S. & Shapiro, E. S. (1990). Intervention techniques and programs for academic performance problems. In T. B. Gutkin & C. R. Reynolds, & et al. (Eds.), The Handbook of School Psychology (2nd ed.). (pp. 635-660). New York, NY, USA: John Wiley & Sons.

Enns, C. Z. (1993). Integrating separate and connected knowing: The experiential learning model. Teaching of Psychology, 20(1), 7-13.

Entwistle, N. (1981). Styles of learning and teaching: An integrated outline of educational psychology for students, teachers, and lecturers. New York, NY: John Wiley & Sons.

Faust, M. A. (1996). Intermediate possibilities: The language of reform and Dewey's experience and education. English Journal, 85(6), 94-97.

Feemster, R. (1999). Going the distance. American Demographics: Consumer Trends For Business Leaders, 21(9), 59-64.

Feldman, S. (1974). Escape from the doll's house. New York, NY: McGraw-Hill.

Fox, E. A., & Roberts, D. Y. (1993). Personality-focused learning environments: Learning preferences of students in dietetics and restaurant, hotel/institution management programs. Journal of the American Dietetic Association, 56(2), 182-185.

Gardner, H. (1983). Frames of mind: The theory of multiple intelligences. (10th ed.). New York, NY: BasicBooks.

Gregg, N. (1989). Review of the learning-style inventory. In J. C. Conoley & J. J. Kramer (Eds.), The tenth mental measurements yearbook (pp. 441- 442). Lincoln, NE: The University of Nebraska Press.

Gusentine, S. D., & Keim, M. C. (1996). The learning styles of community college art students. Community College Review, 24(3), 17-26.

Halliburton, D. (1997). John Dewey: A voice that still speaks to us. Change, 29(1), 24-29.

Harb, J. N., Durrant, S. O., & Terry, R. E. (1993). Use of the Kolb learning cycle and the 4MAT system in engineering education. Journal of Engineering Education, 82, 70-77.

Hickcox, L. K. (1995). Learning styles: A survey of adult learning style inventory models. In R. R. Sims & S. J. Sims (Eds.), The importance of learning styles: Understanding the implications for learning, course design, and education (pp. 25-47). Westport, CT: Greenwood.

Hickman, L. (1997). Inquiry: A core concept of John Dewey's philosophy. Free Inquiry,17(2), 21.

Howard, W. C. (1990). Left-brain vs. right-brain: Learning how students learn. Community, Technical, and Junior College Journal, 61, 14-15.

Hughes, J. N. (1990). Review of the learning style inventory. In J. J. Kramer & J. C. Conoley (Eds.), The supplement to the tenth mental measurements yearbook (pp. 111-112). Lincoln, NE: The University of Nebraska Press.

Hunter, W. E., & McCants, L. S. (1977). The new generation gap: Involvement vs. Instant information. Washington, DC: ASHE-ERIC (ERIC Document Reproduction Service No. ED 148412)

James, W. B. & Blank, W. E. (1991). A comparison of adults' perceptual learning style and their educational level. Journal of Adult Education, 19(2), 11-20.

Johanson, L. S. (1987). An investigation of learning styles of baccalaureate student nurses (Doctoral dissertation, Northern Illinois University, 1987). Dissertation Abstracts International, 49, 407.

Johnson, G. M. (1998). Principles of instruction for at-risk learners. Preventing School Failure, 42(4), 167-168.

Johnson, L., & Lobello, S. (Eds.). (1996) The 21st century community college: Technology and the new learning paradigm. White Plains, NY: IBM.

Jung, C. (1977). Psychological types (R.F.C. Hull, Trans.). Collected works of C.G.Jung (Vol. 6). Bollingen Series XX. Princeton, N J: Princeton University Press.

Kalous, T. D. (1992). Multidimensional unfolding analyses of the associations among learning styles, study approaches, and academic success: A comparison of academic majors (Doctoral dissertation, The Ohio State University, 1992). Dissertation Abstracts International, 5305A, 0525.

Kidd, J. R. (1973). How adults learn. London, UK: Cambridge Publishers.

Knight, K.H., Elfenbein, M. H., & Martin, M. B. (1997). Relationship of connected and separate knowing to the learning styles of Kolb, formal reasoning, and intelligence. Sex Roles: A Journal of Research, 37(5-6), 401-415.

Knowles, M. S. (1970). The modern practice of adult education: Andragogy vs. pedagogy. New York, NY: Association Press.

Kolb, D. A. (1984). Experiential learning: Experience as the source of learning and development. Englewood Cliffs, NJ: Prentice-Hall.

Kolb, D. A. (1995). Learning style inventory: Technical specifications Boston, MA: McBer & Company.

Kolodny, A. (1991). Colleges must recognize student's cognitive styles and cultural backgrounds. The Chronicle of Higher Education,37, A44.

Latham, A. S. (1997). Responding to cultural learning styles. Educational Leadership, 54(7), 88-90.

Lee, K. & Lodewijks, H. G. L. C. (1995). The adaptation of international students' learning styles to different learning contexts. College Student Journal, 29(3), 319-332.

Levine, A. (Ed.). (1983). Higher learning in America: 1980-2000. Baltimore, MD: John Hopkins University Press.

Matthews, D. B. (1996). An investigation of learning styles and perceived academic achievement for high school students. The Clearing House, 69(4), 249-255.

Matthews, D. B. & Hamby, J. V. (1995). A comparison of the learning styles of high school and college university student. The Clearing House, 68(4), 257-262.

McCarthy, B. (1980). The 4mat system: Teaching to learning styles with right/left mode techniques. Barrington, IL: EXCEL.

McCaslin, M. & Good, T. L. (1996). The informal curriculum. In D. C. Berliner, R. C. Calfee, & et al. (Eds.), Handbook of Educational Psychology. (pp. 622-670). New York, NY: Macmillan Library Reference.

McKinnon, N. M. (1992). A comparison of teaching and learning techniques by teachers and students at Northern Maine Technical College. (ERIC Document Reproduction Service ED344631).

McNeal, G. & Dwyer, F. (1999). Effect of learning style on consistent and inconsistently designed instruction. International Journal of Instructional Media, 26(3), 337-348.

Neilsen, N. (1991). Responding to the new student diversity. Community, Technical, and Junior College Journal, 61(5), 46-48.

O'Banion, T. (1996). A learning college for the 21st century. In L. Johnson & S.T. Labello (Eds.), The 21st century community college: Technology and the new learning paradigm. (pp.7-18). White Plains, NY: IBM.

Oblinger, D. G. (1996). Creating a learning culture. In L. Johnson & S.T. Lobello (Eds.), The 21st century community college: Technology and the new learning paradigm. (pp. 27-38). White Plains, NY: IBM.

Ornstein, R. E. (1977). The psychology of consciousness (2nd ed.). New York, NY: Harcourt Brace, Jovanovich.

Park, C. C. (1997). Learning style preferences of Korean, Mexican, Armenian-American, and Anglo students in secondary schools. NASSP Bulletin, 81(585),103-112.

Philbin, M. , Meier, E., Huffman, S., & Boverie, P. (1995) A survey of gender and learning styles. Sex Roles: A Journal of Research, 32(7-8), 485-495.

Piaget, J. (1970). Genetic epistemology. New York, NY: Columbia University Press.

Purkiss, W. (1994). Learning styles and their relationship to academic success: A community college perspective. Unpublished doctoral dissertation, The Claremont Graduate School.

Purkiss, W. (1995). Learning styles and the changing face of community colleges. In R. R. Sims & S. J. Sims (Eds.), The importance of learning styles: Understanding the implications for learning, course design, and education (pp. 79-98). Westport, CT: Greenwood.

Raines, R. H. (1976). A comparative analysis of learning styles and teaching styles of mathematics students and instructors. (University Microfilm No. 00373147)

Rainey, M. A., & Kolb, D. A. (1995). Using experiential learning theory and learning styles in diversity education. In R. R. Sims & S. J. Sims (Eds.), The importance of learning styles: Understanding the implications for learning, course design, and education. Westport, CT: Greenwood.

Robinson, A. R. (1981). An investigation into the relationship between teaching styles and learning styles (Doctoral dissertation, Northern Illinois University, 1981). Dissertation Abstracts International, 4302A, 0530.

Schroeder, C. C. (1993). New students-new learning styles. Change, 25(5), 21-27.

Silver, H., & Hanson, J. R. (1995). Learning styles and strategies. Woodbridge, MA: The Thoughtful Education Press.

Silver, H., Strong, R., & Perini, M. (1997). Integrating learning styles and multiple intelligences. Educational Leadership, 55(1), 22-27.

Sims, R. R. (1993). Training enhancement in government organizations. Westport, CT: Quorum.

Sims, R. R. & Sims, S. J. (Eds.). (1995a). The importance of learning styles: Understanding the implications for learning, course design, and education. Westport, CT: Greenwood.

Sims, S. J. & Sims, R. R. (1995b). Learning and learning styles: A review and look to the future. In R. R. Sims & S. J. Sims (Eds.), The importance of learning styles: Understanding the implications for learning, course design, and education. (pp. 193-208). Westport, CT: Greenwood.

Sperry, R. W. (1973). Lateral specialization of cerebral function in the surgically separated hemispheres. In F. J. McGuigan & R. A. Schoonover (Eds.), The Psychophysiology of Thinking. (p. 23). New York, NY: Academic Press.

Vahala, M. E. (1990). The effects of learning style, institutional type, and academic discipline on students' perceptions of the classroom environment (Doctoral dissertation, University of Georgia, 1990). Dissertation Abstracts International, 5202A, 0745.

Vondrell, J. H. (1987). Learning style as a predictor of success for adult students participating in an independent study course (Doctoral dissertation, Pennsylvania State University, 1987). Dissertation Abstracts International, 48, 1962.

Wang, M. C. & Zollers, N. J. (1990). Adaptive instruction: An alternative service delivery approach. RASE: Remedial and Special Education, 11(1), 7-21.

Wasson, B. (1997). Advanced educational technologies: The learning environment. Computers in Human Behavior, 13(4), 571-594.

Williams, L. V. (1983). Teaching for the two-sided mind: A guide to right brain/left brain education. Englewood Cliffs, NJ: Prentice-Hall.

Wooldridge, B. (1995). Increasing the effectiveness of university/college instruction: Integrating the results of learning style research into course design and delivery. In R. R. Sims & S. J. Sims (Eds.), The importance of learning styles: Understanding the implications for learning, course design, and education (pp. 49-67). Westport, CT: Greenwood.

Yount, J. L. (1988). Measuring and comparing cognitive learning styles by academic discipline, class, and gender (Doctoral dissertation, The University of Tennessee, 1988). Dissertation Abstract International, 4911A, 0525.

APPENDIXES

APPENDIX A

STUDENT DEMOGRAPHIC SURVEY

Student Demographic Survey

Please provide the following information by checking the appropriate response or writing in the correct response.

1. Race/Ethnicity: Caucasian ___ African American ___ Native American ___ Asian American ___ Latino American ___ Other:_____.
   If you are an international student, what is your nationality?_____.
2. Age: ___ Sex: ___ Male ___ Female
3. Full-time student___ Part-time student ___
4. Live on campus ___ Commute ___
5. Don't Work ___ Work on campus ___ Work off campus ___ Work jobs both on and off campus ___
6. Single ___ Married ___ Parent with child/children living at home ___
7. Completed high school:___ or GED program: ___
8. Are you the first one in your family to go to college? Yes ___ No ___
9. College Major: _____ or ___ Undecided
10. One or two year certificate program: ___ or Associate degree program: ___
11. If you are in an Associate degree program, do you plan to transfer to another college after you graduate from NEO? ___ Or before you graduate from NEO? ___

APPENDIX B

INSTITUTIONAL REVIEW BOARD

APPROVAL FORM

OKLAHOMA STATE UNIVERSITY
INSTITUTIONAL REVIEW BOARD

Date:	February 18, 2000	IRB #:	ED-00-211
Proposal Title:	"ARE LEARNING STYLES SUBJECT-AREA SENSITIVE?"		
Principal Investigator(s):	K. Mokhtari Cheryl Jones		
Reviewed and Processed as:	Exempt		

Approval Status Recommended by Reviewer(s): Approved

Signature:

Carol Olson

Carol Olson, Director of University Research Compliance

February 18, 2000
Date

Approvals are valid for one calendar year, after which time a request for continuation must be submitted. Any modification to the research project approved by the IRB must be submitted for approval with the advisor's signature. The IRB office MUST be notified in writing when a project is complete. Approved projects are subject to monitoring by the IRB. Expedited and exempt projects may be reviewed by the full Institutional Review Board.

VITA

Cheryl F. Nixon Jones

Candidate for the Degree of

Doctor of Education

Thesis: ARE LEARNING STYLES SUBJECT-AREA SENSITIVE?

Major Field: Curriculum and Instruction

Biographical:

Education: Graduated from Miami High School, Miami, Oklahoma in May, 1966; received Bachelor of Science in Education degree in Speech and English from Pittsburg State University, Pittsburg, Kansas in December, 1970; graduate work from the University of Hawaii, Honolulu, Hawaii in 1972-73; received Master of Science in Education degree in Reading from Northeastern Oklahoma State University, Tahlequah, Oklahoma in August, 1982; received Educational Specialist degree in Community College and Higher Education from Pittsburg State University, Pittsburg, Kansas in July, 1992. Completed requirements for the Doctor of Education degree in Curriculum and Instruction from Oklahoma State University in July, 2000.

Professional Experience: Substitute Speech Instructor, Secondary, Honolulu State Department of Education, 1971-73; Secondary Reading Instructor, Jay Jr. and Sr. High School, Jay, Oklahoma, 1972-1975; Secondary Reading Instructor, Jay Middle School, Jay, Oklahoma, 1978-1983; Reading Specialists, Wilson and Washington Elementary Schools, Miami, Oklahoma, 1983-1985; Secondary English Instructor, Will Rogers Jr. High School, Miami, Oklahoma, 1985-1988; Adjunct instructor and consultant on learning styles, Pittsburg State University, Pittsburg, Kansas, 1993-1994; College English Instructor, Northeastern Oklahoma A & M College, Miami, Oklahoma, 1988 to present.