UNDERSTANDING LEARNING STYLES AND LEARNING STRATEGIES OF ADULT LEARNERS AT OSU-OKMULGEE

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CHAPTER 1

INTRODUCTION

Higher Education

University student populations have changed significantly over the past decades. "Although the first colleges in the United States were founded for an elite group of citizens, a college degree is now accessible to a much broader cross-section of American Citizens" (King, 1999, p. 1). The prominent characteristics of today's students include their diversity in age, socioeconomic status, gender, race and ethnicity, sexual orientation, and learning and physical ability. The undergraduate population no longer reflects the "traditional" college student who is considered to be white, male, 18 to 20 years old, and living on campus. More than half of the undergraduates are over 21 and 41% are over 24. The majority of undergraduate students are women, and 25% are members of historically under-represented racial and ethnic groups (National Center for Education Statistics, 1994).

Traditionally college degrees have meant better jobs

and more money and were viewed as a luxury, but today postsecondary education is a necessity for three out of four jobs (Speer, 1996, p. 34). With rapid changes in technology, there is also a greater need for ongoing education so employees can stay current on their jobs, allowing them to stay employed. Education will continue long after graduation as adults enter and re-enter higher education institutes in order to maintain desired levels of competency. Social, demographic, economic, and technological factors are major forces that significantly affect the increasing demand for adult learning (Imel, 1990).

However, many post-secondary students and especially under-represented groups never attain their goal of attaining a college degree (King, 1999). Creating campus environments conducive to students' successful completion of their educational goals has become more complicated as the student population has become more diverse. There are many retention studies looking for explanations of why students leave institutions prematurely. Some feel students leave because they do not get involved; they do not connect to the college experience (Astin, 1979; Tinto, 1993).

> Older students, like many at-risk students and students of color, may experience a sense of being marginal to the social and intellectual climate of the college. For them going to college is not a matter of doing college or something else, as it is for many younger students. Rather it is a question of doing college in addition to many other things. (Tinto, 1993, p. 187)

Two-year colleges tend to attract a disproportionate number of individuals who are not prepared for learning in a higher education setting (Cohen & Brawer, 1982). Many of these adult learners and especially those who are women, elderly, members of minority communities, persons with disabilities, less affluent, and educationally disadvantaged often have not always had positive experiences in the classroom (Imel, 1994). They do not always have the skills or sometimes do not realize they have the skills to succeed. Others are caught in the "revolving door syndrome", which refers to the ease with which students can enroll and drop out (Almanac, 1992).

Retention of students has become a national concern and institutions are beginning to pay more attention to the reasons students leave before graduating. "Student retention is a primary challenge for every college and university across the country" (Kaplan, 1998). "The largest proportion of institutional leaving occurs in the

first year" (Tinto, 1993, p. 17). A national study of first-year attrition rates for full-time entrants at public four-year and two-year colleges was 28.3% and 47.9%, respectively (Tinto, 1993, p. 14).

Successful retention strategies for this new and diverse student population are not easily identified and implemented (Ignash, 1998, p. 1). This creates new challenges for campuses. However, it is apparent that institutions are not putting learning first in order to survive. Most retention interventions are non-academic. "Putting learning at the heart of the academic enterprise will mean overhauling the conceptual, procedural, curricular, and other architecture of postsecondary education on most campuses" (Wingspread Group on Higher Education, 1993, p. 14). Yet, "Higher Education is a thousand years of tradition wrapped in a hundred years of bureaucracy" (Moe, 1994, p. 1). Many agree that in order to place learning first, it will be necessary to re-engineer campuses to break down the bonds that bind everyone to time, place, role, and efficiency (O'Banion, 1997, p. 9). The next 50 years will prove to be more significant in reshaping our universities than the last 300 years combined (Drucker, 1992, 97).

OSU-Okmulgee

The Oklahoma State System of Higher Education, which was created in 1941, is comprised of 25 colleges and universities, 10 constituent agencies, and 2 higher education centers. OSU-Okmulgee is a branch campus within the Oklahoma State University system and one of only three higher education institutions in Oklahoma with a statewide mission. Oklahoma public colleges and universities fall in one of six categories: Comprehensive Tier, Four-Year Regional I Universities, Four-Year Regional II Universities, Two-Year Rural Colleges, Two-Year Urban Colleges, and Technical Branches. OSU-Okmulgee falls under the Technical Branch and is unique from the other associate degree granting institutions which have two-year programs.

Unlike comprehensive universities and community colleges, OSU-Okmulgee has the singular purpose of offering Associate in Applied Science (AAS) Degrees in advanced technology. While most AAS degrees are two0year, 60-credit hour degrees, the AAS degrees offered at OSU-Okmulgee are a three-year-equivalent and average 90 credit hours. OSU-Okmulgee is recognized locally, nationally, and internationally as a premier technology-oriented institution of higher education (OSU-Okmulgee Employees,

1993, p. 1). The mission is "to serve as the lead institution of higher education in Oklahoma and the region for comprehensive high-quality, advancing-technology programs and services to prepare and sustain a diverse student body as competitive members of a world-class workforce and contributing members of society" (p. 1).

The Oklahoma State Regents for Higher Education coordinate the state system, and a board of regents governs each institution. According to State Regents Chairman, Bill W. Burgess Jr. (2000), "Oklahoma higher education is committed to finding new, innovative ways to increase and enhance learning opportunities throughout the state" (p. 1). Despite this goal and recent progress within the state, Chancellor Hans Brisch (2000) reports that Oklahoma lags behind the national average on retention and graduation rates.

Adult Learners

The learning process is becoming more important than constantly changing content, employer needs are shifting, and the necessity of advanced technical skills to compete in the working world are increasing. To meet the challenges and demands of a changing society, adult learners need to continually upgrade their skills. This

need translates into lifelong learning, and it requires the restructuring of the learning environment to empower all kinds of learners to be successful in college and beyond.

> In the face of such dramatic statements about the future, the observation that no education will last a lifetime seems conservative and even mundane. But change is now so great and so far reaching that no amount of education during youth can prepare adults to meet the demands that will be made upon them. The reality should change the way schools and colleges prepare upcoming generations for their future as lifelong learners, and it should change the way societies think about education and learning. (Cross, 1981, p. 2)

Adult learners are becoming the majority on college and university campuses, yet adult learning theory is relatively new or unknown to many of those teaching in college or university programs. Knowles (1973) was one of the first to attempt to formulate a comprehensive theory of adult learning. He proposed basic assumptions about adult learners. When working with adults, it is imperative that facilitators address each of these assumptions on an individual basis and begin working with learners at their starting point. Initially, the role of the facilitator may be critical to successful adult learning.

Knowles proposed a learner-centered system. This shift in philosophy from teacher-centered to learner-centered is well supported in the literature (Knowles,

1973; O'Banion, 1997; Rogers, 1969). Great philosophers laid the foundation for the learner-centered system in the early 1900's. "Why is it, in spite of the fact that teaching by pouring in, learning by a passive absorption, are universally condemned, that they are still so entrenched in practice" (Dewey, 1916, p. 35)? "Our academic system has grown in reverse order: Subjects and teachers constitute the starting point, students are secondary" (Lindeman, 1926, p. 6).

Others have also emphasized the importance of the facilitator identifying the needs of each learner. Rogers (1969) discussed the importance of a personal relationship between the facilitator and the learner and emphasized the need for the facilitator to be genuine and real. The climate should be one of mutual respect and trust for learning to occur (Brookfield, 1986). Facilitators have the responsibility of creating environments that "encourage self-initiated, significant, experiential, 'gut-level' learning by the whole person" (Rogers, 1969, p. 105). Likewise, Maslow (1972) was especially concerned with the role of safety and felt teachers can gratify ones basic needs for safety, belongingness, love, and respect. Educators should also strive to bring about self-

actualization, which is one's need to develop to one's fullest potential. This is the primary goal of learning (Merriam & Caffarella, 1991).

At the very core of learning is the critical reflection on experience (Brookfield, 1986; Freire, 1978; Mezirow, 1991). The facilitator's role is one of "ensuring that opportunities for the interplay between action and reflection are available in a balanced way for students" (Brookfield, 1990, p. 50). In this environment, "significant personal learning entails fundamental change in learners and leads them to redefine and reinterpret their personal, social, and occupational worlds" (pp. 213-214).

For transformative learning to occur, individuals must critically reflect upon new learning experiences and adjust their existing assumptions and beliefs to redefine their world accordingly (Mezirow, 1997). Indeed, learning begins when individuals challenge their present situation and realize that their reality can be changed (Freire, 1978). Such an educational process centers on the student and everything that determines that student's reality. Colleges can be places to stimulate and foster this reflection.

Learning Styles

Learning depends on many factors, and many of them are personal. "Science is telling us that each human brain is more unique than a thumb print--a combination of 'nature' and 'nurture'--the result of the genetic programming of 100,000 genes as these have interacted with our unique pattern of life experiences" (Marshall, 1999, p. 5). Learning styles describe a person's typical mode of thinking, processing, or remembering. Learning styles refer to a pattern in the way in which each individual collects, organizes, and transforms information (Kolb, 1993). Learning styles are a result of heredity and environment (Dunn & Dunn, 1992) and are not easily changed or are slow to change (Rule & Grippen, 1988). "We hover near different places on a continuum and the place where we hover is our most comfortable place" (Fardouly, 1998, p. 1). Students bring to the classroom with them a variety of learning styles (Dunn, 1990; Felder & Silverman, 1988; Kolb, 1993). Yet, the modern university still supports a traditional teaching style for theoretical learning that emphasizes lecture and visual learning (Terenzini & Pascarella, 1994).

Only recently, have educators begun to question the

traditional concept of teaching. This is because teaching that is based on the definition of causing to know a subject or of imparting knowledge makes sense only when the environment is unchanging (Rogers, 1969, p. 104). Institutions must begin to teach to the variety of ways learners learn rather than ignoring when they do not learn the way that instruction is provided (Dunn, 1990). Most do not advocate trying to match learning styles of students and teachers (Kolb, 1993) or teaching to accommodate all learning styles at all times but instead encourage teaching across learning styles (Grasha, 1996; Kolb, 1993). Information comes in all forms, and much of it will be lost to those who cannot take in and process information other than through their unique learning style (Felder, 1996).

Learning styles are classified in a number of different ways and presented through a variety of models. Three general categories are affective styles, physiological styles, and cognitive styles (Keefe, 1991). Affective styles of learning are a by-product of personality and cultural environment. One of the most well known instruments for identifying personality types is the Myers-Briggs Type Indicator which has been widely used to classify student learning styles in various disciplines

(Schroeder, 1993). Physiological styles include perceptual modes and environmental factors that affect learning. This is the means by which learners extract information from their surroundings through the use of their senses and environment (Keefe, 1991).

Another way to look at learning styles is through cognitive processes. Cognitive styles of learning include those aspects of the brain which perceive meaning and interact with the world (Keefe, 1991). The major direction for this view of learning has been provided by Kolb (1984) who proposed a theory of experiential learning that involves four principal stages: Concrete Experiences (CE), Reflective Observation (RO), Abstract Conceptualization (AC), and Active Experimentation (AE). He has used these stages of learning as the basis for developing a learning styles model. The CE/AC and AE/RO dimensions are polar opposites as far as learning styles are concerned, and Kolb postulates four types of learners based on these: Divergers, Assimilators, Convergers, and Accomodators. The Diverger learns intuitively through reflection. The Assimilator learns by analyzing and reflecting. The Converger learns by thinking and then doing. The Accomodator learns by doing what is intuitively felt as

right.

Trends between academic success and learning style have been identified (Kolb, 1993). It has also been found that particular professions tend to attract individuals with specific learning styles (Kolb, 1984; Stice, 1987). For example, Divergers make good researchers because they work best when they can organize relationships into meaningful wholes. Assimilators, who are more focused on theory than practical application, become good theorists and college professors. Convergers, who are not into the big picture but are into minute detail and enjoy answering single questions related to practical applications, are good scientists and engineers. Accomodators, who are best at exploratory and discovery learning, tend to be good teachers. Yet, often students select fields of study that are not well matched with there learning style.

Learning Strategies

Another way of examining individual differences in learners is by identifying the learning strategies that learners prefer to use. Learning strategies are external behaviors a learner "elects to use in order to accomplish a learning task" (Fellenz & Conti, 1989, p. 7). Strategies are carefully sequenced behaviors used to approach a

specific learning task. Any method, tool, technique, skill, or behavior, which facilitates the process of task completion and learning, can be called a learning strategy (Naour & Torello, 1991).

If learning styles are more innate and less likely to change (Rule & Grippen, 1988), learning strategies may be the key to developing efficient and effective learners. "Adeptness and insight in the use of learning strategies appears to be a significant part of one's ability to learn how to learn" (Fellenz & Conti, 1993, p. 3). Learning how to learn refers to "possessing, or acquiring, the knowledge and skill to learn effectively in whatever learning situation one encounters" (Smith, 1982, p. 19).

Learning strategies may change depending on the learning situation. "The skills or techniques selected to accomplish the task often have a great influence on the success of that learning activity" (Fellenz & Conti, 1993, p. 3). It seems a very basic skill for mastering material may be learning how to match the appropriate strategy with a particular task (Conti & Kolody, 1999, p. 3). Students should be able to generalize strategies to new and unfamiliar learning environments.

Like learning styles, strategies can be categorized in

many ways. While some distinguish between cognitive and metacognitive strategies (Sturomski, 1987, p.4), learning strategies in the field of Adult Education have been conceptualized as being in the five areas of Metacognition, Metamotivation, Memory, Critical Thinking, and Resource Management (Conti & Fellenz, 1991, p. 3).

Based on research in this area, three distinct groups of learners have been identified, and each group has a preferred pattern of learning strategies for initiating a learning activity (Conti & Kolody, 1999, p. 9). These three groups are Navigators, Problem Solvers, and Engagers. Navigators are Problem Solvers are learners (Conti & Kolody, 1999, p. 12). Engagers are passionate learners who operate in the affective domain of learning. (Conti & Kolody, 1999, p. 13).

Statement of the Problem

Higher education is in a state of crisis. Rapid changes in society challenge the very essence of colleges and universities (Garland, 1985, p. 11). The speed in which change is occurring requires increased flexibility, interdependence, and innovation. The transition from the Industrial Age to an information-based, technology-driven society has impacted the economic system, the educational

system, and the larger society (Merriam & Cafarella, 1999). More jobs today require post-secondary education, continual upgrading of skills, and adapting old skills to new environments (Kerka, 1986).

The "new student" in higher education has also changed dramatically over the last 30 years. Today there are more "at-risk" students. Retention rates of students in Oklahoma are below the national average (Brisch, 2000). Yet, a shortage of skilled technicians continues to grow at a faster rate than universities can supply graduates. Thus, educators in higher education need to explore new ways to promote student success and lifelong learning. Some suggest the key to improving student success is to begin focusing on individual differences.

Overall, understanding of how individual students learn and where they are in the process can help educators meet the needs of students. An understanding of learning styles and strategies and a recognition that students have their own unique learning preference can help instructors augment their methods of instruction. This knowledge of learning can also become a catalyst in helping students identify their preferred learning styles and strategies.

Instructors must move away from traditional classroom

environments and create ones in which students learn how to learn and develop the problem-solving and critical-thinking skills necessary to be successful in college and throughout their careers (Kerka, 1986). While all learning will involve content, content is no longer as important as process; students must learn how they learn so they can learn how to learn (Smith, 1982). By learning how to learn, students may begin to attribute their successes to choices they made rather than only to personal competence (Naour & Torello, 1991). Knowledge of personal learning strategies can give students confidence leading to an understanding of the abilities they have to succeed rather than attributing successes to luck (Sturomski, 1887).

Knowing ones learning style and learning strategy preferences allows students to focus on their strengths. "Self-understanding links directly to learning how to learn when learners become sensitive to, and in control of, the learning process, in other words, more aware of themselves as learners" (p. 57). This process is empowering for students because it helps them understand and come to terms with their strengths and differences thereby increasing self-acceptance and can give specific direction to successful study. There is little question that:

> It pays to develop awareness and understanding of self as a learner. One can gain valuable insight into personal blocks to learning, to personal strengths and weaknesses, as well as personal preferences for the methods of learning and for learning environments. (pp. 21-22)

OSU-Okmulgee recognizes that national and local retention rates are undesirable and that like other institutions of higher education, it must begin looking for new ways to provide the opportunity of success for all students. "We need to learn more about why students leave college without earning degrees and find proactive solutions to help students achieve success in college" (Brisch, 2000, p. 1). "Early problem identification and early and intensive interventions" (Seidman, 1996, p. 20) are critical to helping students reach their goals. However, this is difficult because there are no two human beings who are the same and because these differences increase with age (Lindeman, 1926). "It follows that the best educational enterprise will be one that best responds to those individual differences" (O'Banion, 1997, p. 52). There is has been no research completed to document individual learning differences for students at OSU-Okmulgee. Once this profile is established, administration can begin to make data-based decisions for program and service improvement plans tailored to meet individual

learner needs.

Purpose

The purpose of this study was to describe learning styles and learning strategy preferences of learners at OSU-Okmulgee. This information was used to make specific recommendations for program and service improvement in order to enhance student success. This purpose was achieved by measuring learning styles with the Learning Styles Inventory (LSI) that was developed by Kolb (1985) and by measuring learning strategies with Assessing The Learning Strategies of AdultS (ATLAS) which was developed by Conti and Kolody (1999). After a profile was developed, learning styles and learning strategies were compared in various ways. First, they were compared to see if there was a difference between learning styles and learning strategies and programs of study. Next, they were compared to determine if there was a difference between learning styles and learning strategies and successful learning and retention. Finally, they were compared to determine if learning styles and learning strategies were related to a set of either academic or demographic variables. Finally, learning styles and learning strategies information was combined with other variables to explore for groups of

learners at OSU-Okmulgee.

Hypotheses

The following null hypotheses were tested using two-tailed tests where appropriate.

1. There is no significant relationship between the learning strategy scores as measured by ATLAS of the students at OSU-Okmulgee and the norms for ATLAS.

2. There is no significant relationship between learning styles as measured by the LSI and learning strategies as measured by ATLAS.

3. There is no significant relationship between a student at OSU-Okmulgee's selected program of study and either (a) learning styles as measured by the LSI or (b) learning strategies as measured by ATLAS.

4. Among OSU-Okmulgee students, it is not possible to discriminate between those grouped by either (a) learning styles as measured by the LSI or (b) learning strategies as measured by ATLAS and the academic variables of ACT scores, Accuplacer scores, and cumulative grade point average.

5. Among OSU-Okmulgee students, it is not possible to discriminate between those grouped by either (a) learning styles as measured by the LSI or (b) learning strategies as measured by ATLAS and the demographic variables of gender, ethnicity, marital status, first-time student status, and age.

6. It is not possible to cluster OSU-Okmulgee students based on measures of learning style, learning strategy preference, academic variables, and demographic variables.

Data were collected from a variety of sources. Learning style and learning strategy data were collected from the students. Program, academic, and demographic data

were collected from Computer Services. The learning styles and learning strategy instrument information were used to construct a profile to describe the learning styles and learning strategies of the students.

A chi-square test compares the proportions actually observed in a study to the proportions expected to see if they are significantly different. This study compared the proportion of students at OSU-Okmulgee in each learning strategy group with the norms of the ATLAS. Learning styles and learning strategies were also examined to determine if people differ by their classification. The chi-square test of independence is used to determine if two variables are independent of each other. Chi-square test of independence were used to determine if there is a systematic difference between the learners at OSU-Okmulgee at the expected learning styles and learning strategies.

Analysis of variance (ANOVA) is used to determine if there is a significant difference between two or more means. Kolb's LSI identifies continuous and categorical data. Several analyses of variance were conducted to determine if the continuous scores from the LSI differ with students grouped by learning strategies. ANOVA and chi-square tests were also conducted to determine if students

differed in the various program areas based on learning styles or learning strategies.

"Discriminate analysis is concerned with the grouping of people and with analyzing the interrelationship of multiple variables to determine if they can explain a person's placement in a specific group" (Conti, 1993, p. 91). Several discriminate analyses were conducted using academic data and demographic data with the students grouped according to learning styles and learning strategies.

Cluster analysis is the process of placing objects into more or less homogeneous groups in a manner such that the relationship between groups is revealed. This study will use cluster analysis to determine if other groups exist.

Definitions

Accuplacer - Accuplacer/CPT is a computerized assessment test that provides information about a student's level of skill accomplishment in reading, writing, and one of three levels of mathematics.

Accommodator: A learning style in which the learning strengths are Concrete Experience (CE) and Active Experimentation (AE). Accomodators learn primarily from hands-on experience and doing what they intuitively feel is right (Kolb, 1985).

Andragogy: A theory of adult learning initially defined as "the art and science of helping adults learn" (Knowles, 1990, p. 54).

Assimilator: A learning style in which the learners are

best at Abstract Conceptualization (AC) and reflective observation (RO) and learn best by analyzing and reflecting (Kolb, 1985).

ATLAS: (Assessing The Learning Strategies of AdultS) An instrument created to quickly assess the learning strategies of adults and to provide immediate feedback (Conti & Kolody, 1999).

Converger: A learning style in which the learners are best at Abstract Conceptualization (AC) and active experimentation (AE) and learn by thinking and then doing (Kolb, 1985).

Diverger: A learning style in which learners are best at Concrete Experience (CE) and Reflective Observation (RO) and learn intuitively through reflection (Kolb, 1984).

Engager: Engagers are passionate learners who learn with feeling and learn best when the learning experience is meaningful (Conti & Kolody, 1999 p. 13).

Learning Strategies: Learning strategies are external behaviors a learner "elects to use in order to accomplish learning task" (Fellenz & Conti, 1989, p. 7).

Learning Styles: Learning styles describe a person's typical mode of thinking, processing, or remembering. Learning styles refer to a pattern in the way in which each individual collects, organizes, and transforms information (Kolb, 1993).

Navigators: Navigators are focused learners who determine a plan of action for learning and follow it (Conti & Kolody, 1999, p. 9).

Problem Solvers: Problem Solvers are learners who are curious, inventive, and intuitive and rely heavily on Critical Thinking skills (Conti & Kolody, 1999, p. 12).

Self-Directed Learning: Learning where the learner himself assumes responsibility for planning, implementing, and completing a learning project. This may be done with

or without the help of others (Knowles, 1975, p. 18).

CHAPTER 2

REVIEW OF THE LITERATURE

Higher Education

Retention is a recurrent theme in higher education. As early as the 1600's, institution administrators had been faced with unprepared learners, resistance to adapt to individual learner needs, and attrition (Casazza & Silverman, 1996, p. 7). Research in the field of retention and higher education has exploded. However, there is no one definition for retention, and definitions vary among institutions (Tinto, 1997, p. 139; Seidman, 1996, p. 18). Universities may view retention as students enrolling in their second year, program completion, or graduation. Most institutions and some federal legislation define retention as degree attainment at the initially entered institution (Astin & Others, 1996) which does not account for transfer students and stop outs. Also, more people, especially men, are taking more than four years to complete degrees (Astin, Green, & Korn, 1987) yet are counted as a non-persister based on this definition. Also, degree completion rates

differ between types of institutions. Others base retention statistics on whether or not a student persisted from one year to the next (Tinto, 1997). Forty-eight% of the students, who seek an associate degree, leave after only one year (Henscheid, 2000, p. 3).

Definitions of retention do not take individual goals into consideration (Tinto, 1997, p. 139; Seidman, 1996, p. 18). Failure to persist may not equate to individual failure. Student intent may be to meet a personal goal and not to persist beyond that goal. This personal goal might be to learn a particular skill in an individual class for job promotion, complete a series of classes to improve job opportunities, or simply to take one class for personal growth. Therefore, true student persistence cannot be evaluated without assessing individual goals.

Retention should be viewed broadly and data needs to be collected from three different perspectives (Seidman 1996). Course data measures whether or not students are completing specific courses during a semester. Program data measures whether or not first-time, full-time students finish the program in which they initially started. The time allotted for program completion is usually six years for a bachelors degree and three years for an associate

degree. Student data would identify those students who met their academic and/or personal goals at the time of exit from the institution (p. 19).

Profile of Persisters and Non-persisters

Although there has been a tremendous amount of research on the typology of persisters and non-persisters, there is still no clear-cut answer to why some students do not persist. Tinto (1997) promotes "knowing your students" by developing a profile of why they enroll, why they persist, and why they leave the institution early (p. 7). ACT or SAT scores and high school grades were found to be strong predictors of retention (Astin et al, 1987). Students with GPA's of 2.0 or lower were seven times less likely than those with a 4.0 or better to complete their degree in four years. Students with higher ACT or SAT scores were more than six times as likely to have a degree in four years as those with the lowest scores. Combined, those with the lowest test scores and GPA's were over 16 times less likely to complete degrees in four years. Only 59% of students admitted with ACT scores below 15 and SATs below 700 persisted into their second year compared to 90% admitted with ACT scores of 26 or better and SAT scores of 1100 or above (Noel, 1985).

Full-time attendance was found to be the most prevalent characteristic for retention (Moore, 1995; Windham, 1994). Part-time attendance was found to be the most prevalent characteristic of non-persisters (Feldman, 1993; Moore, 1995; Price, 1993).

There is conflicting information about whether or not age affects persistence. Some studies indicate young students between 20-24 years old (Feldman, 1993) are more likely to drop out whereas another study (Mohammadi, 1994) found attrition rates to be higher for students between 23-35 years old and 45-50 years old.

Academic dismissal accounts for less than 15% of student attrition nationally (Tinto, 1993). Most student departure occurs voluntarily because of personal, social, and financial reasons (Tinto, 1993, p. 68; Noel, 1985; Pantages & Creedon, 1978). Reasons students do not persist reflect their adjustment to college life, available financial resources, personal commitments and goals, integration into the college experience, and academic under-preparedness (Henscheid, 2000; Tinto, 1997, p. 33). Students also leave institutions before meeting their goals because they lack family support, are unable to see the benefits for staying (Henscheid, 2000), experience racial

and gender bias, and lack the necessary motivation (Eaton, 1992, p. 153). Many believe retention is affected by a direct proportional relationship between the student's personal values, goals, and attitudes and those of the institution (Lenning, Beal, & Sauer, 1980; Pantages & Creedon, 1978; Pascarella, 1982; Pascarella, Smart, & Ethington, 1986; Tinto, 1975, 1987).

Many students are not prepared to meet the academic and social demands of college life (Noel & Levitz, 1985; Tinto, 1997). Typical coping strategies do not transfer to this unfamiliar environment. They do not know how to fit with the institutional culture, and they are unprepared to deal with the outside pressures and lack of support from family, friends, and peers. Institutions cannot assume students have the skills to adjust to college life, and without assistance, they may not persist (Noel & Levitz, 1985; Tinto, 1997).

Among the most common stated reasons for leaving are financial and personal reasons (Tinto, 1997). Students leave or become part-time students because they do not have the necessary financial resources. Often, they have to work part time to make ends meet. Some students do not feel the benefits of an education outweigh the financial

costs. One study indicated 90% of students who received a grant during the first year of college enrolled in the second semester. Yet, 75% who did not receive a grant did not enroll in the second semester (Porter, 1990).

Personal commitments and goals also affect retention. Students are not always willing to commit the time necessary to progress toward degree completion. Those with competing commitments outside of their college life often times "stop out" until they can devote more time and energy to their coursework.

> One of the clearest outcomes of research on student departure is the finding that individual experiences within college after entry are more important to persistence and departure than what has gone on before entry. (Tinto, 1997, p. 35)

Student goals are sometimes vague or changing as the student matures and develops. Those with unclear goals for an extended period of time are more likely to leave the institution. The effort becomes difficult with lack of purpose (Tinto, 1993, pp. 38-43).

Isolation occurs when students do not feel connected to the social and academic environments of the institution (Tinto, 1997). Even students socially isolated form their peers may persist with appropriate interaction with faculty (Pascarella & Terenzini, 1977). The "intensity of

involvement" theory demonstrates why residents are more likely to persist than commuters (Astin, 1979). These students increase their chances of persistence by 12% because they have more contact with faculty, do better academically, and are more satisfied with their overall experience. Yet, African-American students find it more difficult to feel like they are part of the campus community (Allen, 1988). Institutions ranked a "caring attitude of faculty and staff" as the most important "positive factor" contributing to persistence (Pascarella & Terenzini, 1977).

Under-prepared students exist on all campuses because compared to others in the class, there are always those who are less prepared (Noel & Levitz, 1985). The transition from high school to college can be academically challenging for those needing remediation as well as for well-prepared high school graduates. Additionally, there are adult students sometimes lacking confidence in their ability to learn, uncertain about college expectations, and requiring a different approach to learning altogether (Knowles, 1990, p. 57).

Interventions

Student profiles of persisters and non-persisters are not

easily attainable (Asher, 1994). Focusing on interventions may be an alternative for increasing student retention. "For an intervention to be effective, it must be powerful enough to affect change" (Seidman, 1996, p. 20). It has been over twenty-five years since Vincent Tinto (1975) published his model of attrition and retention. Numerous studies have validated his premise (Halpin, 1990; Pascarella, et al. 1986; Terenzini & Wright, 1987). Retention programs nationwide are based on this model. This model acknowledges that a student's goals and commitments will undergo many changes throughout the college experience. The more integrated students' interactions between the academic and social systems of the institution, the more likely that they will persist until graduation (Tinto, 1997). Students go from being unattached to the institution to being attached (Noel & Levitz, 1985).

In order to make a significant change in student retention, it must be a conscious and consistently high institutional priority (Roueche, Johnson, & Roueche, 1997). Every employee in the institution must be committed to the success of students (Noel & Levitz, 1985). Institutional commitment to the students being served is one of three

essential characteristics of successful retention programs identified by Tinto (1997). Campus commitment is demonstrated through action and occurs when institutions are concerned with how their actions impact student welfare.

The second component for program success is a focus on education and student success rather than retention (Tinto, 1997). Early assessment of student needs leads to appropriate interventions. Successful retention programs provide "an academic support safety net with ongoing orientation, intensive extended contact with advisors, and increased use of academic support services" (Levitz and Noel, 1995, p. 4).

Finally, meaningful interactions with faculty are key to student success (Tinto, 1997). "The frequency and perceived worth of interaction with faculty, staff, and other students is one of the strongest predicators not only of student persistence but also of student development" (p. 40).

Four principals are identified to assist institutions with implementation of retention programs (Tinto, 1997, p. 41-42). First, retention efforts must focus on the critical first year because this is when most student

departure occurs. Second, programs must be coordinated, campus-wide initiatives that are tailored to the uniqueness of each campus. Third, timely assessment, monitoring, feedback, and assistance are critical. Finally, the focus should be on a quality educational experience for which institutions should be willing to provide the necessary resources including faculty and staff development.

Three common interventions found on campuses are orientation programs, mentoring programs, and multiple-strategy approaches. University personnel need to understand the relationship between orientation programs and adjustment to the college environment. Boyer states, "We are convinced that colleges should be as committed and creative in helping students adjust to college life as they are in getting them to the campus in the first place" (p. 46). Students who complete freshmen orientation classes complete more credit hours, have higher GPA's, and are more likely to re-enroll than students never enrolled in these courses (Cuseo, 1991; Davis, 1992; Fidler, 1986; Hyers & Joslin, 1996; Richardson, 1994; Strumpf & Hunt, 1993).

Mentoring programs are another strategy used successfully at some institutions. Coffeeville Community College in Kansas implemented the SELECT Advisor program

focusing on master advisement and mentoring (Clark & Others, 1995). Retention rates were compared for first year students in the SELECT program, those in an orientation program, and those not enrolled in either. The retention rates were 73%, 70%, and 42%, respectively. Retention rates also improve when peer-mentoring programs are instituted (Mueller, 1993; Grevatt, 1992). Campuses are beginning to take a more holistic approach to retention incorporating a series of intervention strategies across campuses (Fink & Carrasquillo, 1994; Price, 1993). Different approaches accommodate individual diversity. Return rates increased 10% when faculty mentoring and orientation were combined at Valencia Community College (Nelson, 1993).

Adult Learning

Andragogy

As far back as 1929, intuitive and innovative adult educators were crossing the boundaries of traditional models of teaching and experimenting with what today is known as adult education principles. Yet, often these leaders in the adult education movement felt guilty for breaking the rules and practicing without theory to back up their assumptions. Knowles (1980) was one of several in

the 50's to begin analyzing their works and looking for common themes. In the 1960's, related disciplines also began looking at adults as learners and the research supported what researchers in the field of adult education were finding. Thus, four decades of research laid the foundation for adult learning theory.

Knowles (1980), however, was the first to formulate a comprehensive theory of adult learning. He presented a model he termed "andragogy", the word first used in Germany as early as 1833. He defined andragogy as the art and science of helping adults learn (p. 43). It is based on assumptions about adult learners that Knowles initially stated were very distinct from children and adolescents. With experience and feedback, he later asserted that most of those assumptions apply equally to adults and children although children have fewer experiences than adults to draw upon.

The teacher-learner relationship is changed and more intensive in the andragogy model. The role of the facilitator shifts from teacher-centered to learner-centered and may be critical to successful adult learning. Knowles (1990) expanded his original four assumptions to six assumptions about adult learners that should be

addressed on an individual basis beginning at each learner's starting point. The assumptions relate to (a) the learner's need to know, (b) the learner's self-concept, (c) the role of the learner's experience, (d) the learner's readiness to learn, (e) the learner's orientation to learning, and (f) the learner's motivation.

"Adults need to know why they need to learn something before undertaking to learn it" (Knowles, 1990, p.57). Unlike children, who innocently learn what the teacher tells them to, adults need to understand how this information relates to the task they are working on, their job, or their life (Knowles, 1990, p.57).

Adults, typically, have a need to make their own decisions and be responsible for their lives. When they feel others are trying to control them, often adults will resent and resist these situations. However, when it comes to learning, adults often take on a "tell me what to do attitude" and are not always ready to be totally responsible for their learning experience. Facilitators should match their role in the learning process to the learner's stage of self-direction. The goal should be to help the learner to advance to higher stages of self-direction. Adult learners move from dependency to self-

direction (Knowles, 1990, p. 59).

Adults come into educational activity with volumes of rich experiences. These experiences define who they are and contribute to the overall learning. Ignoring their experience is the same as rejecting the individual (Knowles, 1990, p. 60).

Adults, like children, become ready to learn when the educational experiences coincide with developmental tasks. Developmental tasks for adults tend to be tied to social roles such as considering employment, marriage, or starting a family (Knowles, 1990, p. 61).

Adults are life-centered, motivated to devote energy and time to a learning activity if it will help them in real-life situations. They need to know that the new information can help them solve a problem, improve their performance, or further develop them as an individual (Knowles, 1990, p. 63).

Adults are more internally motivated than externally motivated. Adults respond to external motivators such as job promotions and salary increases. However, they are more driven by internal motivators such as increased satisfaction, self-

esteem, and quality of life (Knowles, 1980, p. 55).

The assumptions for adult learners translate into the following phases of program planning: (a) establishment of a climate conducive to adult learning, (b) creation of an organizational structure for participative planning, (c) diagnosis of needs for learning, (d) formulation of directions of learning (objectives), (e) development of a design of activities, (f) operation of the activities, and (g) rediagnosis of needs for learning (revaluation) (Knowles, 1980, p. 59).

The first step in the planning process, creating a learning climate that sets the stage for learning, should begin at the time of recruitment to the educational program (Knowles, 1980, pp. 223-234). Adults need an environment that is comfortable, aesthetically pleasing, and facilitative of interaction. Physical surroundings such as appropriate-sized seating and classrooms, arrangement of chairs, and non-institutional and adult focused surroundings are significant. Most important, however, is the psychological environment which is largely created by the facilitator. Choice of dress, approach to human interaction in an educational setting, attitude about the

role of a facilitator, and attention to small details can all contribute to creating a warm, inviting, and trusting learning environment.

> I am convinced that what happens in the first hour or so of any learning activity (course, seminar, workshop, institute, tutorial, etc.) largely determines how productive the remaining hours will be. I see the setting of a climate that is conducive to learning as perhaps the single most critical thing I do as a facilitator of learning. (p. 224)

Collaborative planning is the next step to be considered. The goal is to involve as many learners as possible in the planning process to ensure individual needs are met as well as program requirements (Knowles, 1980, pp. 226-227). Mutual planning is much easier to accomplish with small groups. However, team planning and steering committees are techniques used to get group participation. Those not involved initially have an opportunity to review and modify the plan.

Participants in educational activities who self-diagnose their specific learning needs are more likely to reach the highest level of motivation. The diagnostic process of step three includes (a) the development of competency models, (b) assessment of the present level of performance in each of the competencies, and (c) assessment

of gaps between the two. "If one thing stands out about adult learning, it is that a self-diagnosed need for learning produces much greater motivation to learn than an externally diagnosed need" (Knowles, 1980, p. 232).

For the fourth step of the model, the learner and the facilitator develop learning objectives jointly, and the learner is encouraged to review and revise them repeatedly.

> Tough's research regarding how adults learn naturally is that very often they will enter into a learning project with rather vague objectives and that as they become better informed about the content of their inquiry their objectives become sharper and clearer. (Knowles, 1980, p. 234)

The educative quality of an adult education program is directly affected by the aesthetic quality (Knowles, 1980, pp. 232-233). In the fifth step, the facilitator designs the course, as an artist would paint a picture creating a sense of order and excitement. Learning design is aligned with the learning objectives.

The sixth step involves translating the learning design into sequenced activities (Knowles, pp. 235-236). The facilitator's role is to involve the students in executing decisions and provide resources for them to make informed decisions regarding the most effective technique and useful materials.

Developing learning contracts, the final step in program planning, involves the learners in setting objectives, identifying resources and strategies to accomplish these objectives, developing timelines for project management, identifying evidence to show they accomplished their goal, and determining how to get that evidence judged. This significantly increases the degree of responsibility the learners assume for their own learning (Knowles, 1980, p. 171).

Self-Directed Learning

Self-directed learning has existed for centuries and efforts by scholars to understand it began more than 150 years ago. However, not until the early 1960's did Houle (1961) begin laying the foundation for development of the concept self-directed learning. Houle interviewed "continuing learners" and found they had three orientations for participating in a learning activity: (a) goal-oriented, (b) activity-oriented, and (c) learning-oriented.

Tough (1979), a student of Houle was the first to further the research on the learning-oriented individual. He refers to self-directed learning as self-teaching and defines it as the learners taking responsibility for designing their learning projects. A culmination of many

studies, several of which were his, led to the following findings: (a) almost everyone undertakes at least one or two major learning efforts a year with the median being eight; (b) it is common for adults to average 700 hours a year in learning projects; and (c) about 70% of all projects are planned by the learner (p. 1).

> A learning project is simply a major, highly deliberate effort to gain certain knowledge and skill (or to change in some other way). Some learning projects are efforts to gain new knowledge, insight, or understanding. Others are attempts to improve one's skill or performance, or to change one's attitudes or emotional reactions. Others involve efforts to change one's overt behavior or to break a habit. (p. 1)

Tough (1979) states that his own teaching methods changed toward increased self-direction as a result of the enthusiasm and success his subjects experienced in their self-planned learning.

Knowles also stresses the need for adults to become self-directed learners. "It is a tragic fact that most of us only know how to be taught; we haven't learned how to learn" (Knowles, 1975, p. 14). Not only do individuals need to leave an educational setting with a foundation of knowledge but with skills of inquiry for "survival as an individual, and also the survival of the human race" (p. 16).

> In its broadest meaning, "self-directed learning" describes a process in which individuals take the initiative, with or without the help of others, in diagnosing their learning needs, formulating learning goals, identifying human and material resources for learning, choosing and implementing appropriate learning strategies, and evaluating learning outcomes. (p. 18)

Human development and maturity is directly proportional to one's need for control over life's choices (Knowles, 1975). Thus, the natural progression for adults is to become increasingly in control of their lives and self-directing. When control for learning is not relinquished to adults, they may become resentful and resistant. Furthermore, educational institutions and teachers no longer have the control over adult learning because of the ever-widening access to information now available to the general population. The educator's modern task is to link learners with resources, facilitating self-directed learning.

Yet, not all learners seize the opportunity for self-direction. Some may not have the requisite skills or knowledge or are not committed to the learning process. Others may be intimidated because they lack confidence and need greater amounts of direction and support (Pratt, 1988). There are noticeable levels of readiness needed for self-directed learning to take place, requiring

facilitators to be sensitive to the starting point for each learner (Knowles, 1975).

Brookfield (1986) has explored the concept of the self-directed learner in great depth. He distinguishes between self-directed techniques such as identifying goals and resources, implementing learning strategies, and evaluating progress and self-directed learning. Self-directed learning constitutes an internal change of consciousness.

> The external technical and the internal reflective dimensions of self-directed learning are fused when adults come to appreciate the culturally constructed nature of knowledge and values and when they act on the basis of that appreciation to reinterpret and recreate their personal and social worlds. In such a praxis of thought and action is manifested a fully adult form of self-directed learning. (Brookfield, 1986, p. 59)

Brookfield (1986) identified several themes in self-directed learning. First, he discussed the benefits of the learning contract which is to assist learners in diagnosing their needs, develop plans for specific activities, self-evaluate, and identify learning resources and materials. This requires a skill that may need to be developed before developing a learning contract. Just as facilitators need specific training to learn the skills needed to work with self-directed learners, the learners need preparation

before engaging in self-directed learning activities. There also needs to be a transition period to help resistant learners. Peer support groups are beneficial to self-directed learners providing avenues for information exchange. The networks have helped learners in formal and informal settings and should be encouraged by the facilitator as soon as possible. The time commitment can be overwhelming for facilitators, and if there is no support form administration, career advancement opportunities may be jeopardized. Finally, learners typically come to value self-directed learning opportunities because they have mutual input into their learning experience resulting in increased personal investment and commitment.

Transformation

Learning in adulthood is not additive but transformative. "New learning transforms existing knowledge into a new perspective and in doing so emancipates the learner" (Merriam & Caffarella, 1991, p. 260). This type of learning, called perspective transformation, emphasizes personal psychological change based on changes in consciousness.

> Perspective transformation is the process of becoming critically aware of how and why our

> presuppositions have come to constrain the way we perceive, understand, and feel about our world; of reformulating these assumptions to permit a more inclusive, discriminating, permeable, and integrative perspective; and of making decisions or otherwise acting upon these new relationships. (Mezirow, 1981, p. 4)

Adult learning can be classified into three types: subject-oriented, consumer-oriented, and emancipatory (Cranton, 1994; Mezirow, 1991). Subject-oriented learning focuses on acquiring content. Consumer-oriented adult learning focuses fulfilling the learner's expressed needs. Emancipatory learning frees individuals from limiting constructs they uncritically acquired in childhood and never questioned or challenged as adults, therefore limiting their options and control of their lives (Mezirow, 1991). Mezirow (1981) states that only adults can experience this type of learning because "it is only in late adolescence and in adulthood that a person can recognize being caught in his/her own history and reliving it" (p. 11).

"Learning may be defined as the process of making a new or revised interpretation of the meaning of an experience, which guides subsequent understanding, appreciation, and action" (Mezirow, 1990, p. 1). Making meaning or making sense of new experiences plays a

significant role in adult learning and can be viewed on two dimensions: meaning schemes and meaning perspectives. "Meaning schemes are defined as specific knowledge, beliefs, value judgments, or feelings involved in making an interpretation" (Mezirow, 1991, p. 5). They "are habitual, implicit rules for interpreting" (Mezirow, 1990, p. 2); they are assumptions. These rules or assumptions "can be viewed as the interpretive glue that binds the various meaning schemes comprising our structures of understanding" (Brookfield, 1990, p. 177).

"Meaning perspectives refer to the structure of assumptions within which new experience is assimilated and transformed by one's past experience during the process of interpretation" (Mezirow, 1990, p. 2). They are one's frame of reference determining how that individual perceives and processes new information, how they respond to the information, and how they judge the world. Meaning perspectives are developed through cultural assimilation and learning, intentional and unintentional, and these perspectives become the principles for interpreting new experiences.

Emancipation begins with reflection upon one's experience (Willyard, 2000). "Reflection involves a

critique of assumptions to determine whether the belief, often acquired through cultural assimilation in childhood, remains functional for adults. We do this by critically examining its origins, nature, and consequence" (Mezirow, 1994, p. 223). Exploring alternative ideas are not only difficult but psychologically threatening. Sometimes it is safer and less stressful to defend and rationalize distorted views of reality, but ultimately this robs an individual of transformative learning. Transformative learning occurs only when interpretation involves a new set of expectations, altering the meaning and perspective of the old experience.

However, the transformation process is almost inevitable and most predictable following a "disorienting dilemma" such as death of a loved one, loss of a job, or a divorce or an anomaly (Mezirow, 1994, p. 223). The meaning schemes and perspectives that once made sense do not help an individual cope with the new situation. This begins the process of reflection, challenging those previous assumptions and interpretations that are no longer effective.

Mezirow identified progressive steps in the transformative process based on interviews with women who

were attending community colleges. The steps include: (a) a disorienting dilemma, (b) self-examination, (c) critical personally internalized role assumptions and a sense of alienation from traditional social expectations, (d) relating one's discontent to similar experiences of others or to public issues-recognizing that one's problem is shared and not exclusively a private matter, (e) exploring options for new ways of acting, (f) building competence and self-confidence in new roles, (g) planning a course of action, (h) acquiring knowledge and skills for implementing one's plans, (i) provisional efforts to try new roles and to assess feedback, and (j) a reintegration into society on the basis of conditions dictated by the new perspective (Mezirow, 1981, p. 7).

Learning Styles and Kolb

Kolb's Experiential Learning Cycle and accompanying Learning Styles Inventory have been extensively analyzed, tested, and critiqued. There were 679 citations of Kolb's work listed in the Social Sciences Citation Index between 1971 and 1989 (Hickcox, 1991, p. 4). His work builds on earlier work by Dewey, Lewin, and Piaget recognizing the critical elements in the learning process as experience, perception, cognition, and behavior (Kolb, 1984, p. 20).

He provided "a comprehensive theory which offers the foundation for an approach to education and learning as a lifelong process and which is soundly based in intellectual traditions of philosophy and cognitive and social psychology" (Zuber-Skerritt, 1992, p. 98). Kolb's sound theoretical base is not often seen in others' work (Holman, Pavlica, & Thorpe, 1997). "Criticisms usually center on psychometric issues, and it should be noted that even the most critical studies of the LSI are not entirely unsupportive of the theory" (Hickcox, 1991, pp. 319-320).

A Hierarchy of Learning Styles

There are so many learning styles theories and instruments that the information and research becomes very confusing. Learning style theories can be conceptualized by using the "onion model" that consists of four layers (Curry, 1987). The first layer in the center refers to personality dimensions that evaluate how one's personality traits influence the learning process. Several instruments address this dimension. The Embedded Figure Test (Oltman, Raskin, & Witkin, 1971) measures the amount of field independence by asking the individual to identify geometric figures in a picture with distracting backgrounds. Field dependence is implied by lack of independence (Bonham,

1988, p. 12). The Myers-Briggs Type Indicator (Myers, 1978) yields scores with dichotomous scales measuring extroversion versus introversion, sensing versus intuition, thinking versus feeling, and judging versus perception which is based on Jung's theory of psychological types.

The outermost layer of the hierarchy includes those models that focus on multidimensional and instructional preferences. The focus here is on the external world, that is, the environment in which an individual prefers to learn. The Learning Styles Model of Dunn and Dunn (1978) only examines the conditions under which learning occurs and not the learning itself. Similarly, Canfield's Learning Style Inventory (1983) examines the conditions, content, mode of learning, and the expected degree of success.

Learning style theories dealing with social interaction fall in one of two middle layers of the hierarchy. These theories address how students interact in the classroom. For example, independent, dependent, collaborative, competitive, participant, and avoidant types of learners are identified by the Grasha-Riechmann (1974) Student Learning Style Scales (SLSS).

Theories dealing with information processing fall in the other middle layer. This refers to an individual's

intellectual approach to assimilating information. The Inventory of Learning Processes (Schmeck, Ribich, & Ramanisah, 1977) focuses on the construct of cognitive complexity and has scales for study methods and synthesis of materials, the retention of information, and the ability to generalize information to personal experiences. "Deep" and "surface" learning is differentiated by Entwistle (1981, p. 105). "Holist and "serialist" learning are differentiated by Pask (1976, p. 130). The Experiential Learning Model (Kolb, 1984) falls in this category as well. Kolb's Learning Styles Inventory (LSI) describes how people perceive and process information.

Kolb's Experiential Learning Model

Kolb defines learning as "the process whereby knowledge is created through the transformation of experience" (Kolb, 1984, p. 38). Kolb's explanation of learning is based upon his Experiential Learning Model (Kolb, 1974, pp. 27-28), which is one of the most widely referenced theories on experiential learning (Henry, 1989). There are two reasons Kolb chose to label this model experiential (Kolb, 1974, p. 91). First, it was labeled this to tie it to its historical roots in psychology during the forties, fifties, and sixties. The term relates back

to the social psychology of Kurt Lewin, sensitivity training, and laboratory education. Second, Kolb's emphasis on reflection places it in the experience-based learning camp. "The term 'learning from experience' really means learning from reflection on experience" (Boreham, 1987, p. 89). As experience is critical to the learning process, Kolb wanted to accentuate that importance (Kolb, 1974, p. 91).

This model suggests that learning is cyclical and that there are four stages or cognitive tasks in the learning cycle: (a) concrete experience, (b) observations and reflections, (c) formation of abstract concepts and generalizations, and (d) testing implications of concepts in new situations (Kolb, 1974, pp. 27-28). Kolb refers to these stages as (a) Concrete Experience (CE), (b) Reflective Observation (RO), (c) Abstract Conceptualization (AC), and (d) Active Experimentation (AE). Sometimes the stages are referred to as (a) sensing and feeling, (b) watching and reflecting, (c) thinking, and (d) doing (Fielding 1994). Although the learner may enter the cycle at any point, the stages should be followed in sequence (Kolb, 1974).

Perception (grasping) and processing (transforming)

are two dimensions in the learning process. Kolb uses these dimensions to classify learners (Smith & Kolb, 1986). Perception is the way learners perceive or grasp new information. At one end of the continuum are the learners that immerse themselves in the learning experience by using their senses and feelings (Concrete Experience) and at the other end are those learners who gain new insights through abstract thinking using logic and reason (Abstract Conceptualization). Once learners perceive information, they must internalize it and make it a part of their overall knowledge base. Some can process the information by watching and reflecting (Reflective Observation) while others may need to actively work with the new information for assimilation to occur (Active Experimentation) (Fielding, 1994).

> Indeed a closer examination of the four-stage learning model reveals that learning requires abilities that are polar opposites and that the learner, as a result must continually choose which set of learning abilities he will bring to bear in any specific learning situation. (Kolb, 1974, p. 92)

The learner strengths, or combination scores, for perception and processing are placed on a two dimensional grid (Kolb, 1984). The perception dimension is on a vertical plane, and the processing dimension is on a

horizontal plane. Abstract Conceptualization (AC) and Concrete Experience (CE) and, the AC/CE dimension, and Active Experimentation (AE) and Reflective Observation (RO), the AE/RO dimension, are polar opposites and produce four quadrants. Each quadrant is associated with an individual learning style: Accommodator, Diverger, Converger, and Assimilator. Kolb describes each learning style with general characteristics.

Divergers' learning strengths are Concrete Experience (CE) and Reflective Observation (RO) (Kolb, 1974, pp 30-31; Kolb, 1984, p. 94). They learn intuitively through reflection; are the big picture people who enjoy generating ideas, seeing situations from many perspectives, and organizing relationships into meaningful wholes; like brainstorming and small group discussions; understand people and like personal involvement; and are motivated by curiosity and passion. Limitations may include becoming paralyzed by alternatives and generating too many options.

Convergers have the opposite learning strengths of the Divergers and are best at Abstract Conceptualization (AC) and Active Experimentation (AE) (Kolb, 1974, pp 30-31; Kolb, 1984, p. 94). They learn by thinking and then doing; work best when systematically planning and logically

analyzing ideas and finding solutions to problems; are not big picture people but learn best when dealing in minute detail; have the ability to find practical applications for ideas, concepts, and theories; enjoy situations where there is a single or best answer to a problem; may prefer to deal with technical issues rather than people issues; and are motivated by problems. Convergers may sometimes solve wrong problems and often resent being given an answer.

The Accommodators' learning strengths are Concrete Experience (CE) and Active Experimentation (AE) (Kolb, 1974, pp 30-31; Kolb, 1984, p. 94). They learn primarily from hands-on experience and doing what they intuitively feel is right; get things done; take leadership roles; take risks; are flexible, adapting themselves to the specific and immediate circumstances; learn best when there is a body of experts to draw from; tend to act on intuition rather than careful analysis; are quick to reject solutions that do not work out and improvise; may concentrate on the urgent aspects of a situation, sacrificing long-term understanding; and are motivated by a finished product. On the other hand, Accommodators may find themselves involved in meaningless activities and are impatient individuals.

The Assimilators have the opposite strengths of the

Accommodators and are best at Abstract Conceptualization (AC) and Reflective Observation (RO) (Kolb, 1974, pp 30-31; Kolb, 1984, p. 94). They learn best by analyzing and reflecting; are good at combining distinct factual observations into a meaningful explanation for a particular phenomenon; have a talent for creating theoretical models; enjoy inductive reasoning and distilling varied observations into logical explanations; and are motivated by expertise and mastery. Assimilators sometimes forget practical application.

Learning Style Inventory (LSI)

The Learning Styles Inventory (LSI) developed by Kolb (1985) provides a framework for identifying individual learning styles. Researchers have used Kolb's LSI more than any other instrument with a variety of adult populations in order to determine how the diversity of learning styles are distinctively manifested (Davie, 1987; Harb, Durrant, & Terry, 1993; Katz, 1988; Kruzick, Friensen, & Van Soest, 1986). However, the inventory was originally developed for use with college students (Bonham, 1989). Numerous research studies have specifically measured differences between learning style and academic achievement, gender, career choice, and instructional

design.

The LSI has been used to determine if student performance can be predicted by learning style. At Fairfield University, there was no significant difference between concrete and abstract learners and grade point average (GPA). Yet, active learners had a significantly higher GPA than reflective learners (Cook, 1997, p. 5). The results also suggest that Divergers and Assimilators had the most academic difficulty whereas the Convergers and Accommodators did better academically. However, more Divergers and Accommodators were on academic probation.

Overall, performance in the sciences was found to be related to the perception dimension on the LSI (Nakayama, 1988). Students who preferred Abstract Conceptualization out-performed students who preferred Concrete Experience. A study of student performance in an organic chemistry course found a positive correlation between students' AC scores for abstractness and grade point average (Kevin & Liberty, 1975). However, no predictive relationship between LSI score and academic performance was found for students in computer-based instruction (Reifle & Edwards, 1975).

Data suggest that women and men score differently on

the Learning Style Inventory (Kolb, 1976). Women often score higher on Concrete Experience (CE) and men on Abstract Conceptualization (AC) although there is no difference on the active/reflective dimension (p. 24). A study conducted at the University of New Mexico found that women were spread more evenly across Kolb's four learning styles than men (Philbin, Meier, Huffman, & Boverie, 1995, p. 489). Men were more likely to be Assimilators with very few men classified as Divergers. The sample size for this study was very small, and therefore it may be difficult to generalize the results. Cook (1997) and Magolda (1989) found no difference between learning style type and gender. However, Magolda did find that females preferred Concrete Experience more often than Abstract Conceptualization, but men did not show any differences. Both groups preferred Reflective Observation to Active Experimentation, thus no gender differences were found.

Gender and learning style differences have also been found for students enrolled in specific college majors. A study of physical therapy students and clinicians revealed a significant difference between gender and learning styles (Bowman, Delargy, Deshong, Hutcher, & Roush, 2000). A study of 501 pharmacy students revealed a relationship

between gender and learning styles finding more males were identified as Converger and more females were one of the other three styles (Garvey, Bootman, McGhan, & Meredith, 1984). They also found females scored higher on the concrete dimension and males scored higher on the abstract dimension. However, it was not determined as to whether or not these data were statistically significant. Political science students had a fairly equal distribution of learning styles as assessed by the LSI except there were slightly more Assimilators which was found to be statistically significant (Fox & Ronkowski, 1997). Most significant were the differences found between genders. Females identified themselves as Accommodators one third of the time while only 15% of the men did the same. Most political science classes cater to the exact opposite learning modes, reflection and abstraction.

There is some measure of agreement about clusters of disciplines and learning styles (Kolb, 1994). Clusters of disciplines are groupings of related occupations that make up a classification system. "People choose fields that are consistent with their learning styles" (Kolb 1974, p. 94). Divergers tend to choose majors in history, English, political science, and psychology. Convergers enroll in

the sciences such as engineering, nursing, and physical science which is consistent with problem-solving and practical application. Accomodators tend to choose majors in business and tend to make good salespersons (Lam, 1998, p. 1). Assimilators, who prefer learning by analyzing and reflecting, choose majors such as economics, foreign language, mathematics, sociology, and chemistry. Assimilators usually make good theorists and college professors. Physics majors are very abstract and fall between the Assimilator and Converger learning styles (p. 94). A study of a population of professional chemists, in contrast to Kolb's study of managers in which only 27 of the 800 were chemistry majors, found that the average were identified as Convergers (Smedley, 1987, p. 321).

Learning Strategies

Learning style theory and research once dominated the field of education. Today there is a growing body of new knowledge that focuses on learning strategies. It should be emphasized "more is needed than a knowledge of a student's learning style in order to improve the quality of teaching and learning" (Conti & Welborn, 1986, p. 22). Accommodation of learning styles in the teaching-learning transaction are largely dependent upon the instructor or

facilitator in the classroom whereas learning strategies empower individuals to take charge of their own learning. If learning styles are more innate and less likely to change (Rule & Grippen, 1988), learning strategies may be the key to developing efficient and effective learners.

"One can learn how to learn more effectively and efficiently at any age" (Smith, 1982, p. 15). "Adeptness and insight in the use of learning strategies appears to be a significant part of one's ability to learn how to learn" (Fellenz & Conti, 1993, p. 3). Learning how to learn refers to "possessing, or acquiring, the knowledge and skill to learn effectively in whatever learning situation one encounters" (Smith, 1982, p. 19).

"Strategies vary by individual" (Fellenz & Conti, 1989, pp. 7-8). These differences in learners result in clusters or groups that can be distinguished (Conti & Kolody, 1995; Strakal, 1995). Much of the research in the area of learning strategies began with SKILLS (Self-Knowledge Inventory of Lifelong Learning Strategies). Skills (Conti & Fellenz, 1991) identifies five areas of learning that are used in real-life learning: metacognition, metamotivation, memory, critical thinking, and resource management. SKILLS is composed of 15 learning

strategies that are then broken down into these five learning areas. Learners are presented with six real-life learning scenarios. They are asked to read each situation followed by 15 questions each of which correlates to one of the learning strategies. These questions assess the specific strategies an individual is most likely to use to solve these problems. Three of the 15 strategies fall in each learning area (Fellenz & Conti, 1993, page 5).

Metacognition

Metacognition involves thinking about one's own thinking (Fellenz & Conti, 1989, p. 9) and requires the learner to explore, evaluate, and manage learning activities (Conti & Kolody, 1999). Metacognition has been described as "one's knowledge concerning one's cognitive processes and products or anything related to them, e.g., the learning-relevant properties of information or data" (Flavell, 1976, p. 232). It has also been defined as "having knowledge (cognition) and having understanding, control over and appropriate use of that knowledge" (Tei & Stewart, 1985).

Planning, Monitoring, and Adjusting are the three learning strategies involved in Metacognition. Planning involves deciding how to approach a learning task in the

most effective way. "The basis for such planning is an awareness of one's most effective learning characteristics, insight into the learning task, and an understanding of the planning process" (Fellenz & Conti, 1993, p. 9). Examples include overviewing and focusing on purpose. Monitoring is the learner's way of evaluating progress and encouraging deeper processing (Fellenz & Conti, 1993, p. 9). "Operationally, comprehension monitoring involves establishing learning goals, assessing the degree to which these goals are being met, and if necessary modifying the strategies being used to facilitate goal attainment" (Weinstein, 1988, p. 294). Monitoring might include self-testing and asking for feedback. Metacognitive adjusting is plan adaptation resulting from monitoring (Fellenz & Conti, 1993). "Effective learning calls for such modification or change in order to fine-tune or occasionally revise learning situations" (p. 9). This could involve changing strategies or changing the learning process (p. 9).

Metamotivation

Metamotivation "deals with one's knowing and understanding how or why one is motivated to participate in or remain in a learning activity" (Conti & Kolody, 1999, p.

4). It is "the awareness of and influence over factors that energize and direct one's own learning" (Fellenz & Conti, 1993, p. 12). "Motivation results from people's attempts to achieve and maintain order in their lives" (Conti & Fellenz, 1991).

Learning strategies involved in Metamotivation include Attention, Reward/Enjoyment, and Confidence. "Attention is the focusing of an individual's learning abilities on material to be learned" (Fellenz & Conti, 1993, p. 15). Typically, individuals pay attention to a number of things at once and in varying degrees. "Yet, attention is essential to learning—at least to deliberate, planned learning" (p. 15). Setting a specific time and place for studying are uses of the strategy of Attention.

Reward or Enjoyment is another metamotivational strategy. "This is anticipating or recognizing the value to one's self of learning specific material, having fun, or experiencing satisfaction with the learning activity (Fellenz & Conti, 1989). Taking pride in one's accomplishment and personal growth are examples of Reward or Enjoyment strategies (Conti & Kolody, 1999, p. 6). The learning strategy of Confidence refers to the learner's self-belief that they can learn (Keller, 1987). This

relates to self-esteem and how learner's view their ability to succeed (Rubenson, 1977). "Belief that one can complete the learning task successfully is an important factor in motivation to learn" (Fellenz & Conti, 1993, p. 16).

Memory

Memory is "the capacity of humans to retain information, to recall it when needed and recognize its familiarity when they later see it or hear it again" (Wingfield & Byrnes, 1981, p. 4). Memory is what people know about and how they organize and remember new information in relation to the existing information (Fellenz & Conti, 1993). "Metamemory is practical knowledge acquired about our own memory capacities and what we must do to remember; or simply, what people know about how they remember" (Paul & Fellenz, 1993, p. 22).

Strategies associated include the Use of Organization, External Aids, and Memory Application (Conti & Kolody, 1999, p. 6). Organization of information increases one's ability to store, retain, and retrieve information (p. 7). It is one's ability to reorganize the information presented (Seamon, 1980). A major characteristic of memory is the richness in relationships formed during information reorganization (Norman, 1982) that improve the ability for

information to be retrieved (McKeachie, 1978). Examples of this strategy are the chunking of information and the use of mnemonics. External Aids "involve the learner in controlling the environment in some manner to enhance recall" (Conti & Kolody, 1999, p. 7). External Aids include, the use of to-do lists, notebooks, and sticky notes (p. 7). Memory Application is a strategy that "involves using the ... processes, structures, and strategies of long-term memory to enable individuals to access their vast knowledge system in order to plan, carry out, and evaluate learning" (Fellenz & Conti, 1993, p. 24). "Learning strategies improving the manner in which past memories are applied could be quite useful to adults" (p. 25).

Critical Thinking

Critical Thinking involves how one discriminates and reflects upon learning material (Conti & Kolody, 1999, p. 7). "Critical Thinking is a reflective thinking process utilizing higher order thinking skills in order to improve learning" (p. 7). The Critical Thinking strategies in SKILLS are based on Brookfield's (1987) components outlined in his book Developing Critical Thinkers. They are (a) identifying and challenging assumptions, (b) challenging

the importance of concepts, (c) imagining and exploring alternatives, and (d) reflective skepticism.

Testing Assumptions, Generating Alternatives, and Conditional Acceptance are the learning strategies associated with Critical Thinking. Testing Assumptions "invite respondents to examine the accuracy or the acceptance uncritically given to an assumption while others prompt them to identify relationships, spot inconsistencies, or question value sets" (Fellenz & Conti, 1993, p. 32). Generating Alternative involves "exploring alternatives when engaged in critical thinking or problem solving" (Conti & Kolody, 1999, p. 8). Conditional Acceptance entails "advocating reflective skepticism to avoid absolutes or over simplifications" (Conti & Kolody, 1999, p. 8). Conditional Acceptance is measured by "monitoring results and evaluating consequences" (p. 8).

Resource Management

Resource Management relates to how one identifies, uses, and manages appropriate sources of information (Conti & Kolody, 1999, p. 8). A resource may differ from printed materials such as books, newspapers, and journals to interactive resources such as TV and computers to personal resources such as an expert in the field (Fellenz & Conti,

1993, p. 35). However, learners, are not always prepared for resource management due to the vast changes in information sources and lack of education in the process (p. 35).

The three learning strategies associated with Resource Management include Identification of Resources, Critical Use of Resources, and Use of Human Resources. Identification of Resources requires the learner to find the best resources possible (Conti & Kolody, 1999, p. 8) and decide if the effort involved in gathering that information (Tough, 1979) is worth it or not. Critical Use of Resources "involves critical reflection about the material and selection of the most appropriate resource rather than simply those that are readily available. Use of Human Resources refers to engaging in "dialogue that involves listening to people with different opinions or insights into issues as well as the use of discussion to think through or study problems" (Fellenz & Conti, 1993, p 37). For some the support received is a critical part of the adult learning process (Conti & Kolody, 1999, p. 9).

SKILLS has been used in over 20 studies and has resulted in a data set of 3,070 individuals (Conti & Kolody, 1999, p. 17). It has proven to be a valid and

reliable instrument. Studies include a variety of populations and settings which have been organized into several categories.

> These studies included college students (Bighorn, 1997; Conti & Kolody, 1995; Hill, 1992; Gallagher, 1998; Kolody, 1997; Strakal, 1995; Ungricht, 1997), nursing students (Lockwood, 1997), business and non-profit leaders (Conti, Kolody, & Schneider, 1997; Courtnage, 1998; Gehring, 1997; Moretti, 1994), military personnel (Korinek, 1997; Yabui, 1993), public school administrators (McKenna, 1991), senior citizens (Quarles, 1998), and learning disabled students (Hays, 1995). (James, 2000, pp. 66-67)

Cluster analysis, discriminant analysis, and analysis of variance were used in many of these studies to determine groups of learners based on the 15 learning strategies identified with the SKILLS instrument. Results continually demonstrated that learners fell into distinct groups of learners.

The data set from SKILLS was used to create Assessing The Learning Strategies of AdultS (ATLAS) for identifying groups of learners based on learning strategies (Conti & Kolody, 1999). ATLAS places respondents in one of three learning strategy preference groups: Navigators, Problem Solvers, and Engagers. "The distribution of the respondents among the three groups was relatively equal: Navigators—

36.5%, Problem Solvers--31.7%, and Engagers--31.8%" (p. 18). Personal interviews and focus groups further identified learner characteristics for each of the groups of learners (p. 9). "The Navigators and Problem Solvers initiate a learning task by looking externally to themselves at the utilization of resources that will help them accomplish the learning. Engagers, on the other hand, involve themselves in the reflective process of determining internally that they will enjoy the learning task enough to finish it" (p. 18).

Navigators

Navigators want to see the "big picture" and like to plan their learning around these expectations.

> Navigators are focused learners who chart a course for learning and follow it. They are conscientious, results-oriented high achievers who favor making logical connections, planning and organizing activities, and who rely heavily on the learning strategies of Planning, Attention, Identification and Critical Use of Resources, and Testing Assumptions. (Conti & Kolody, 1999, p. 9)

They do not like to waste time nor have their plans disrupted. Group work is not something Navigators enjoy because they feel pressured to meet deadlines and become domineering. They have little

"tolerance for slackers, whiners and time-wasters" (p. 10). Control of their surroundings and structure are also important. They can avoid distractions by attending to the task. The environment does not affect their productivity (Goodwin, 2001). Navigators do not rely on their emotions when it comes to learning. They can easily "separate the message from the messenger" (Conti & Kolody, 1999, p. 10).

Navigators prefer instructors who provide "schedules and deadlines, by outlining objectives and expectations" (Conti & Kolody, 1999, p. 11). They like to know how to prepare for upcoming classes. Prompt feedback, such as receiving grades, is appreciated (p. 11). Navigators do not tolerate inefficiency and get frustrated when those in authority do not do their job and are not available for them (Goodwin, 2001).

Problem Solvers

Problem Solvers are learners who rely heavily on all the strategies in the area of Critical Thinking.

> Problem Solvers test assumptions to evaluate the specifics and generalizability within a learning situation; they generate alternatives to create additional learning options; and they are open to conditional acceptance of learning outcomes while keeping an open mind to other learning

possibilities. (Conti & Kolody, 1999, p. 12)

Problem Solvers tend to have difficulty making choices because of all the alternatives they are able to generate. They usually prefer essay type exams to objective tests. "Problem Solvers rely heavily on human resources and prefer expert advice" (p. 12).

Problem Solvers are not always best suited for classroom work because they require more time to process information. For the same reasons, they typically do not like working in groups. "They prefer a learning environment that promotes experimentation through practical experience and hands-on activities" (p. 13). These learners are often referred to as "rebel rousers" because they do not conform easily (p. 13). However, if there is a problem related to their learning environment, they are eager to explore the situation and create new alternatives (Goodwin, 2001).

Engagers

"Engagers are passionate learners who love to learn, learn with feeling, and learn best when actively engaged in a meaningful manner with the learning task" (Conti & Kolody, 1999, p. 13). They immerse themselves in the learning project, and sometimes their whole being becomes

attached to that project. Engagers need to feel confident that they will want to finish a learning project before undertaking the task. Learning is more about "meeting their internal needs rather than meeting external standards" (p. 15).

Engagers appreciate learning environments that encourage teamwork, helping others, and personal growth. Human interaction is extremely important to these learners. They are the group that especially enjoys meeting those around them and participating in activities such as drawing for a prize. They are quick to offer suggestions on making the learning environment more fun (Goodwin, 2001). "They succeed best with teachers who focus on learning rather than on formal evaluation and who encourage involvement in projects based on individual interests" (Conti & Kolody, 1999, p. 15). Engagers are passionate learners.

CHAPTER 3

METHODOLOGY

Design

This study utilizes a causal-comparative design. It focused on the learning styles and learning strategy preferences of OSU-Okmulgee students, their program divisions, and specific educational and demographic variables.

> Causal-comparative, or ex post facto, research is that research in which the researcher attempts to determine the cause, or reason, for existing differences in the behavior or status of groups of individuals. In other words, it is observed that groups are different on some variable and the researcher attempts to identify the major factor that has led to this difference. Such research is referred to as "ex post facto" ("after the fact") since both the effect and the alleged cause have already occurred and are studied by the researcher in retrospect. (Gay, 1987, p. 247)

This causal-comparative study examined the learning styles and learning strategies of students at OSU-Okmulgee. These are characteristics students already possess before the beginning of the study. Learning style was identified with the Learning Style Inventory, and learning strategies

were identified with Assessing The Learning Strategies of AdultS.

Sample

"The population is the group of interest to the researcher, the group to which she or he would like the results of the study to be generalizable" (Gay, 1987, p. 102). This ideal population is also referred to as the target population. The accessible, or available, population is the population from which the researcher can realistically select (Gay, 1987). The accessible population for this study was the students at OSU-Okmulgee.

A sample is a group that is representative of the population from which it was selected. Random sampling, stratified sampling, cluster sampling, and systematic sampling are the four basic sampling techniques or procedures (Gay, 1987). Random sampling is the process of selection that ensures each individual from the population has an equal opportunity for being selected.

> The researcher, either literally or figuratively, puts the names of all members of the population into a hat, shuffles the hat's contents, and then blindly selects out a portion of the names to determine which members of the total group will or won't be included in the sample. (Huck & Cormier, 1996, p. 105)

Stratified sampling is the process of selection

in which subgroups are represented the same as they are in the real population. Proportional stratified sampling guarantees proportional representation. "The group proportions in the sample are the same as in the population" (Gay & Airasian, 2000, p. 126).

In cluster sampling, groups are selected instead of individuals. Cluster sampling consists of selecting "a group of individuals who are naturally together. These individuals constitute a cluster insofar as they are alike with respect to characteristics relevant to the variables of the study" (Ary, Jacobs, & Razavieh, 1985, p. 143).

Systematic sampling is sampling in which individuals are selected from a list based on some set number such as every fourth name. In systematic sampling, all numbers of the population do not have an independent chance of being included in the sample (Gay, 1987, p. 112).

Proportional, stratified, cluster sampling was used in this study. In order to get a representative group of the total population, the technical divisions were divided into strata. The strata were four technical divisions including Automotive and HEVi Technologies, Construction

Technologies, Engineering Technologies, and Creative Arts Technologies. These four divisions collectively offer 40 distinct programs of study that at completion result in the awarding of the Associate of Applied Science degree. During recent restructuring, the Automotive and HEVi, Construction, and Engineering Technology Divisions were created. The Hospitality Services, Small Business, and Visual Communications departments have not yet been organized into a division. Presently, they are three separate and distinct departments not yet unified. Therefore, for the purpose of this study, each of these departments was treated as a division. These groups were proportionally stratified based on the number of students in a division compared to the total number of students at OSU-Okmulgee. Approximately 1,900 students enrolled in classes at OSU-Okmulgee in the fall of 2000 semester. An appropriate sample size for this population is 320 participants (Gay & Airasian, 2000, p. 135). This number was exceeded with a sample of 443 students.

The sample was also stratified by first-year and second-year students. Half of the classes selected in each division were designed for first-year students and the other half were designed for second-year students. First-

year students (63.7%) participating in the study outnumbered the second-year students (36.3%). This is consistent with the school breakdown for first-year students (68.78%) and second year students (31.22%).

The clusters utilized in this study were individual classrooms. Clusters selected for this study include 13 classes in Automotive/HEVi Technologies, 6 classes in Construction Technologies, 7 classes in Engineering Technologies, and 11 classes from the 3 program areas of Hospitality Services, Visual Communications, and Small Business that informally make up the Creative Arts Division. These three program areas will be treated as divisions for reporting purposes. Specifically, there were 134 students from the Automotive/HEVi Technologies Division, 84 from the Construction Technology Division, 79 from the Engineering Technologies Division, 46 from Hospitality Services, 70 from Visual Communications, and 21 from Small Business (see Table 1). The General Studies/Business Technology division did not participate in the study. This population was 34% of the total student body during the Fall 2000 semester. Continuing education students and concurrent enrollments account for the remaining nine students. These students were not included

in the analyses because they are in a special student status.

Table 1: Classes by Division & Student Body Representation

Divisions	Students by Division	Percentage of Student Population	Students in Sample	Percentage of Student Sample
Automotive/HEVi	345	18%	134	31%
Construction	234	12%	84	19%
Engineering	229	12%	79	18%
Hospitality	131	7%	46	11%
Visual Communications	271	14%	70	16%
Small Business	65	3%	21	5%
Gen Studies/Business	657	34%	N/A	N/A
Special Programs	N/A	N/A	9	N/A
Total	1932	100%	434	100%

Instruments

Kolb Learning Style Inventory (LSI)

The Learning Style Inventory was designed to measure an individual's learning-style preferences (Kolb, 1974) quickly and easily. The original questionnaire developed in 1974 had nine items, and three of these were distracters. The 1985 version was expanded to 12 items, all of which are used (Gregg, 1989, p. 441). The LSI takes only 10-15 minutes to complete and can be self-scored. Each item has four choices which are to be ranked in order of preference from a rating values of "4" to "1". Individuals choose a value of "4" to describe how they learn best and continue the ranking down to a "1" for the sentence ending that

seems least like the way they would learn (Kolb, 1985, p. 2).

In each item, the four choices deal with (a) Concrete Experience, (b) Reflective Observation, (c) Abstract Conceptualization, and (d) Active Experimentation. The order of the four categories is consistent for all questions simplifying the scoring process. The four primary scores are computed by adding the rating values for each stem: CE for Concrete Experience, RO for Reflective Observation, AC for Abstract Conceptualization, and AE for Active Experimentation (Kolb, 1985).

Scores for Abstract Conceptualization (AC) and Concrete Experience (CE) are at opposite ends of the perception learning scale, and scores for Active Experimentation (AE) and Reflective Observation (RO) are at opposite ends of the processing learning scale. Composite scores are calculated by subtracting the AC score from the CE score and the AE score form the RO score. These composite scores are used to place individuals along two axes; this assigns them to one of four quadrants, each representing a specific learning style (Kolb, 1985). The ranking format yields ipsative scores. Ipsative scores compare people to themselves rather than against others

(Bonham, 1988, p. 15). However, group norms are used to adjust the positions of scores on the axes (Kolb, 1985, p. 5).

Instrument validity is the degree to which a test measures what it is supposed to measure, and it is the single most important quality of an instrument (Gay & Airasian, 2000, p. 161). Construct validity, content validity, and criterion-related validity are specific types of instrument validity (Gay, 1987). "Construct validity is the degree to which a test measures an intended hypothetical construct" (Gay, 1987, p. 131). It assesses the underlying theory of the test (Borg & Gall, 1983, p. 280). Constructs are names for non-observable behaviors, which help to explain differences between individuals such as learning styles or learning strategies. The credibility of a construct requires a number of independent studies. Construct validity assessment involves expert judgment and external criteria (Gay, 1987). Construct validity for the LSI rests in the theoretical model of experiential learning that Kolb developed (Kolb, 1984).

"Content validity is the degree to which a test measures an intended content area" (Gay, 1987, p. 129) and "is determined by expert judgment" (p. 130). The concept

of content validity could also be addressed with statistical analysis. One of the things done with the LSI has been to compare it to different dimensions. The two dimensions on the LSI are dialectically opposed. That is, there is not a perfect mathematical relationship but a general relationship between LSI scores for AC and CE and between AE and RO. Results from a sample of 807 people indicated moderately negative correlations between AC and CE ($\underline{r} = -.57$, $\underline{p} < .001$) and between AE and RO ($\underline{r} = -.50$, $\underline{p} < .001$). The other correlations ranged from .13 to -.19. Based on this study, Kolb states:

> We would predict a moderate (but not perfect) negative relation between Abstract Conceptualization (AC) and Concrete Experience (CE) and a similar negative relation between Active Experimentation (AE) and Reflective Observation (RO). Other correlations should be near zero. (Kolb, 1984, p. 74)

Criterion-related validity "is determined by relating performance on a test to performance on another criterion" (Gay, 1987, p. 129). To support the validity of the idea that the two dimensions of the learning model are independent, Kolb relates studies that show that the LSI concrete/abstract dimension correlates with measures of cognitive development according to Kohlberg, Piaget, and others while the active/reflective dimension does not. The

same holds for correlations between LSI scores and age at entrance to college (Mentkowski & Strait, 1983).

The LSI technical reference manual shows a graph titled "Validity Relationship between Learning Styles and Career Field of Study" (Kolb, 1985), but there is no indication of how the graph supports the validity. Overall, the information provided by Kolb concerning the validity of the LSI is relatively weak. "The data do not prove the validity of the structural learning model" (Kolb, 1984), but Kolb suggests that the LSI is useful as an "analytic heuristic" for exploring the characteristics of learning (p. 76).

"Reliability is the degree to which a test consistently measures whatever it measures" and is usually expressed as a coefficient (Gay, 1987, p. 135). The higher the reliability the more likely the same results would be obtained if administered again (Gay, 1987). The reliability for the expanded version of the LSI is improved over the original. Both the primary and composite scores "show good internal reliability as measured by Cronback's Standardized Scale Alpha" (Gregg, 1989, p. 442) with values ranging from .73 to .88 (Kolb, 1985).

In a factor-analytic study, Kolb's LSI was the only

instrument of four learning style instruments "for which a match between factors and learning styles existed" (Ferrell, 1983, p. 36). Items loaded on four factors which generally matched the four learning styles determined from the LSI. However, some maintain that the ranking format of the LSI makes factor analysis inappropriate (Bonham, 1988, p. 15). Various studies have been done over time to address the validity although it is sometimes questioned. Therefore, the results of this study related to learning style must be interpreted with caveats concerning the validity and reliability of the LSI.

ATLAS

The ATLAS is an instrument used to determine learning strategy preferences of adult learners. The five different colored 5.5" x 8.5" card stock pages and the flow-chart design make the ATLAS simple to administer and easy to take providing immediate feedback to learners. On each page learners read:

> Sentence stems, which are in the top box on the page, lead to options in other boxes which complete the stem. Connecting arrows direct the respondent to the options. Each option leads the respondent to another box which either instructs the respondent to proceed to another colored card or which provides information about the respondents' correct group placement. (Conti & Kolody, 1999, p. 16)

"The construct validity for ATLAS was established by reviewing the literature of studies using SKILLS in field-based research and by consolidating the similar data from many of these studies" (Conti & Kolody, 1999, p. 18). The Inventory of Lifelong Learning Strategies (SKILLS) is an instrument that defines learning strategies in the five conceptual areas of Metacognition, Metamotivation, Memory, Critical Thinking, and Resource Management (p. 3). The data set from 3,070 cases from these studies was cluster analyzed to identify three groups of learners: Navigators, Problem Solvers, and Engagers (p. 16).

The content validity of ATLAS refers to the extent to which items in the instrument accurately depict the actual learning strategy characteristics of the three groups of learners delineated in the SKILLS' research (Conti & Kolody, 1999, p. 18). "Content validity was established by using discriminate analysis to determine the exact pattern of learning strategies used by each group when it was compared to the other groups" (Conti & Kolody, 1999, p. 19). The results of the discriminant analysis were used to form the questions for ATLAS.

Criterion-related validity is "validity which is determined by relating performance on a test to performance

on another criteria" (Gay, 1987, p. 543). The authors of ATLAS are continuing to gather criterion-related data from researchers (Ghost Bear, 2001; Goodwin, 2001; James, 2000; Turman, 2001; Willyard, 2000). Participants are asked if ATLAS correctly identifies their learning strategies. ATLAS group identification is accurate approximately 90% of the time which is consistent with follow-up studies of nearly 1,000 participants (Ghost Bear, 2001, p. 83).

Reliability for the ATLAS is ongoing. "Test-retest measures results are approximately 90% accurate for placing people in the same learning strategy preference category" (Willyard, 2000, pp. 88-89). Data from test-retest examinations covering periods of time from one-week to three-weeks, indicate a reliability coefficient of .89 (Conti, personal communication, October, 2000).

Procedure

Permission to conduct this study on the OSU-Okmulgee campus was granted by the President. Once the study was approved, several steps were taken to identify the stratified cluster sample. The initial goal was to sample a proportionate number of the students in each division, half first-year students and half second-year students. Once the number of students in each department was

identified, each division chair or program chair was contacted personally to explain the purpose of the study and the need to conduct the survey during class time with a specific number of first-year and second-year students in their area. Four divisions out of five chose to participate. Together classes were selected to gain the correct number and mix of participants. A total of 37 clusters were identified. A total of 429 students were identified through this process.

Next, the ATLAS and the Kolb LSI were administered to students in specific classes on scheduled dates. The students were given an overview of the purpose of the study. The ATLAS and data form were handed out first. Answers were recorded on a one-page, three-part data form. The researcher read directions for the ATLAS verbally, and students were asked to complete the ATLAS and fill out the data form. As the ATLAS instruments were collected, the LSI was passed out, and directions for completing this instrument were read to each class. Students completed the LSI by answering each question on the data form.

Finally, students were informed that participation was voluntary and that providing their Social Security Number on the answer sheet would verify their desire to

participate. Students were informed that their information on the data form would remain anonymous and that their names would never be connected to the survey. Each class was told the data would be scored and tallied. Class packets were given back with individual data sheets identified by student identification numbers.

At the end of the fall semester, data concerning students' cumulative grade point averages (GPA's) and hours attempted and completed were secured from student records through Computer Services. Accurate information was gathered because students' academic records were linked directly to their Social Security Numbers provided on the data form. This information was merged with the students' learning style and learning strategy information.

CHAPTER 4

FINDINGS

Data were gathered from two instruments, Kolb's Learning Styles Inventory and ATLAS. Both were administered to students at the beginning of a class period. Classes were selected from three academic divisions and three departments which for the purpose of this study are being treated as divisions at OSU-Okmulgee. Students electing to participate provided their Social Security Number for collecting additional data from OSU-Okmulgee Computer Services. This data included demographic, academic, and retention information.

Demographics

The male to female ratio for college enrollment has changed dramatically over the last 39 years. In 1962 males outnumbered females 65% to 35%, and 20 years ago that number had only changed slightly to a ratio of 60% to 40%. During the 1998-99 academic year, females outnumber males by a ratio of 55% to 45%. Among Oklahoma two-year institutions, only two still enroll more males than

females. One institution enrolled 88 more males than females, resulting in a ratio of 51% to 49%. The other institution is OSU-Okmulgee. It enrolled 684 more males than females (Oklahoma State Regents for Higher Education, OSRHE, 2000, p. 31). Females make up only 40% of the total enrollment at OSU-Okmulgee (Fox, 2000). Participants in this study were predominantly male (84%) (see Table 2). Thus, the sample contained more males than the overall OSU-Okmulgee population.

Table 2: Demographics Variables for Sample

Variable	Number	Percent
Gender		
Male	374	0.84
Female	69	0.16
Marital		
Single	404	0.92
Married	34	0.08
First Generation Student		
Yes	231	0.52
No	212	0.48
High School Grad		
Yes	349	0.79
No	94	0.21
Ethnic		
White	349	0.79
Native American	45	0.10
Black	18	0.04
Prefer no response	15	0.03
Hispanic	11	0.02
Asian	3	0.01
Other	1	0.00

	Mean	St. Dev.
Hours	57.18	40.10
Age	22.3	6.91
GPA	3.15	1.57

The mean age for students enrolled in public institutions in Oklahoma is 27.11. The mean age for freshmen and sophomores is 23.17 and 26.83 respectively (OSRHE, 2000, p. 31). OSU-Okmulgee's average age for males is 24.1, average age for females is 26.4, and the mean age for the total population is 24.9 (Fox, 2000). In this study, the mean age for all participants was 22.3; the average age for males was 21.78 and the average age for females was 25.13 (see Table 2).

Single students accounted for 80.6% of OSU-Okmulgee's enrollment in the fall 2000 semester (Fox, 2000). Of the 19.4% of married students, 11% were males. Almost all of the participants in the study are single (91.2%) (see Table 2). Of the 9.8% of married students, 14% were males.

Most (98.6%) participants in the study are United States citizens as are almost all (99.9%) of the students at OSU-Okmulgee. Of those OSU-Okmulgee students that are U.S. citizens (see Table 2), 93.4% are in-state residents and represent 75 Oklahoma counties (Fox, 2000). OSU-Okmulgee is below the average for foreign students (.1%)

when compared to the average for all Oklahoma two-year public institutions (.7%) during the 1998-99 academic year (OSRHE, 2000, p. 75).

Minority enrollments made up 25.8% of the Oklahoma state system's enrollment in the fall 1998 term, 23.5% of enrollment for two-year colleges (OSRHE, 2000, p. 75), and 25.4% of enrollment at OSU-Okmulgee (Fox, 2000). The sample for this study was representative of the total population with 27.9% minority participation (see Table 2). There were slightly fewer Blacks (4.1%) in the sample than in the OSU-Okmulgee total population (6.2%) during the Fall 2000 semester; the number of Blacks at OSU-Okmulgee is lower than the 1998 average for two-year institutions (7.9%) in Oklahoma. Asians made up .7% of the participants; this is representative of the .8% attending OSU-Okmulgee and is less than the 2.6% at other two-year institutions. Although Native Americans had higher representation in the study (10.2%) than other two-year colleges (9.4%), the percentage was lower than the total enrollment at OSU-Okmulgee (15.5%). The overall number of Native Americans in the population of the school may be higher because Okmulgee County is 12.8% Native American (Bureau of Census, 2001), and the Creek Nation Council

Headquarters is located in Okmulgee. Hispanics had lower representation in the study (2.5%) than other two-year institutions (2.9%) but the percentage was higher than the total enrollment at OSU-Okmulgee (2.3%).

Of the participants in this study, 78.8% were high school graduates (see Table 2). This is slightly higher than the number of high school graduates enrolled at OSU-Okmulgee (70.3%) during the same semester (Fox, 2000).

All first time students are required to submit ACT scores. Transfer students with 24 or more credit hours and students admitted in the adult admission category are exempt from this requirement. Students scoring a 19 or above in math, reading, or science are considered proficient in that subject area. The average ACT composite score for participants in the study was 18.9 (see Table 2) compared to 18.3 for all OSU-Okmulgee students the same semester (Fox, 2000). Statewide the three-year average for all colleges and universities from 1997 to 1999 is 20.9, and the last reported year average, 1999, is 20.6 (OSRHE, 2000, p. 25). The average cumulative GPA of the participants is 2.92 and the current GPA is 2.88.

Persistence rates produced by the Oklahoma State Regents for Higher Education is based on the number of

first-time, full-time freshmen in the fall who enroll the following academic year. Within state persistence refers to students who enroll the next year at the same institution or another Oklahoma state higher education institution (OSRHE, 2000, p. 109). Within institution persistence rates refers to those students who enroll the next year at the same institution. The 1997 average within state persistence rate at two-year institutions was 65.5% (p. 108). OSU-Okmulgee had a 66.4% persistence rate. However, OSU-Okmulgee has the highest within institution persistence rate (58.8%) of all two-year institutions (57.2%) in Oklahoma (p. 110).

Persistence rates as defined by the Oklahoma State Regents of Higher Education, cannot be determined for this study of learning styles and learning strategies of adult learners at OSU-Okmulgee. Data is limited to the Fall 2000 and Spring 2001 semesters. There is no data to indicate whether students who enrolled in the Fall 2000 semester will enroll in the Fall 2001 semester. Therefore, persistence data cannot be compared to persistence data reported by the Oklahoma State Regents of Higher Education.

The definition of persistence for this study will describe those students who enrolled in the Fall 2000

semester and re-enrolled in the Spring 2001 semester. The persistence rate for those in this study was 89%. Of those who did not re-enroll, 14.3% withdrew, 30.6% graduated, and 55.1% stopped out, which means they completed the semester but did not re-enroll.

Students were selected by classes from each division. Class size was part of the selection criteria in an attempt to have a proportionate representation of the entire student body. Divisions were represented as follows: Automotive/HEVi Technologies (134), Construction Technologies (84), Engineering Technologies (79), Hospitality (46), Visual Communications (70), and Small Business (21).

Participants in this study were predominantly male (84%) and single (91%) with a mean age of 22. Most of the participants were United States citizens (99%), in-state residents (93%), Caucasian (74%) and high school graduates (79%). The average ACT composite score was 18.9, and the cumulative GPA was 2.92. Most (89%) persisted from the Fall 2000 semester to the Spring 2001 semester.

Learning Styles and Strategies Profile

Learning Style Inventory

The LSI yields continuous and categorical scores. The

continuous scores produce individual scores and combination scores for each of the four dimensions: Concrete Experience (CE), Reflective Observation (RO), Abstract Conceptualization (AC), and Active Experimentation (AE). Learners scoring high on Concrete Experience (CE) prefer to learn by emerging themselves in new experiences. Learners scoring high on Reflective Observation (RO) need opportunities to reflect on new information. Those scoring high on Abstract Conceptualization (AC) prefer learning environments conducive for integrating new information with existing theories. They use theory to problem solve and make decisions. Those scoring high on Active Experimentation (AE) take a more practical approach to learning and want to see what works; they experiment, influence, and change situations (Kolb, 1974, p. 92). These scores are then calculated to determine two composite scores: Abstract Conceptualization and Concrete Experience (AC-CE) and Active Experimentation and Reflective Observation (AE-RO). These scores reflect two different ways by which we learn. The composite score for Abstract Conceptualization and Concrete Experience (AC-CE) refers to how an individual perceives or takes in new information. The composite score for Active Experimentation and

Reflective Observation (AE-RO) refers to how an individual processes information. The composite scores, which are the integration of the perception learning scale and the processing learning scale, places individuals in one of four quadrants each representing a particular learning style (see Table 3).

Table 3: Learning Style Distribution

LSI	Count	Percentage
Converger	119	27
Assimilator	124	28
Diverger	95	21
Accomodator	105	24
Total	443	100

The Converger asks how something works. The Assimilator asks for the facts. The Diverger asks why or why not and the Accomodator asks what can this object or situation become (Kolb, 1976). The students were evenly distributed in their learning styles. There were 119 Convergers, 124 Assimilators, 95 Divergers, and 105 Accomodators.

ATLAS

ATLAS places individuals in one of three groups of learners: Navigators, Problem Solvers, or Engagers. Participants in this study were not equally distributed between groups of learners. There are 195 Engagers, 140

Problem Solvers, and 95 Navigators. Of these respondents, the majority (89.9%) felt ATLAS accurately described them.

A chi-square was conducted to determine if there is any significant relationship between the learning strategy scores of the students at OSU-Okmulgee and the norms for ATLAS. The chi-square statistic is used to determine whether an observed frequency distribution is significantly different from a hypothesized frequency distribution (Roscoe, 1975, p. 247).

The expected outcomes based on the norms for ATLAS are relatively equal: Navigators--36.5%, Problem Solvers--31.7%, and Engagers--31.8% (Conti & Kolody, 1999, p. 18). This expected distribution was not found for students attending OSU-Okmulgee Fall 2000. A chi-square goodness of fit indicates a significant difference in the observed and expected outcomes for ATLAS (x^2=47.9, df=2, p=.001). There were fewer Navigators (22.2%) and more Engagers (45.1%) than expected (see Table 4). However, Problem Solvers (32.7%) were represented very closely to the expected frequencies.

Table 4: Observed and Expected Outcomes for ATLAS Categories

Groups	Observed	Expected	Difference
Navigator	95	156.22	-61.22

Problem Solver	140	135.68	4.32
Engager	193	136.10	56.90
Total	428		

Learning Styles and Learning Strategies Relationship

The relationship between learning styles and learning strategies was analyzed using the LSI and ATLAS. Since both instruments place respondents into categories, chi-square was used with this nominal data to analyze the relationship of these ratings. Chi-square tests for contingency tables are useful statistical procedures for determining whether two nominal (or higher level) measures are related. The expected frequencies are derived from sample data (Roscoe, 1975, p. 254-255) to determine if two variables are independent of each other. Scores on both the LSI and ATLAS were available on 428 participants. No significant differences were found in the distribution of the categories on the two scales (x^2=9.01, df=6, p=.17) (see Table 5). Thus, the categorical groupings for learning styles and learning strategies are independent of each other.

Table 5: Crosstabulation of Learning Styles and Learning Strategies

ATLAS Groups	LSI Groups			
	Converger	Assimilator	Diverger	Accomodator
Navigator				
Observed	21	33	21	20

Expected	26	26	20	23
Problem Solver				
Observed	38	45	24	33
Expected	38	39	29	34
Engager				
Observed	57	41	45	50
Expected	52	54	41	46

In addition to the categorical groupings for learning styles, the LSI also produces several continuous scores. For each of these scores, an analysis of variance (ANOVA) was conducted to examine the relationship between learning styles and learning strategies. Analysis of variance is a means for "the researcher to use the data in the samples for the purpose of making a single inferential statement concerning the means of the study's populations" (Huck & Cormier, 1996, p. 296). It determines "whether there is a significant difference between two or more means at a selected probability level" (Gay & Airasian, 2000, p. 490).

Several one-way analysis of variance procedures were conducted with the participants grouped by their learning strategy on ATLAS and with LSI scores. The LSI scores for Concrete Experience (CE), Reflective Observation (RO), Abstract Conceptualization (AC), and Active Experimentation (AE) and the combination scores of Abstract Conceptualization and Concrete Experience (AC-CE) and

Active Experimentation and Reflective Observation (AE-RO) were used. Significant differences were found for Abstract Conceptualization and for the Abstract Conceptualization and the Concrete Experience scales (see Table 6). Post hoc analysis using the Duncan procedure indicated that means for Navigators (29.6) and Problem Solvers (30.2) differ from Engagers (27.8) in Abstract Conceptualization. Navigators and Problem Solvers rely more on systematic planning and like to integrate new information with existing theories than Engagers. Engagers are less likely to develop theories to solve problems.

Table 6: ANOVA for Learning Styles and Learning Strategies

Source	SS	df	MS	F	p
AC					
Between	503.96	2	251.98	6.54	0.002
Within	16102.18	418	38.52		
AC-CE					
Between	1513.69	2	756.84	5.73	0.004
Within	54464.09	412	132.19		
AE-RO					
Between	730.31	2	365.16	2.58	0.077
Within	57656.10	407	141.66		
AE					
Between	265.47	2	132.74	2.34	0.098
Within	23701.78	418	56.70		
CE					
Between	261.68	2	130.84	2.09	0.125
Within	26123.75	418	62.50		
RO					

Between	111.84	2	55.92	1.16	0.315
Within	20204.45	418	48.34		

Kolb regards the dimensions Abstract Conceptualization and Concrete Experience (AC-CE) to be polar opposites for perceiving information and Active Experimentation and Reflective Observation (AE-RO) to be polar opposites for processing information. The ANOVA indicates a significant difference on the AC-CE scale (see Table 6). Thus, Navigators, Problem Solvers, and Engagers do not all perceive information the same. Post hoc analysis with the Duncan shows that means for Engagers (2.6) differ from Problem Solvers (6.6) and Navigators (6.0) in the way they perceive information. The Engagers are more likely to perceive information through the "feeling" dimension while the Navigators and Problem Solvers rely on the "thinking" dimension.

Programs of Study and Learning Styles and Strategies

ANOVA was conducted to determine if there is a relationship between a student's selected program of study by division and their learning style. Separate one-way analyses of variance were conducted for the Concrete Experience (CE), Active Experimentation (AE), Reflective Observation (RO), Abstract Conceptualization (AC), Active Experimentation and Reflective Observation (AE-RO), and

Abstract Conceptualization and Concrete Experience (AC-CE) scales. For each analysis, the participants were grouped according to their academic division. Several departments are in the process of forming a Creative Arts Technology division. However, since that division has not yet been formed, each of these departments was treated as a division.

Significant differences were found for the cognitive tasks Active Experimentation and Concrete Experience (see Table 7). Post hoc analysis using the Duncan procedure indicated that those in Visual Communications (32.96) had mean scores lower than all the other groups on Active Experimentation. Since Active Experimentation and Reflective Observation are polar opposites, these data suggest students in Visual Communications are less inclined for their learning to take an active form such as "experimenting with, influencing or changing situations" (Kolb, 1984, p. 4) than students in other programs of study. Those who score high on this dimension would take a practical approach and be concerned with what really works (p. 4). The post hoc analysis for Concrete Experience indicated that no differences could be found among the groups despite the overall difference reported in the

ANOVA.

Table 7: ANOVA for Learning Style Dimensions by Program of Study

Source	SS	Df	MS	F	p
AE					
Between	1123.71	5	224.74	4.07	0.001
Within	23251.97	421	55.23		
CE					
Between	940.53	5	188.11	3.08	0.010
Within	25702.75	421	61.05		
AC-CE					
Between	1178.05	5	235.61	1.77	0.118
Within	55063.14	414	133.00		
AC					
Between	335.01	5	67.00	1.72	0.130
Within	16438.88	421	39.05		
AE-RO					
Between	1227.57	5	245.51	1.70	0.134
Within	59312.89	410	144.67		
RO					
Between	159.80	5	31.96	0.64	0.671
Within	21094.24	421	50.11		

The relationship of program of study to learning was also analyzed based upon the participants' classification for learning style and learning strategy. Chi-square analyses found that there was no relationship for learning styles (X^2=19.34, df=15, p=.20) or learning strategies (X^2=7.80, df=10, p=.65). Thus, the distribution of students in the various divisions is independent of either learning style (see Table 8) or learning strategies (see Table 9).

Table 8: Chi-square for Learning Styles by Program of Study

Divisions	KOLB			
	Converger	Assimilator	Diverger	Accomodator
Automotive/HEVi				
Observed	40	31	26	37
Expected	36	38	28	32
Construction				
Observed	23	25	13	23
Expected	22	24	18	20
Engineering				
Observed	27	25	14	13
Expected	21	23	17	19
Hospitality				
Observed	11	11	15	9
Expected	12	13	10	11
Visual Communications				
Observed	10	25	19	16
Expected	19	20	15	17
Small Business				
Observed	5	7	4	5
Expected	6	6	4	5
Total				
Observed	116	124	91	103
Expected	116	124	91	103

Table 9: Chi-square for Learning Strategies by Program of Study

Divisions	ATLAS		
	Navigator	Problem Solver	Engager
Automotive/HEVi			
Observed	27	46	58
Expected	28	43	60
Construction			
Observed	13	25	42
Expected	17	26	36
Engineering			

Observed	19	30	29
Expected	17	26	35
Hospitality			
Observed	9	12	21
Expected	9	14	19
Visual Communications			
Observed	16	21	32
Expected	15	23	31
Small Business			
Observed	7	4	9
Expected	4	7	9
Total			
Observed	91	138	191
Expected	91	138	191

Academic Variables and Learning Styles and Strategies

The interaction of available academic variables with learning styles and with learning strategies was analyzed using discriminant analysis. This study is one of several studies that explores individual differences in learning and that has been conducted using the Learning Styles Inventory (Kolb, 1985) to investigate learning styles of college students and Assessing The Learning Strategies of AdultS (Conti & Kolody, 1999) to investigate the learning strategies preferences of adults. Many of these learning strategy studies have used a similar format for presenting the discriminant analyses that were conducted. In order to compare results of the current research with earlier ones, the following presentation of the discriminate analyses

parallels the write-up of earlier studies (cf., Kolody, 1997; Lockwood, 1997).

Discriminant analysis is a statistical technique which allows the investigation of the differences between two or more groups in relationship to several variables simultaneously (Klecka, 1980, p. 7). The emphasis is upon analyzing the variables together rather than singly in order to examine the interaction of these variables (Conti, 1993). "Discriminant analysis requires the researcher to make meaningful decisions about the data and to impose sense upon it" (p. 90).

Discriminant analysis can be used either to describe the way groups differ or to predict membership in a group. In this study, four separate discriminant analyses were used to investigate if learning styles and learning strategies could be used to identify the ways groups differed. For the first two analyses, the participants were grouped by learning style and learning strategies with academic variables used as the discriminating variables. In the final two analyses, they were grouped in a similar fashion with demographic variables used as the discriminating variables.

Two criteria were used in this study for judging if it

was possible to discriminate between those in the group using the discriminating variables related to learning styles and learning strategies. The discriminant function produced by the analysis had to be describable using the structure coefficients with a value of .3 or greater (Conti, 1993, p. 93) and the discriminant function had to correctly classify at least one-half of the cases above the chance placement.

Discriminant analysis produces a discriminant function regardless of the meaning or the statistical significance of the function. The first criterion requires that the discriminant function must have clarity in order to be judged good and useful. The second criterion requires the discriminant function to account for a significant amount of variance before it could be judged good and useful. Thus, these two criteria required that the function be both clearly descriptive and highly accurate in order to be used.

Learning Styles

Learning styles was first used to describe the combination of academic variables that could be used to distinguish the learning styles of students at OSU-Okmulgee. For this analysis, the 443 respondents were

placed in four groups according to the classification on the Learning Style Inventory. The breakdown of participants in each group was as follows: Convergers--119, Assimilators--124, Divergers--95, and Accomodators--105. The set of discriminating variables used to predict placement in these groups consisted of ACT scores, Accuplacer scores, and cumulative GPA. ACT scores included the separate scores for English, math, reading, science, and composite. Accuplacer scores included the separate variables of reading, English, math, and algebra.

The pooled within-groups correlations are the correlations for the variables with the respondents placed in their groups of Converger, Assimilator, Diverger, and Accomodator. The pooled within-groups correlation matrix of discriminating variables was examined because interdependencies among variables are important in multivariate analyses. Variables should not be sharing variance. If they are, they should not be included in the analysis. The within-groups matrix reveals how the discriminant function is related to the variables within each group in the analysis. The examination of the 36 coefficients in this analysis showed that most were at a sufficiently weak level to retain the variables in the

analysis. Only four coefficients were at the .6 level and .7 level, six were at the .5 level, seven at the .4 level, five at the .3 level, and seven at the .2 level, and seven at the .1 level. Thus, the variables in this analysis were not sharing enough variance to justify removing any from the analysis.

Stepwise selection was used to determine which variables added most to the discrimination between the learning styles groups. Wilks' lambda was chosen for this analysis because it takes into consideration both the differences between the groups and the cohesiveness within the groups and because it is commonly used in discriminant analysis studies in education. This study resulted in one variable being included in the discriminant function. The only variable included was Cumulative GPA with a Wilks' lambda of .93. The other eight variables included in the analysis did not account for enough variance to be included in the discriminant function.

Standardized discriminant function coefficients are used to determine which variables contribute most to the discrimination between the groups. The standardized coefficients indicate the relative importance of each variable to the overall discriminant function. The

standardized coefficient for Cumulative GPA for this function which discriminated between Convergers, Assimilators, Divergers, and Accomodators was 1.00.

The percentage of cases correctly classified shows how accurate the discriminant function was in grouping the students at OSU-Okmulgee. Because of the four learning styles groups, the chance of random placement in a group is 25%. This discriminant function was 29.8% accurate in classifying cases; this is only a 4.8% improvement over chance. It correctly placed 77 (64.7%) in the Converger group, 43 (34.7%) in the Assimilator group, 9 (9.5%) in the Diverger group, and 3 (2.9%) in the Accomodator group. Thus, the discriminant function does not prove much improvement over chance in predicting group placement.

The discriminant function which was used to classify the cases into these groups was as follows:

$\underline{D}$ = 1.144(Cumulative GPA) - 3.358.

The group centroids for the four groups were as follows: Converger (.390), Assimilator (-.278), Diverger (.035), and Accomodator (-.172). The canonical correlation, which is a measure of the degree of association between the discriminant scores and the groups, was .27 for this analysis. When this is squared, it indicates that the

groups explain only 7% of the variation in the discriminant function.

The structure matrix contains the coefficients which show the similarity between each individual variable and the total discriminate function. The variables with the highest coefficients have the strongest relationship to the discriminant function (Klecka, 1980, p. 31). In a descriptive study, this is the most important information related to the discriminant function. In this interpreting process, variables with coefficients of approximately .3 and above are generally included in the interpretation (Conti, 1993).

Two variables had sufficient coefficients to be included in the interpretation of the meaning of the discriminant function. They were Cumulative GPA (1.00) and Algebra ACP (.322). However, because of the low percentage of variance explained by the discriminant function and because of its lack of accuracy in placing people into the correct group, the discriminant function was not named.

Thus, a discriminant analysis was calculated to investigate the hypothesis that it was not possible to use a variety of variables related to academic performance to discriminate between students' learning styles at OSU-

Okmulgee. Based on the low percentage of variance explained by the discriminant function between groups and the low percentage of accuracy of prediction into the groups by the discriminant function, it was determined that it is not possible to use ACT scores, Accuplacer scores, or GPA to discriminate between groups categorized by learning styles.

Learning Strategies

The same process and set of discriminating variables were used to discriminate between groups categorized by learning strategies. For this analysis, the 379 respondents were placed in three groups: Navigators--78, Problem Solvers--116, and Engagers--172.

The examination of the 36 pooled within-groups coefficients in this analysis showed that most were at a sufficiently weak level to retain the variables in the analysis. Only four coefficients were at the .6 level and .7 level, six were at the .5 level, six at the .4 level, seven at the .3 level, and six at the .2 level. The remaining seven were all below the .2 level. Thus, the variables in this discriminant analysis were not related to each other and consequently were not sharing a common variance.

As a result of using stepwise selection and Wilks'

lambda, only one variable was included in the discriminant function. This was the Accuplacer Reading score with a Wilks' lambda of .90. The other eight variables included in the analysis did not account for enough variance to be included in the discriminant function. The standardized coefficient for this Reading score was 1.00.

With the learning strategy groups, the chance placement in a group in this analysis was 33.3%. This discriminant function was 45.6% accurate in classifying cases. This is a 12.3% improvement over chance. It correctly placed 0(0%) in the Navigator group, 62 (53.4%) in the Problem Solver group, and 105 (61%)% in the Engager group. Thus, the discriminant function did not provide much improvement over chance in predicting group placement.

The discriminant function which was used to classify the cases into these groups was as follows:

$\underline{D}$ = .030(Reading ACP) - 1.596.

The group centroids for the three groups were Navigator (.279), Problem Solvers (.356), and Engagers (.321). The canonical correlation was .31 for this analysis. When this is squared, it indicates that the groups explain only 10% of the variation in the discriminant function.

Three variables from the structure matrix had

sufficient coefficients to be included in the interpretation of the meaning of the discriminant function. They were Reading ACP (1.00), Math ACP (-.558), and Algebra ACP (.339). However, because of the low percentage of variance explained by the discriminant function and because of its lack of accuracy in placing people into the correct group, the discriminant function was not named.

Thus, a discriminant analysis was calculated to investigate the hypothesis that it was not possible to use a variety of variables related to academic performance to discriminate between students' learning strategies at OSU-Okmulgee. Based on the low percentage of variance explained by the discriminant function between groups and the low percentage of accuracy of prediction into the groups by the discriminant function, it was determined that it is not possible to use ACT scores, Accuplacer scores, and GPA to discriminate between groups categorized by learning strategies.

Demographic Variables and Learning Styles a and Strategies

Learning Styles

Two discriminant analyses were also conducted to investigate the relationship of demographic variables to

learning style and to learning strategies. In the first of these two analyses, the discriminating variables were the demographic variables of gender, age, marital status, race, first time college student, and high school graduate. The 443 respondents were placed in the learning style groups of Convergers (119), Assimilators (124), Divergers (95), and Accomodators (105).

The examination of the 15 pooled within-groups coefficients in this analysis showed that most were at a sufficiently weak level to retain the variables in the analysis. Only 1 coefficient was at the .3 level, 2 were at the .2 level, and the remaining 12 were all below the .1 and below level. Therefore, all variables were retained in the analysis.

As a result of the stepwise procedure, one variable was included in the discriminant function. This was being a first time college student and had a Wilks' lambda of .97. The other five variables included in the analysis did not account for enough variance to be included in the discriminant function. Because it was the only variable in the function, its standardized coefficient was 1.00.

The chance placement into one of the four learning styles groups is 25%. This discriminant function was 31.2%

accurate in classifying the cases and was therefore a 6.29% improvement over chance. It correctly placed 0(0%) in the Converger group, 76 (61.3%) in the Assimilator group, 0(0%) in the Diverger group, and 62 (59%)% in the Engager group. Thus, the discriminant function did not provide much improvement over chance in predicting group placement.

The discriminant function which was used to classify the cases into these groups was as follows:

$\underline{D}$ = 2.022(First Time College Student) - 2.991.

The group centroids for the three groups were Converger (-.06), Assimilator (.269), Diverger (-.118), and Accomodator (-.142). The canonical correlation was .17 for this analysis. When this is squared, it indicates that the groups explain only 3% of the variation in the discriminant function.

Two variables from the structure matrix had sufficient coefficients to be included in the interpretation of the meaning of the discriminant function. They were First Time College Student (1.00) and Age (.294). However, because of the low percentage of variance explained by the discriminant function and because of its lack of accuracy in placing people into the correct group, the discriminant function was not named.

Thus, a discriminant analysis was calculated to investigate the hypothesis that it was not possible to use a variety of demographic variables to discriminate between students' learning styles at OSU-Okmulgee. Because of the low amount of variance explained, and the low percentage of accuracy of prediction into the groups, it was determined that it is not possible to use demographic variables to discriminate between groups categorized by learning styles.

Learning Strategies

The same process and discriminating variables were used to discriminate between groups categorized by learning strategies. For this analysis, the 427 respondents were placed in the following three groups: Navigators--95, Problem Solvers--140, and Engagers--192.

The examination of the 15 pooled within-groups coefficients in this analysis showed that most were at a sufficiently weak level to retain the variables in the analysis. Only two coefficients were at the .3 level, one at the .2 level, and the remaining twelve were all below the .2 level. Thus, the variables in this discriminant analysis were not related to each other and consequently were not sharing a common variance.

As a result of the stepwise procedure, one variable was included in the discriminant function. Age had a Wilks' lambda of .95. The other five variables included in the analysis did not account for enough variance to be included in the discriminant function. As the only variable, it had a standardized coefficient of 1.00.

The chance placement into one of the three learning strategy groups is 33.3%. This discriminant function was 45.2% accurate in classifying cases. It correctly placed 29 (30.5%) in the Navigator group, 10 (7.1%) in the Problem Solver group, and 154 (80.2%) in the Engager group. Thus, the discriminant function did not provide much improvement over chance in predicting group placement.

The discriminant function which was used to classify the cases into these groups was as follows:

$\underline{D} = .158(\text{Age}) - 3.501.$

The group centroids for the three groups were Navigator (.325), Problem Solver (.110), and Engager (-.241). The canonical correlation was .23 for this analysis. When this is squared, it indicates that the groups explain only 5% of the variation in the discriminant function.

Three variables from the structure matrix had sufficient coefficients to be included in the

interpretation of the meaning of the discriminant function. They were Age (1.00), Marital Status (.357), and First Time College Student (.307). However, because of the low percentage of variance explained by the discriminant function and because of its lack of accuracy in placing people into the correct group, the discriminant function was not named.

Thus, a discriminant analysis was calculated to investigate the hypothesis that it was not possible to use a variety of variables related to demographics to discriminate between students' learning strategies at OSU-Okmulgee. Because of the low amount of variance explained and the low percentage of accuracy of prediction into the groups by the discriminant function, it was determined that it is not possible to use demographic variables to discriminate between groups categorized by learning strategies.

Groups of Learners

Cluster analysis was conducted to determine if groups existed among OSU-Okmulgee students based on the measures of learning styles, learning strategy preferences, academic variables, and demographic variables. Of the 443 participants, complete data were available on 435. The

goal of cluster analysis is to "have meaning and understanding emanate from the data itself" (Conti, 1996, p. 67). Whereas, discriminant analysis is a deductive process in that the researcher attempts to impose sense upon the data, cluster analysis is an inductive process (p. 67). Cluster analysis is an encompassing term for a variety of techniques that can be used to group objects and variables into a meaningful classification system (Aldenderfer & Blashfield, 1984, p. 7). "A clustering method is a multivariate statistical procedure that starts with a data set containing information about a sample of entities and attempts to reorganize these entities into relatively homogeneous groups" (p 7). Rather than examining variables individually, cluster analysis is a holistic approach combining all variables which are then "analyzed in relationship to each other" (Conti, 1996, p. 68).

Cluster analysis is a hierarchical agglomerative technique which compares cases and sequentially merges the most similar cases (Aldenderfer & Blashfield, 1984, p. 36). There are several different types of hierarchical agglomerative methods distinguished by their rules for clustering. The specific procedure used in this study was

the Ward's method. Ward's method attempts to minimize the variance and "tends to create clusters of relatively equal size" (Aldenderfer & Blashfield, 1984, p. 43).

In this study, specific variable measures were used to determine if clusters of student learners existed at OSU-Okmulgee. The 25 variables consisted of specific measures in the areas of learning styles, learning strategy preferences, academic information, and demographic information. The learning styles variables were the scales for Concrete Experience (CE), Reflective Observation (RO), Abstract Conceptualization (AC), and Active Experimentation (AE) and the combination scores of Abstract Conceptualization and Concrete Experience (AC-CE) and Active Experimentation and Reflective Observation (AE-RO). Dummy variables were created for Navigators, Problem Solvers, and Engagers as the three learning strategies variables. Academic variables included cumulative GPA, ACT scores, Accuplacer scores, and hours and classes attempted and passed. ACT scores included English, reading, math, science, and a composite. Accuplacer scores included English, reading, math, and algebra. Demographic variables included gender, age, marital status, race, first time college student status, high school graduate status,

classification, learning style, learning strategy preferences, and retention. The SPSS Cluster Analysis procedure was utilized. Upon examination of the data, the three-cluster solution was determined to be the best explanation of the data based on the distribution of participants in each group. The three groups were named At Risk (165), Marginal (134), and Prepared (105).

In order to understand the meaning of the clusters, additional information is needed. One technique is to look at each variable within a cluster separately (Norusis, 1988, p. B-95). Another method of gaining insight is discriminant analysis. Although it is not be used to validate the cluster structure (Aldenderfer & Blashfield, 1984, pp. 64-65), discriminant analysis is a useful tool for identifying the process that separates the clusters. This helps to describe the clusters (Conti, 1996, p. 71).

A meaningful discriminant function is produced because the groups have been created by the cluster analysis (Aldenderfer & Blashfield, 1984, p. 12; Conti, 1996, p. 70-71). An examination of the 198 pooled within-groups coefficients in this analysis showed that most were at a sufficiently weak level to retain the variables in the analysis. Only 7 coefficients were above the .4 level, 3

were at the .4 level, 10 were at the .3 level, 5 at the .2 level, and the remaining 165 were all below the .2 level. Thus, the variables in this discriminant analysis were not related to each other and consequently were not sharing a common variance.

The Wilks' lambda stepwise procedure revealed that out of the 25 variables included in the discriminant function, eight had a Wilks' lambda strong enough to be included in the analysis: ACP reading--.13, ACP English--.10, ACP math --.09, ACP algebra--.08, ACT science--.07, ACT composite--.07, high school graduate--.07, and AE--.07. For Function 1 the standardize coefficients were as follows: ACT science (-.27), ACT composite (-.09), ACP reading (1.09), ACP English (-.11), ACP math (-.45), ACP algebra (.24), AE (.16), and HS graduate (.00). For Function 2 the standardize coefficients were ACT science (.05), ACT composite (.36), ACP reading (-.15), ACP English (.72), ACP math (-.28), ACP algebra (.51), AE (-.09), and HS graduate (-.39). This function correctly classified 95% of the cases with the following accuracy rate for each cluster: At Risk--99.4%, Marginal--86.7%, and Prepared--96.3%.

The discriminant function used to classify the cases for Function 1 was as follows:

$$\underline{D} = .09(\text{ACP reading}) + .01(\text{ACP algebra}) + .02(\text{AE}) + .00(\text{high school graduate}) - .06(\text{ACT science}) - .01(\text{ACT comp}) - .01(\text{ACP English}) - .02(\text{ACP math}) - 2.42.$$

The discriminant function used to classify the cases for Function 2 was as follows:

$$\underline{D} = .01(\text{ACT science}) + .05(\text{ACT comp}) + .05(\text{ACP English}) + .03(\text{ACP algebra}) - .01(\text{ACP reading}) - .02(\text{ACP math}) - .01(\text{AE}) - .99(\text{high school graduate}) - 3.77.$$

The eigenvalue for Function 1 was very high at 9.88. The canonical correlation, which was .95, explained 90.3% of the variance in the groups. The eigenvalue for Function 2 was .38 and the canonical correlation of .53, explained 28.09% of the variance in the groups.

The most important item in the discriminant analysis to help name the process that separates the clusters is the structure matrix. The structure for this analysis contained two variables with high enough coefficients to be included in the naming process although one was almost 2.5 times more powerful than the other. The ACP reading variable had the highest coefficient which was .82. This variable is the score from a required assessment used for placement in college classes. The second variable was First Time College Student and had a coefficient of .28. This refers to those students who had never attended college on any

campus prior to the Fall 2000 semester. Therefore, the process that separates the groups was called Campus Acculturation. The mean ACP reading scores for each group was as follows: At Risk (19.03), Marginal (51.66), and Prepared (89.57). Students are considered proficient in reading with a score of 77. A score of 76 or below indicates performance deficiency. Students must either retest for a maximum of three tries or enroll in the remedial class College Reading 1. The First Time College Student percentages for each group were as follows: At Risk (90.90%), Marginal (45.70%), and Prepared (9.70%).

Based upon the structure matrix, the process that separates the three groups of At Risk, Marginal, and Prepared was named Campus Acculturation. The variables that contributed to grouping OSU-Okmulgee students were the academic variable of Reading Level and the demographic variable of First Time College Student. Learning styles, learning strategies, the remaining academic variables, and the remaining demographic variables did not make a difference.

Data from the clusters and discriminant analysis help describe the three groups. Analyses of variance were also run to give the data more meaning. There were more males

(86%) and fewer females (14%) in the At Risk group than males (82%) and females (18%) in the Marginal group or males (83%) and females (17%) in the Prepared group (see Table 10). However, an analysis of variance indicated no relationship between gender and group placement (see Table 11).

Table 10: Campus Acculturation Group Descriptions

Variables	Groups		
	At Risk	Marginal	Prepared
Number of Participants	165	105	134
Demographics			
Male	86%	82%	83%
Female	14%	18%	17%
Age	19.42	24.00	23.75
Single	96%	90%	88%
Race			
Black	1.80%	6.70%	4.50%
Native American	9.70%	18.10%	4.50%
Other	4.90%	4.90%	0.70%
Variables	Groups		
	At Risk	Marginal	Prepared
White	83.60%	69.50%	81.30%
First Time College	90.90%	45.70%	9.70%
HS Graduate	92.70%	65.70%	72.40%
Freshmen	99%	52%	31%
Sophomore	1%	48%	69%
ACT			
English	17.41	16.36	18.49
Math	17.89	16.35	18.47
Reading	18.46	17.15	20.39
Science	19.34	17.76	20.66
Composite	19.93	17.85	21.68

Accuplacer			
Reading	19.03	51.66	89.57
English	87.46	75.11	92.76
Math	93.13	71.85	65.46
Algebra	68.60	58.67	83.73
LSI			
CE	25.34	24.84	23.06
RO	30.27	30.59	31.16
AC	28.48	27.89	30.43
AE	35.92	36.69	35.35
AE-RO	5.65	6.10	4.19
AC-CE	3.14	3.05	7.37
ATLAS			
Navigator	0.20	0.19	0.28
Problem Solver	0.25	0.38	0.37
Engager	0.55	0.43	0.34
Academic Progress			
Cumulative GPA	2.89	2.89	2.99
Hours Attempted	14.88	14.42	14.87
Hours Earned	12.97	12.29	13.35
Enrolled Remedial	13%	13%	4%
Passed Remedial	10%	11%	2%
Enrolled Cornerstone	14%	52%	78%
Passed Cornerstone	33%	63%	84%
Re-enrolled Spring	93%	87%	87%

Table 11: ANOVA-Relationship between Selected Variables and Group Placement

Source	SS	df	MS	F	p
	ACT				
Reading					
Between	661.89	2	330.95	23.40	0.001
Within	5571.26	394	14.14		
English					
Between	285.03	2	142.52	19.81	0.001
Within	2834.26	394	7.19		

Science					
Between	520.65	2	260.33	15.13	0.001
Within	6778.59	394	17.20		
Math					
Between	298.03	2	149.02	10.40	0.001
Within	5646.24	394	14.33		
Composite					
Between	892.41	2	446.21	8.32	0.001
Within	21124.47	394	53.62		
	Accuplacer				
Reading					
Between	364727.58	2	182363.79	1376.31	0.001
Within	52205.84	394	132.50		
Math					
Between	72382.50	2	36191.25	100.48	0.001
Within	141918.94	394	360.20		
Algebra					
Between	38414.99	2	19207.50	50.45	0.001
Within	150008.72	394	380.73		
English					
Between	18719.57	2	9359.79	40.33	0.001
Within	91439.55	394	232.08		
	Learning Style Inventory				
AC-CE					
Between	1554.68	2	777.34	5.84	0.003
Source	SS	df	MS	F	p
Within	52401.71	394	133.00		
AC					
Between	431.26	2	215.63	5.47	0.005
Within	15539.62	394	39.44		
CE					
Between	378.70	2	189.35	2.98	0.052
Within	24996.21	394	63.44		
AE-RO					
Between	258.35	2	129.18	0.89	0.411
Within	57072.14	394	144.85		
AE					

Between	100.25	2	50.12	0.85	0.429
Within	23283.68	394	59.10		
RO					
Between	61.55	2	30.78	0.62	0.539
Within	19587.37	394	49.71		
	ATLAS				
Engager					
Between	3.16	2	1.58	6.54	0.002
Within	95.23	394	0.24		
Problem Solver					
Between	1.70	2	0.85	3.90	0.021
Source	SS	df	MS	F	p
Within	85.74	394	0.22		
Navigator					
Between	0.61	2	0.31	1.79	0.169
Within	67.32	394	0.17		
	Demographic				
High School Grad					
Between	5.19	2	2.59	17.41	0.001
Within	58.69	394	0.15		
First-Time Student					
Between	48.29	2	24.15	187.71	0.001
Within	50.68	394	0.13		
Marital					
Between	1856.97	2	928.48	26.10	0.001
Within	14016.01	394	35.57		
Race					
Between	11.65	2	5.83	6.60	0.002
Within	347.62	394	0.88		
Age					
Between	0.74	2	0.37	4.92	0.008
Within	29.81	394	0.08		
GPA					
Between	0.69	2	0.34	0.37	0.691
Within	367.10	394	0.93		

Gender					
Between	0.08	2	0.04	0.32	0.725
Within	50.85	394	0.13		

The mean age for the At Risk group was 19 compared to a mean age of 24 for the other groups. More students in the At Risk group were single (96%) than in the Marginal group (90%) or the Prepared group (88%) (see Table 10). Analysis of variance indicated a significant relationship between age and group placement, and marital status and group placement (see Table 11).

Race varied across all groups. The At Risk group was made up of Blacks (2%), Native Americans (10%), Whites (84%), and other racial groups (5%). The Marginal group was made up of Blacks (7%), Native Americans (18%), Whites (70%), and other racial groups (5%). The Prepared group was made up of Blacks (5%), Native Americans (5%), Whites (81%), and other racial groups (1%) (see Table 10). When the participants were grouped as being White or non-white, analysis of variance indicated a significant relationship between race and group placement (see Table 11).

A significant number of the At Risk group were First Time College Students (91%) and first year students (99%). In comparison, the Marginal group had fewer First Time

College Students (46%) and first year students (52%); the Prepared group had even less First Time College Students (10%) and first year students (31%) (see Table 10).

The At Risk group's ACT scores for English (17.41), math (17.89), reading (18.46), science (19.34), and composite (19.93) were lower than the scores for the Prepared group for English (18.49), math (18.47), reading (20.39), science (20.66), and composite (21.68) but were higher than scores for the Marginal group for English (16.36), math (16.35), reading (17.15), science (17.76), and composite (17.85). The At Risk group also scored lower on the Accuplacer sections for reading (19.03), English (87.46), and algebra (68.60) than the Prepared group for reading (89.57), English (92.76), and algebra (83.73), but they scored higher (93.13) on the math section than the Prepared group (65.46). The Marginal group scored higher than the At Risk group for Accuplacer reading (51.66) but lower on English (75.11), math (71.85), and algebra (58.67) (see Table 10). An analysis of variance indicated a significant relationship between the placement in the Campus Acculturation groups and ACT and Accuplacer scores (see Table 11).

The At Risk group (25.34) utilizes the cognitive task

on the LSI of Concrete Experience (CE) more than the Marginal group (24.84) and the Prepared group (23.06). Reflective Observation (RO) was more prominent in the Prepared group (31.16) than the Marginal group (30.59) and the At Risk group (30.27). Abstract Conceptualization (AC) was found more frequently in the Prepared group (30.43) than the At Risk group (28.48) and the Marginal group (27.89). Active Experimentation (AE) was utilized more by the Marginal group (36.69) than the At Risk group (35.92) and the Prepared group (35.35) (see Table 10). An analysis of variance indicated significant difference only for the cognitive task Abstract Conceptualization (AC) (see Table 10). Learners from the Prepared group are much more likely to rely on the formation of abstract concepts and generalizations to make sense of new information.

The learning styles combination score for processing, Active Experimentation and Reflective Observation (AE-RO), was highest for the Marginal group (6.10), less for the At Risk group (5.65), and lowest for the Prepared group (4.19). The learning styles combination score for perceiving, Abstract Conceptualization and Concrete Experience (AC-CE), was highest for the Prepared group (7.37), less for the Marginal group (6.10), and lowest for

the At Risk group (5.65) (see Table 10). An analysis of variance indicated a significant difference only for the perceiving score for Abstract Conceptualization and Concrete Experience (AC-CE) (see Table 11). Significant differences were found only between Campus Acculturation groups for the perceiving phase (AC-CE) of the learning process. Findings indicate those in the Prepared (7.37) group are more likely to perceive information through the cognitive domain whereas learners from the Marginal (3.05) and At Risk (3.14) group are more likely to perceive information through the affective domain. There were no significant differences in the way the groups processed information.

ATLAS scores varied with more Engagers in the At Risk group (55%) than the Marginal group (43%) and the Prepared group (34%). Although Problem Solvers were represented fairly equal in the Marginal (38%) and Prepared group (37%), there were fewer in the At Risk group (25%). Navigators were equally represented across all three groups (see Table 10). Analysis of variance indicates a significant relationship between learning strategies and group placement (see Table 11).

Academic progress for all three groups remained

consistent in most of the areas. The GPA's were a 2.89 for the At Risk and Marginal groups and a 2.99 for the Prepared groups (see Table 10). The relationship for group placement and GPA were not found to be significant (see Table 11).

The credit hours attempted during the Fall 2000 semester and the credit hours earned were similar across groups. The At Risk and Marginal groups had a 13% enrollment rate for remedial classes whereas the Prepared group had a 4% enrollment rate. Of those that enrolled in remedial classes, 10% passed in the At Risk group, 11% in the Marginal group, and 2% in the Prepared group (see Table 10).

The data for Cornerstone was more unique. This is a class required for all students and it is suppose to be taken the first semester. Only 14% of the At Risk group, of which many were First Time College Students (91%), took this class. Yet, 52% of the Marginal group and 78% of the Prepared group were enrolled in Cornerstone. The pass rate for Cornerstone was as follows: At Risk (33%), Marginal (63%), and Prepared (84%) (see Table 10).

Of the participants in this study who were enrolled in the Fall 2000 semester, 89% re-enrolled in the Spring 2001

semester. The return rates for the groups were as follows: At Risk—93%, Marginal—87%, and Prepared—87%.

CHAPTER 5

SUMMARY, CONCLUSIONS, AND DISCUSSION

Summary of the Study

Retention of students is a continual challenge for college and university personnel. Institutions of higher education can no longer produce the number of graduates necessary to meet the demands of business and industry. Yet, many of the students who enroll do not stay in school until they graduate. In fact, the largest percentage of students leaves within the first year (Tinto, 1993, p. 17). Understanding student learners and their individual differences is the first step to helping students reach their goals. Research studies have examined demographic variables related to retention, but few have looked at individual learning styles and learning strategies.

Therefore, the purpose of this study was to describe the learning styles and learning strategy preferences of learners at Oklahoma State University-Okmulgee. This was accomplished by (a) identifying the learning styles and learning strategy preferences of adult learners at OSU-

Okmulgee, (b) examining the relationship of these learning styles and learning strategies to programs of study by division, (c) examining the relationship of these learning styles and learning strategies to academic variables, (d) examining the relationship of these learning styles and learning strategies to demographic variables, and (e) identifying groups of learners at OSU-Okmulgee.

This was a causal comparative study that involved 443 students at OSU-Okmulgee. Proportional stratified cluster samples were selected from classes within the divisions of Automotive/HEVi Technology, Construction Technology, Engineering Technology, and the three departments within the informal division of Creative Arts Technology. These departments were treated as divisions for the purpose of this study. All participants completed the Learning Styles Inventory (LSI) and the Assessing The Learning Strategies of AdultS (ATLAS). The LSI identified learning styles and places individuals in the categories of Converger, Assimilator, Diverger, or Accomodator. ATLAS identified learning strategies and places individuals in the categories of Navigator, Problem Solver, or Engager.

Overview of Findings

Several statistical procedures were used to analyze

the learning style, learning strategy, and demographic data that were collected for this study. These procedures included chi-square, analysis of variance, discriminant analysis, and cluster analysis. Table 12 contains a summary of the results of these analyses.

Table 12: Summary of Findings

Topic	Findings
ATLAS compared to norms	Significant difference with more Engagers
Differences between learning styles and learning strategies	No significant differences
Differences between cognitive tasks and learning strategy groups	Significant difference with Engagers scoring lower on Abstract Conceptualization
Differences between perceiving and learning strategy groups	Significant difference with Engagers perceiving from the affective domain
Difference between cognitive tasks and learning strategy groups and program of study	Significant difference with Visual Communications students scoring lower on Active Experimentation.
Difference between learning styles and strategies and program of study	No significant differences
Interaction between academic or demographic variables and placement in learning style or strategy groups	No significant differences
Existence of groups based on learning styles, learning strategy preferences, academic variables, and demographic variables	3-cluster solution with the process that separates the groups named Campus Acculturation

Chi-square was used to determine the relationship between the learning strategy scores of OSU-Okmulgee

students and the norms for ATLAS. The findings indicate that there is a significant difference between what was observed for OSU-Okmulgee students and what was expected based on the norms of ATLAS. OSU-Okmulgee attracts a disproportionate number of Navigators and Engagers with fewer Navigators than expected and more Engagers. The observed number of Problem Solvers was very close to the expected frequency.

Chi-square was also used to determine the relationship between learning styles and learning strategies using the LSI and ATLAS. Learning strategy groups were evenly distributed within each learning style group (see Table 12). As no significant differences were found, the categorical groupings for learning styles and learning strategies are not related.

Analysis of variance (ANOVA) was used to determine if learning strategy groups differ on the cognitive task they use for learning and the way they perceive and process information. Cognitive task differences were evident only for Abstract Conceptualization (AC) (see Table 12). Unlike Navigators and Problem Solvers, Engagers do not rely as heavily on the formation of abstract concepts and generalizations. They are less likely to depend on logic

and reason to gain new insights.

Although the Kolb and ATLAS are measuring different concepts, similarities were found in the way participants perceive information (see Table 12). Significant differences were found between learning strategy groups for the perceiving phase (AC-CE) of the learning process. Information is perceived through the feeling dimension called the affective domain or thinking dimension called the cognitive domain. Findings indicate, Engagers are more likely to perceive information through the affective domain whereas Navigators and Problem Solvers are more likely to perceive information through the cognitive domain. There were no significant differences in the way learning strategy groups processed information.

ANOVA was also conducted to determine if learning styles are related to program of study choices reported by division. The only differences found were for the Visual Communications students (see Table 12). They scored lower on the Active Experimentation dimension than other students. Active Experimentation and Reflective Observation are on extreme opposite ends of the processing dimension (Kolb, 1974, p. 93). One cognitive task inhibits the other. Therefore, if one is more likely to rely on

Active Experimentation, then development of analytic concepts is less likely to occur. Students in Visual Communications must be able to reflect on and observe experiences from many perspectives and they rely heavily on analytical skills. Assimilation can occur without being actively involved with the information (Fielding, 1994). Thus, it is not surprising that they score lower than students in other programs of study on the cognitive task of Active Experimentation. Although significant differences were found for Concrete Experience, the Duncan post hoc analysis indicated no difference.

Chi-square was used to determine the relationship between program of study and learning using learning style and learning strategy scores. No relationship was found (see Table 12). Thus, students are evenly distributed on learning styles and learning strategies campus-wide.

Discriminant analyses were used to determine if there was an interaction between either academic or demographic variables and placement in learning style or learning strategy groups. No relationships were found between learning styles and learning strategies either for the academic variables of ACT scores, Accuplacer scores, and grade point average or for the demographic variables of

age, gender, marital status, race, being a first time college student, and high school graduate (see Table 12). Thus, the findings indicate it is not possible to use academic variables or demographic variables to discriminate between groups categorized by learning styles or learning strategies.

Cluster analysis was used to determine if learning styles, learning strategy preferences, academic variables, and demographic variables used in this study could be organized into homogeneous groups. The best explanation of the data seemed to be based on the three-cluster solution (see Table 12). Discriminant Analysis was used to determine the process that separates the groups which is called Campus Acculturation. This was based on ACP Reading scores and First Time College Student status. The three groups were named At Risk, Marginal, and Prepared. OSU-Okmulgee students are considered proficient in reading with an Accuplacer score of 77. The At Risk group (19.03), Marginal group (51.66), and Prepared group (89.57) varied significantly on these scores. Differences in the First Time College Student status were also found to be significant for the At Risk (90.90%), Marginal (45.70%), and Prepared (9.7%) groups. Significant relationships were

found between learning styles, learning strategies, academic, and demographic variables and group placement. However, the only variable that separates the groups is Campus Acculturation.

Conclusions for Individual Differences in Adult Learning

Learning Strategies

> Learning strategies offer a more useful way to address individual differences at OSU-Okmulgee than learning styles.

The Learning Styles Inventory found all learning style groups were distributed evenly across campus. There is no data to indicate the university attracts one learning style over another, whereas, data from the ATLAS identified significant differences in the number of learners in learning strategy groups at OSU-Okmulgee and the expected numbers. Past research has found that students with specific learning styles are attracted to certain majors or disciplines (Kolb, 1974; Lam, 1998; Smedley, 1987). Data from this study does not support that idea. Student learning styles were represented equally among the divisions.

> OSU-Okmulgee attracts a disproportionately large number of students who love to learn and gravitate toward learning environments

> where they can be actively engaged in projects and programs that provide them opportunities for human interaction.

This study utilizes ATLAS to identify learning strategies among groups of learners at OSU-Okmulgee. ATLAS identifies three types of learners called Navigators, Problem Solvers, and Engagers. This study found more Engagers than expected and fewer Navigators. This finding is consistent with other studies in adult education (James, 2000) and the community college (Willyard, 2000) using the ATLAS instrument.

Human interaction is a key characteristic for engaging the group of learners entitled Engagers (Conti & Kolody, 1999, p. 13). Adult learners respond to an atmosphere that is friendly and informal. They appreciate being called by name and sensing a feeling of respect from their instructors (Knowles, 1980, p. 47). This is especially important for Engagers. Programs at OSU-Okmulgee incorporate human interaction into the learning process by providing student-centered, highly interactive environments. These environments may attract more Engagers to campus because they appear to promote fun, informal, high-touch learning. "When Engagers decide that a learning activity is worthwhile to them, they participate with full

enthusiasm and full energy, and they encourage others to do likewise" (Ghost Bear, 2001, p. 385). Because of the their enthusiasm for this type of learning environment, Engagers may be recruiting other Engagers to the campus as well. For reasons such as this, they have also been described as Stimulants (Ghost Bear, 2001, p. 385).

Marketing efforts at OSU-Okmulgee which could appeal to the Engager, focus on group work, small classes, peer-teacher interaction, and a friendly, family-like campus. As reflected in brochures, videos, and catalogs, students are not just a number on the OSU-Okmulgee campus. Low instructor-student ratios assure personal attention and mentoring. Instructors and employers are actively involved in the recruitment of students which provides Engagers the personal interaction they desire.

Enjoyment and reward are two important variables that Engagers want to experience while learning (Conti & Kolody, 1999, p. 14). Engagers must buy into a learning project before starting (p. 14). This internal value is necessary for them to see a project through to completion. OSU-Okmulgee is a unique campus in which its very distinct mission and stated goals contribute to highly specialized programs of study. Students learn applicable job skills in

areas of advanced technology. Most programs require an internship in the industry; this provides applicable experience which often results in continued employment after graduation. Automotive-program students are hired by the employer before beginning classes. They rotate eight weeks of classes with eight weeks of internship for six semesters in a lock-step curriculum. This means students follow a set curriculum with the group with which they started. There are additional credit-hour requirements and expense necessary to accomplish these goals. Yet, students continue to choose to enroll in programs at OSU-Okmulgee. This suggests that this type of program structure results in a buy-in of the goals and objectives of the program before it is started and is consistent with the approach to learning of the Engager. OSU-Okmulgee provides that carrot that hooks the Engager.

Problem Solvers are those who prefer practical experience and hands on learning (Conti & Kolody, 1999, p. 13). Practical application helps solidify abstract concepts. They thrive in environments that provide time to reflect on what is being presented. They are spontaneous and creative learners. They have also been described as Storytellers because they elaborate with extraordinary

detail when describing their experiences (Ghost Bear, 2001, p. 383). OSU-Okmulgee is perceived as a hands-on institution providing laboratory intensive technological programs and application rich internship experiences resulting in an Associate of Applied Science degree. This image may explain why the expected proportion of Problem Solvers attends OSU-Okmulgee.

Navigators are focused, desire a charted course of action, and seek to accomplish a goal with the most efficiency (Conti & Kolody, 1999, p. 9). Planning and structure are extremely important to these learners. They need feedback, timelines for project completion, and experience great difficulty tolerating those who waste time and do not significantly contribute (pp. 10-11). They have high expectations for their own performance and are often self-conscious and hypercritical of perceived mistakes (Willyard, 2000). Since Navigators continually seek improvement, they have also been described as Strivers (Ghost Bear, 2001, p. 381).

Navigators have been accurately identified in several studies using ATLAS, and none of these studies found Navigators to be over-represented in any of the learning environments (Ghost Bear, 2001; Goodwin, 2001; James, 2000;

Willyard, 2000). Consistent with these findings, OSU-Okmulgee does not attract a disproportionately large number of Navigators. Because Navigators need to exercise control over their learning environment, group and teamwork are often perceived as impeding progress toward completion of projects. OSU-Okmulgee's size and environment lend itself to a psychological climate of warmth, acceptance, and support which is conducive for personal interaction between the instructor, staff, and learner (Knowles, 1980, p. 47). For most individuals, this type of climate is critical for learning to occur (Brookfield, 1986; Knowles, 1980, p. 224; Rogers, 1969). However, Navigators as a group do not find that an engaging climate is necessary to complete the task (Conti & Kolody, 1999, p. 10) thus not necessarily appreciating the environment to the extent that other groups of learners might. Additionally, Navigators may not see the value in the additional hours required to receive these Associate of Applied Science degrees. Fewer hours may seem more efficient.

OSU-Okmulgee may be systematically driving away Navigators and attracting Engagers. A growing line of inquiry finds that organizations have a certain image that attracts certain types of learners (Ghost Bear, 2001;

Goodwin, 2001; James, 2000; Willyard, 2000). Spencer (2000) and Ghost Bear (2001) found Problem Solvers were more attracted to learning on the Internet. The Internet and eBay auction site allowed Problem Solvers an opportunity to consider different solutions and be open to better options (Ghost Bear, 2001) as well as to "immediately begin exploring solutions" (Spencer, 2000, pp. 137-138).

Engagers are attracted to environments that appear to have a concern for human interactions. Willyard (2000) found that community colleges have an image of a responsive environment where individual needs can be met which is more attractive to the Engagers (p. 201). Goodwin (2001) found Engagers are attracted to specific work environments. They learn and improve through engagement with their environment. This is what makes their jobs worthwhile and enjoyable. It is important for Engagers to thoroughly understand themselves in their environment and see the value in what they are doing (p. 169).

Yet, some institutions are considered to be more general in that they have a broad appeal to all types of learners. Turman (2001) found that the marketing approach of one such institution sent a message that addresses adult

learning principles especially one of flexibility (p. 103). The message from OSU-Okmulgee appears to be one that greatly supports the learning strategies of Engagers. While it is also appealing to Problem Solvers, it is not attractive to many Navigators.

Perception

> There are similarities between learning styles and learning strategies in how learners perceive information.

Perceiving information is an important element in individual differences in learning. Learning styles as conceptualized by Kolb (1984) and learning strategies as conceptualized by Conti and Fellenz (1991) are measuring different concepts. However, both instruments identify individual differences and have perception embedded in them. A taxonomy of learning behaviors exists that describes the goal for any learning objective (Bloom, 1964). Mental skills are grouped in the cognitive area. Feeling and emotion fall in the affective domain. Manual or physical skills are in the psychomotor domain. Learners differ in the way they perceive new information while learning either from the affective or cognitive dimension. Individual differences can be a conceptual link between the affective and cognitive domains.

Both learning styles and learning strategies are concerned with the influence on learning of perceiving information from different domains. Kolb refers to perception as the way learners perceive or grasp new information. At one end of the continuum are the learners that operate in the affective domain (Concrete Experience) and at the other end are those learners who operate from the cognitive domain (Abstract Conceptualization) (Fielding, 1994). Conti and Fellenz (1991) refer to perception as the way individuals approach new learning tasks. Engagers are more likely to perceive information from the affective domain (Conti & Kolody, 1999, p.14). They cannot "separate the message from the messenger" (p. 10). Navigators and Problem Solvers are more likely to perceive information from the cognitive domain. When beginning a new learning task, they are more interested in the external resources available to accomplish the task and are not as concerned with whether or not they will enjoy the task (p. 18). Findings from this study further substantiate the descriptions of these learning strategy groups as they relate to perception. This adds further support to the conceptualization of ATLAS which holds that a major difference between learning strategies is how

individuals initiate a learning activity based on how they perceive information (Conti & Kolody, 1999, p. 18).

Recommendations for Individual Differences in Adult Learning

Learning strategies have been identified as a tool to distinguish between individual learning differences. Since there is now general knowledge of the learning strategy profile for students at OSU-Okmulgee, the next step is to determine what to do with this information. It is recommended that the OSU-Okmulgee administration implement mandatory and continuing professional development activities to promote understanding of learning differences and addressing individual needs. Knowledge of learning strategies equip instructors and service providers with tools to be more sensitive to individual differences and meet learner needs inside and outside of the classroom. Professional development in the area of learning strategies should precede any program or curriculum development.

Understanding placement in one's own learning group and the preferred learning strategies, can help professionals put the other learning groups in better perspective. Those in one of the learning strategy groups do not automatically think about the needs of the other

groups. "In transformative learning...we reinterpret an old experience (or a new one) from a new set of expectations, thus giving a new meaning and perspective to the old experience" (Mezirow, 1991, p. 11). Through this process, an individual can free oneself from distorted reasoning to accept a more unconditional understanding of oneself and the world. Awareness and reflection can lead to positive action. Increased student understanding of their own learning strategy preferences for approaching learning tasks can empower students to take charge of their own learning.

The concepts of learning strategies should be immersed in curriculum, teamwork, student services, and the goals of the institution. ATLAS should be administered to every employee working directly or indirectly with students to increase understanding and awareness of learning strategies. Professional development focusing on learning strategies is a mechanism to consistently address individual differences.

Implications of individual differences extend far beyond the classroom. These factors directly impact university initiatives from the initial marketing and outreach phase through the graduation of students. OSU-

Okmulgee should look at individual differences as they relate to learning strategies and adult learning as a way to improve services campus-wide. Decision makers should plan their efforts with each group of learners in mind recognizing what is important to each of the groups: Navigators need structure and efficiency, Problem Solvers need application and hands-on experimentation through practical application, and Engagers need human interaction and fun activities.

Marketing and recruitment is the first step for the survival of any organization. Marketing is "the business activity of presenting products or services to potential customers in such a way as to make them eager to buy" (Encarta, 1999, p. 1106). Recruitment means "to enroll someone" (Encarta, 1999, p. 1501). The administration at OSU-Okmulgee should consider the fact that the school does not systematically attract and enroll the expected proportionate number of Navigators. However, research data (Turman, 2001) reflects that all groups of learners can be successfully recruited to programs in a general university setting. A marketing plan focusing on all types of learners would ensure dissemination of more complete information absorbed by all types of learners. Also, the

university outreach, or recruitment plan, could incorporate activities for all groups of learners. "One can sense rather quickly on entering an institution, for example, whether it cares more about people or things, whether it is concerned about the feelings and welfare of individuals or herds them through like cattle, and whether it views adults as dependent personalities or self-directing human beings" (Knowles, 1980, p. 47). The institutional message overflows into the classrooms. Administrators should determine if the message the institution sends to prospective students and students is the one intended.

Administration has an ethical decision to address in regards to marketing and recruitment. OSU-Okmulgee is a publicly supported institution with a statewide mission to serve all of the public. As they design the institution's marketing materials for outreach and recruitment, should additional resources be allocated to market and recruit Navigators who are harder to reach, or should current materials be enhanced and expanded to focus on Engagers and Problem Solvers since they are known to enroll in proportionate numbers? Unlike Navigators, Problem Solvers and Engagers already respond to the existing marketing and recruitment efforts of the institution.

Navigators generally are focused, results-oriented, high achievers who like logical connections, planning, and organizing (Conti & Kolody, 1999, p. 9). In order to attract more Navigators, OSU-Okmulgee should clearly communicate the institution's mission and expectations. Communications should expand to include information appealing to Navigators who need structure, timelines, and an understanding of the overall picture. To attract the Navigators it would be necessary to develop a recommended sequence of events and timelines that will let the prospective student maneuver through the enrollment process. Navigators rely heavily on the use of Identification or Resources as well as the Critical Use of Resources so by expanding the on-line services such as campus Pipeline or SCT Web, this would allow them an efficient means of obtaining information. They could complete the entire application and enrollment process without ever coming to campus.

Problem Solvers are innovative thinkers who do not respond well to rigidity (p. 13). Options are very important to these learners. Marketing information should be clearly communicated through a variety of mediums. Expansion of the web services provides additional options

and allows prospective students the ability to generate alternatives by making inquiries via the web any time of day or night. It also provides an avenue for immediate application and hands on learning. As Problem Solvers are best served in an environment that provide opportunity for "hands-on activities" (Conti & Kolody, 1999, p. 13), prospective students should be able to access real time video demonstrating the type of classroom activities that are most appealing to them as learners. In addition, recruitment efforts should start at a young age and the institution should ensure that these students get involved with the Summer Academies with a focus on practical experience.

Engagers are presently attracted to the campus in numbers greater than expected. Marketing materials should continue to reflect the human element of the learning process. However, reaching a larger number of engagers may require getting more prospective students to campus. Once they can actually become engaged in the campus environment and can put meaning to the advertisements, they may be more likely to enroll. Greater efforts should be made to entice these students to campus for tours, open houses, and interaction with faculty, student services personnel, and

other students. These activities should begin as early as junior high and high school. This allows students to build on the relationships from year to year possibly influencing their decision to attend OSU-Okmulgee when the time comes.

New Student Advisement Days are an important part of the outreach plan at OSU-Okmulgee. These events target students who have made application but have not enrolled. The purpose is to bring all of the services to a single location on campus, to provide prospects with critical information, and to complete the enrollment process that day. These events were created to be informative, productive, and fun. This is another step in helping students connect to the campus environment which is critical to retaining students (Astin, 1979; Tinto, 1993).

New Student Advisement Days have always been held on Fridays during the summer months and are an all day event. A hospitality room is set up for each advisement day providing the guests with refreshment and an opportunity to visit with staff and faculty as they arrive to campus. Students who have not taken the Accuplacer, a required assessment, or who have not passed the Accuplacer come to campus earlier than the other students. They are provided plenty of time to complete the assessment and review the

results with staff before the sessions begin. Mid-morning all students and their families attend a large group session at which time the staff presents general information about available services and processes. Concurrent breakout sessions follow giving students and family members an option to attend one or all sessions depending on their need and interest. This reduces the size of the groups creating an atmosphere more conducive for questions and answers. Lunch is served cafeteria style at which time administrators and faculty are encouraged to join the groups. After lunch, each prospective student is escorted to their division and is assisted with the enrollment process.

This process is continually evaluated and feedback from participants is included in improvement planning. Although the feedback has been very positive, there is no data to know what type of learners have attended. By addressing each group of learners individually during process improvement, OSU-Okmulgee may be able to increase the number of students who attend advisement days and enroll more students more efficiently.

Navigators want to make the best use of their time and would want organized, well-planned activities. Navigators

need to know ahead of time what they will be doing before deciding to come. Agendas mailed out prior to the event would provide them with that information and structure. They would find it more beneficial if the information were tailored to their individual questions and concerns as Navigators will read the information in the catalog and brochures and already be familiar with the general information. Alternate formats should also be considered for the Navigators. On-line New Student Advisement Days could be tailored to meet their individual needs. Chat lines could be set up for real-time responses from the experts.

The Problem Solvers already attend OSU-Okmulgee in the expected proportions. Yet, it would be beneficial to create some activities that would better meet the needs of these learners during advisement days and attract more Problem Solvers to campus. They tend to have difficulty making choices because of all the alternatives they are able to generate (Conti & Kolody, 1999, p. 12). They are critical thinkers who generally like to test assumptions. Although Problem Solvers would appreciate the general and breakout sessions where staff provides expert information, they

may need time to process that information before making decisions and asking questions specific to their situation. Thus, they might respond best to the information booths. Because expert advise is important to them (p. 12), staff should be sure that there are qualified team members available to answer questions at all times.

The Engagers enroll at OSU-Okmulgee in greater numbers than expected. Advisement days include many activities that appeal to an the Engager such as hospitality rooms, opportunity to meet staff and faculty, tours of campus providing additional opportunity to meet personnel, and one-on-one time with their faculty advisor. However, information provided is fairly straightforward and presented in a lecture format. Incorporating skits and videos of students and student life activities into the days events might be a more appealing way to get information across to the Engager.

Once students enroll in classes the focus shifts to retention services. Putting learning first and changing the way we do business, can have a significant impact on retention (Wingspread Group on Higher Education, 1993, p. 14). OSU-Okmulgee has recently gone through a major re-

organization of student services in order to restructure the way that services are delivered to better meet the needs of the changing university population. More emphasis is being placed on retention services than ever before. OSU-Okmulgee retention services have been identified as orientation, counseling, accommodations for students with disabilities, identification of students who are at risk for success in the college environment, prescriptive interventions, improved and holistic advisement, and campus involvement. Existing services are currently being evaluated for effectiveness and areas of improvement and other retention services are in the planning stages. Again, as these processes are being developed individual learning differences should be included in the decision-making process.

Flexible and varied options for all retention programs should be implemented. Orientation is currently delivered to all incoming students one day before classes begin. This is a one-time event. Information sessions are packed with information a student might need to know during the time they are at OSU-Okmulgee. This process could be delivered in a number of different ways to appeal to the different learning strategies. Not all individuals respond

to large-group information and question-and-answer sessions. Navigators will respond well to the message staying focused so they can determine the purpose of what they are to do. The Problem Solvers need opportunities to brainstorm some alternatives of what they need to do or can do. They would want the chance to come up with a solution to any situation presented to them. For the Engagers, group activities would be of interest to them. They want to feel good about what they are doing so they can take pride in it.

Adult learners need information that is timely and applicable. "People become ready to learn something when they experience a need to learn it in order to cope more satisfyingly with real-life task or problems" (Knowles, 1975, p. 4). A variety of topics should be offered throughout the semester, every semester. Students should be able to access information as the need arises. Orientation sessions should be delivered personally by staff and also available in other formats for the self-directed learners. Self-directed learning has become a skill for survival; a basic competence necessary to keep up in our changing society (Knowles, 1975, p. 16-17). The institution should take an active role in helping dependent

learners transition to self-directed learning.

Delivery methods should be as diverse as the content. The material should be delivered in a no-nonsense, systematic format as well as through fun, social events. These sessions should be available on the web and through both structured and informal groups. The times and formats should be flexible, focusing on the adult learner.

Campus involvement is important to whether or not students return after their first semester (Tinto, 1997). A web-based portal system is one way to improve communication resulting in increased involvement. This system could be configured to appeal to learners from each learning strategy group in order for more learners to access the wide array of campus activities and related support services. These systems, often referred to as on-line student services, are a high-tech, high-touch approach to student life and residential life. Students are provided their own personalized web page that is a part of the OSU-Okmulgee system. Directory information and individual pictures are available with permission from the student for all students and employees to access. Information can be sent by faculty and staff to individual students, select groups of students, or the entire student

body. Each page can be tailored to meet individual student preferences.

An on-line student services system could appeal to Navigators because they could access their personal calendar and class schedule on their personal page. Navigators like to know how to prepare for upcoming classes and prefer instructors who provide "schedules and deadlines, by outlining objectives and expectations" (p. 11). Instructors would have an increased avenue for communicating this information as well as giving prompt feedback on assignments, projects, questions, and grades (p. 11). Services and other resource information the institution sends may be personally selected to eliminate unwanted mail which Navigators may appreciate.

Student services on-line could appeal to Problem Solvers because they are curious, inventive, and intuitive, and are open to all possible alternatives (Conti & Kolody, 1999, p. 12). They could customize their access and choose those items that would allow them to satisfy their need for spontaneity and creativity. This would provide them various alternatives to learning. On-line class assignments and discussion threads allow the problem solver the time needed to process new information and generate

alternatives before responding to assignments. The more hands-on the activities the more Problem Solvers will enjoy them.

Finally, the system could fulfill the Engager's need for human interaction because it would allow them to look up classmates by name or picture and inquire about campus-sponsored and student initiated groups. They can connect with these individuals on-line or by accessing their directory information. Engagers would know about all campus events on a day-to-day basis and therefore not miss any opportunities to have fun.

Since all campuses are different, action research is one way to build the knowledge base of students for a particular institution. This study provides general information regarding individual differences of learners at OSU-Okmulgee. Further research by practitioners can begin to explore implications of this data and expand the pool of knowledge.

If a more exploratory approach for analyzing learning style dimensions by learning strategy groups were taken, significant differences would have been found at the .10 level for all cognitive tasks except Reflective Observation. The observer who relies on Reflective

Observation is considered to be at the opposite end of the processing continuum from the actor who uses the cognitive task Active Experimentation to process new information (Kolb, 1974, p. 93). Processing for these learners involves "more mental manipulation of symbols and images than overt actions" (p. 93). A more exploratory approach for analyzing learning style dimensions by program of study might also provide additional meaning to the existing research. There is a trend between the significance levels for the AE, CE, AC, AC-CE, and AE-RO scores and the RO scores. Learning styles tend to lean toward Active Experimentation more than Reflective Observation. This aligns with the hands-on, practical application image of the university. Further research, is indicated for increased understanding of the relationship between learning styles by learning strategy groups and by program of study.

No studies have explored the interaction between student success in a particular class, the teacher's learning strategies, and the learner's learning strategies. No studies have specifically explored program retention and learning strategies. Further study is recommended to better understand how individual differences are related to

retention.

Conclusions for Higher Education

Campus Acculturation is the main factor which defines groups of students at OSU-Okmulgee.

Colleges are comprised of two systems, academic and social (Tinto, 1987, p. 106). Students leave institutions because they do not become connected to one or the other and possibly both. Academic preparedness and college experience are variables that impact integration into one of these systems. Students who are better prepared and have experienced the college environment are more likely to persist because they bond to those individuals or services needed to help them succeed and because they feel like they belong. Yet, navigating the campus environment both academically and socially can be a challenge for others. Three distinct groups of learners exist among OSU-Okmulgee students suggesting some students will naturally connect more easily to the campus. The variables differentiating the groups were Accuplacer reading scores and first time college student status. Because the interaction of these variables can affect integration into the campus, the process that separated the groups was named Campus Acculturation. These three groups were named At Risk,

Marginal, and Prepared.

The number of students entering college who need remediation is continually growing, and it is estimated that 4 in 10 students need some type of remediation (Tinto & Riemer, 1998, p. 1). Yet pass rates of those who enroll in remedial classes is around 50% nationally (McCabe, 2000, p. 31) and at OSU-Okmulgee. Thus, the means of remediation currently in place on OSU-Okmulgee campus may not be helping students to persist.

Reading skills are critical to success in the college environment (Tinto & Riemer, 1998, p. 1), and 70 is the score on the Accuplacer considered essential to be successful in college. Yet, participants' scores ranged from 9 to 120 with the mean score falling below the minimum score for proficiency. An Accuplacer score of 80 indicates proficiency in English. A score of 70 indicates proficiency in math, and a score of 56 indicates proficiency in algebra. The ACT scores which show proficiency for all sections is a 19.

The At Risk group of students was most likely to be first-time students and had extremely low reading scores. Yet, they were proficient in science on the ACT and had a composite score of 19.93. They showed proficiency in all

other areas on the Accuplacer. The majority were high school graduates; they were younger and more likely to be single than students in the other two groups. A large percentage of the students in this group were Engagers, and they utilize Concrete Experience while learning new materials and are more likely to perceive information from the affective domain. These learners need to see the internal value of a learning project before starting. However, once they buy into the project they immerse themselves in the new experience and become passionate learners.

The Marginal group was not proficient in reading according to their Accuplacer scores, but they did score much higher than the At Risk group. However, they scored below the At Risk group in all other academic assessments. They were proficient only in English on the Accuplacer and were not proficient on any ACT sections. Almost half were first-time college students. There were fewer high school graduates than in either of the other two groups. They too were more likely to perceive information from the affective domain with more Engagers in the group. Although all of the groups were predominantly White, there were significantly more Native Americans in this group than the

other two groups combined.

The largest percentage of learners in the Prepared group were second-year students. Accuplacer reading scores were much higher than the minimum score needed for proficiency. This group was proficient in reading, in science, and on their composite score for the ACT assessment. They were proficient in reading English and in algebra according to the Accuplacer. Fewer students in this group were high school graduates when compared to those in the At Risk group. However, there were more high school graduates in this group than in the Marginal group. These learners are more likely to use Abstract Conceptualization for approaching new learning tasks meaning they depend on theory to solve problems or make decisions. This was significantly different from the distribution in the other two groups. The distribution of learning groups was close to the norms for ATLAS. The majority of students were White with less than 5% of the students in each of the other categories.

Although, GPA's normally indicate student progress, data from this study are insufficient to assess student success. The fact that GPA's were not significantly different across the groups is understandable. For

students in remedial classes, a GPA is not necessarily reflective of ability. For example, the GPA for students enrolled in three remedial classes and one technical class in their area of interest will only reflect the grade from the technical class. Remedial classes are pass or no-pass and are not figured into the GPA. Therefore, a student could be in grave danger of not being able to persist academically, and this may not be indicated by the one grade.

Persistence is another area that is difficult to surmise from the data in this study. Because the study only covered two semesters, persistence was measured by enrollment in the following semester. Yet, students at risk for persisting can be perpetuated by the system. Students not removing their deficiencies the first semester may continue to enroll in subsequent semesters as long as they are attempting to remove their deficiencies. After 24 credit hours are transcripted, they are only allowed to enroll in classes in which they are deficient. Thus, students could go several semesters without removing all of their deficiencies. Many times this keeps them from enrolling in their major classes due to program restrictions. It puts barriers up that prepared students

do not typically have to encounter.

Although overall course completion rates did not vary significantly between the groups of learners, College Cornerstone course completion rates did vary. College Cornerstone is a foundation class developed to help prepare students for their college experience. Of the At Risk group, only 33% passed the course. In the Marginal group, 63% of those who enrolled in College Cornerstone passed, and 84% of the Prepared group passed. A large part of this class is self-directed requiring outside reading and inquiry. Students in the At Risk group may not be ready for independent learning, and this mode of instruction may not be as enjoyable and rewarding for 55% of the participants in this group who were classified as Engagers.

Recommendations for Higher Education

Colleges and universities are looking for reasons why students do not stay in school until they reach their goals. Identifying the At Risk, Marginal, and Prepared groups of learners may be one piece of that puzzle. At Risk students do not come to the university with the same experiences or skills as learners in the other two groups. A positive Campus Acculturation is not part of who they are, and they may be less likely to persist until they reach their goals.

Although the data regarding Accuplacer reading scores and first-time student status are significant, administration must also consider why there is such a discrepancy between the ACT reading scores and the Accuplacer reading scores for the At Risk group. While the At Risk students scored extremely low on the Accuplacer reading assessment, they were less than one point from proficiency according to their ACT scores. The other two groups were much more closely aligned on the two scores. The ACT and Accuplacer scores are used for academic placement at colleges nationally. For such discrepancies to exist, the two assessments are either measuring different skills or one is not accurately identifying reading proficiency for this group of learners.

OSU-Okmulgee administration must first determine if the Accuplacer reading score is accurately measuring reading proficiency or one's test taking abilities for that type of reading assessment. A tracking system should be implemented to follow student progress for the At Risk, Marginal, and Prepared learners at OSU-Okmulgee to help make this determination. Existing student data should be examined more carefully to explore if there is an interaction between ACT reading scores, Accuplacer reading scores, and student success in remediation classes. If it is decided that

Accuplacer reading scores are not reflective of a student's reading proficiency, steps should be taken to determine if this is the proper assessment tool for placement at OSU-Okmulgee.

Student test taking strategies specific to the Accuplacer reading assessment should also be considered as a possible factor for data discrepancies. If a student struggles with the assessment format, this can interfere with accurate results. The Accuplacer is an adaptive test. This means that each question determines the path of future questions. If a student gives correct responses for the first few questions, the level of difficulty increases. If incorrect responses are given, the difficulty decreases resulting in a much lower score. Therefore, the first few questions are critical and greatly affect the reading score. Pre-assessment advisement could better prepare students for the assessment format helping them to perform at a level that accurately reflects their abilities.

Additional variables to consider for tracking purposes are course completion, goal completion, program completion, and GPA. It has already been established that there are three groups of students at OSU-Okmulgee based on Campus Acculturation. It should be determined if Campus

Acculturation affects student success and retention.

Early problem identification and appropriate interventions are very important to student success. More students leave in the first year than any other time (Tinto, 1993, p. 14).

> Given that student persistence and learning are shaped by all aspects of the first-year experience and are influenced by students' very first encounter with the institution, it follows that institutions should begin to address student needs as early as possible so that potential problems do no become actual problems later in the student career. (p. 152)

College Cornerstone is an intervention designed to better prepare all students for the college experience. Pass rates for College Cornerstone are a good indicator that intervention success varies with different groups of learners. Learners in the At Risk group are more likely to have extremely low Accuplacer reading scores, be first-time students, and Engagers. These learners are less familiar with the campus culture and thrive on human interaction. Literature indicates that programs should be more structured for at risk learners (McCabe, 2000, p. 45). Therefore, learners in the At Risk group are more likely to be successful in an environment that provides structure and opportunities to connect with others. Administration should consider a different approach for the learners named At

Risk especially if they continue to require Cornerstone as a first semester class.

OSU-Okmulgee administrators are faced with numerous decisions regarding students who are considered under-prepared for the college experience. Accurate assessment and early intervention are these students' "lifelines to the future" (McCabe, 2000, p. 28). Therefore, aggressive and intense interventions based on such things as learning strategies should be made available for students known to be lacking in reading skills and who are first-time students unfamiliar with the collegiate environment. Interventions help connect the students to the campus culture and provide them the tools and skills necessary to help them persist and become more successful in school and as lifelong learners. However, interventions must continually be assessed to determine if they are meeting the needs of incoming students whose needs may change over time.

Customization

Customize means to alter something in order to make it fit somebody's requirements better (Encarta, 1999, p. 445). There is no one-size-fits-all approach for higher education. No single marketing technique, recruitment

strategy, orientation, or academic intervention will meet the needs of all students. If OSU-Okmulgee is to survive, it is no longer acceptable to provide services only to a majority. Administrators must recognize and then assume responsibility to ensure that every student is provided equal opportunities for success. They must begin to focus on customized learning experiences through improved understanding and appreciation of individual differences. Traditional attitudes focusing on the mainstream or traditional way of doing business must be replaced with a realization that alternate approaches are important regardless of how few are affected.

> One day, when the old man went down to the beach this neighbor followed to satisfy his curiosity and, sure enough, as he watched, the old man bent down and gently lifted something from the sand and threw it into the ocean. By the time the old man made his next stop the neighbor had come near enough to see that he was picking up a starfish which had been stranded by the retreating tide and would, of course, die of dehydration before the tide returned. As the old man turned to return it to the ocean, the neighbor called out with a degree of mockery in his voice, "Hey, old timer! What are you doing? This beach goes on for hundreds of miles, and thousands of starfish get washed up every day! Surely you don't think that throwing a few back is going to matter." The old man listened and paused for a moment, then held the starfish in his hand out toward his neighbor. "It matters to this one." (Ostrander, 1996, p. 33)

OSU-Okmulgee is an institution that is concerned about the success of every student. Yet, like other institutions it loses students before they meet their goals each semester. Now that the learning strategy profile for students at OSU-Okmulgee is known, administrators have the power to begin to individualize programs and services. Customization that addresses individual learning differences may be the critical link for helping students to attain their personal and professional goals.

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APPENDICES

APPENDIX A

INSTITUTIONAL REVIEW BOARD

APPROVAL FORM

Oklahoma State University
Institutional Review Board

Protocol Expires: 6/17/02

Date: Monday, June 18, 2001 IRB Application No ED01137

Proposal Title: UNDERSTANDING LEARNING STYLES AND LEARNING STRATEGIES OF ADULT LEARNERS

Principal Investigator(s):

Sandra Massey
5634 East 78 Place
Tulsa, OK 74136

Gary Conti
206 Willard
Stillwater, OK 74078

Reviewed and Processed as: Exempt

Approval Status Recommended by Reviewer(s): Approved

Dear PI :

Your IRB application referenced above has been approved for one calendar year. Please make note of the expiration date indicated above. It is the judgment of the reviewers that the rights and welfare of individuals who may be asked to participate in this study will be respected, and that the research will be conducted in a manner consistent with the IRB requirements as outlined in section 45 CFR 46.

As Principal Investigator, it is your responsibility to do the following:

1. Conduct this study exactly as it has been approved. Any modifications to the research protocol must be submitted with the appropriate signatures for IRB approval.
2. Submit a request for continuation if the study extends beyond the approval period of one calendar year. This continuation must receive IRB review and approval before the research can continue.
3. Report any adverse events to the IRB Chair promptly. Adverse events are those which are unanticipated and impact the subjects during the course of this research; and
4. Notify the IRB office in writing when your research project is complete.

Please note that approved projects are subject to monitoring by the IRB. If you have questions about the IRB procedures or need any assistance from the Board, please contact Sharon Bacher, the Executive Secretary to the IRB, in 203 Whitehurst (phone: 405-744-5700, sbacher@okstate.edu).

Sincerely,

Carol Olson, Chair
Institutional Review Board

APPENDIX B

DATA FORM

ATLAS

Directions: Follow the directions for completing ATLAS (orange booklet). Then place **ONE** check mark next to your learning strategies subgroup that indicates your overall group and subgroup as indicated on ATLAS.

Navigator		**Problem Solver**		**Engager**	
__ Subgroup 1	__ Subgroup 2	__ Subgroup 1	__ Subgroup 2	__ Subgroup 1	__ Subgroup 2

Is the description of your learning strategy group from the Groups of Learners page fairly accurate in describing you as a learner?

____Yes ____No

Kolb Learning-Style Inventory

Question No.	Column 1	Column 2	Column 3	Column 4
Example	4	1	2	3
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				

I understand that (1) participation in this study is voluntary, (2) that I will not be penalized if I choose not to participate, and (3) that my name will not be associated with any information in this study. In order to participate in this study, I hereby give permission for this learning style and learning strategy information to be linked to my school records by means of my Student ID Number.

My Student ID Number is: ☐☐☐ - ☐☐ - ☐☐☐☐

VITA

Sandra C. Massey

Candidate for the Degree of

Doctor of Education

Thesis: UNDERSTANDING LEARNING STYLES AND LEARNING STRATEGIES OF ADULT LEARNERS AT OSU-OKMULGEE

Major Field: Occupational and Adult Education

Biographical:

Education: Received a Bachelor of Science degree in Psychology from Arkansas State University, May 1978; received Master of Rehabilitation Counseling from Arkansas State University, May 1980. Completed the requirements for the Doctor of Education degree with a major in Occupational and Adult Education at Oklahoma State University, Stillwater, Oklahoma, in August 2001.

Experience: Employed as a Rehabilitation Counselor from 1987 to 1996 at Arkansas Rehabilitation Services. Employed in Higher Education from 1997 to present at Oklahoma State University-Okmulgee. Current position is Dean, Student Support and Development.

Professional Certifications: Certified Rehabilitation Counselor

Professional Memberships: NASPA, Oklahoma Association for Higher Education and Disability