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A Descriptive Comparative Study of Student Learning Styles from Selected Medical Education Programs

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A DESCRIPTIVE COMPARATIVE STUDY OF STUDENT LEARNING STYLES FROM SELECTED MEDICAL EDUCATION PROGRAMS

By

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ABSTRACT

The authors' hypothesis was to determine whether comparable variation co-existed among the individual learning styles of health professional students and the general population. Our purpose was to demonstrate learning style variability, as well as justification for the utilization of different teaching modalities throughout education. We administered David Kolb's Learning Style Inventory IIa to sample populations of Emergency Medical Technician/Paramedic students (n = 53), third and fourth year Medical students (n = 28), undergraduate Nursing students (n = 65), second and third year Physician Assistant students (n = 49), and a General student population (n = 70). The results were analyzed using Pearson's chi-square test and compared using analysis of variance (ANOVA) methods. A statistical difference did not exist among the learning styles of health professional students and the general population. As a result, implementation of varied teaching modalities in health professional education are discussed with suggestions for future research presented.

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CHAPTER 1
INTRODUCTION

Background to Problem

The release of Kolb's 1976 edition of his Learning Style Inventory I (LSI-I) helped to identify individual learning styles that were considered an essential factor for planning the instruction within medical education programs[1]. Many centers of higher education continue to mask this premise by emulating their own personal academic instruction. From this perspective, health professional education is embedded in tradition with current approaches to teaching antiquated. Educators question the ability to teach students in a manner that is incongruent to their own personal learning style[2]. As a result, individual learning remains incomplete with failure to fulfill one's personal learning capabilities or to achieve global understanding.

Health professional students are primarily educated through the use of lecture. Medical Students and Physician Assistant Students have been, and often are still, instructed with expectations of memorizing a great deal of lectured medical information. They then learn to utilize this knowledge in the future during residency and clinical rotations. Nursing Students have been taught by combining didactic learning with concomitant clinical experience as reinforcement. On the other hand, Emergency Medical Services Students have been instructed with an emphasis on kinesthetics with secondary didactic learning. Each profession continues to instruct their students in a manner consistent with their institutional paradigms; however, didactic learning continues to grow with classroom instruction centered on lecture. There is increasingly less emphasis placed on the many modes of learning, which enables all students to

acquire knowledge and skills more completely despite educational differences. The belief that all similar medical professionals utilize a similar learning style should, therefore, be reevaluated to determine today's standard of learning and education.

Problem Statement

A consensus in medical education is that all adult learners' perceptual modalities are alike and should, therefore, be taught similarly. Lecture becomes the primary teaching style with correspondingly less focus towards alternative audio, visual or kinesthetic teaching methods, which may or may not favor a particular individual's personal strengths and weaknesses. When applied to the general population, the researchers believe that comparable variation will co-exist between the learning styles of each group studied. Therefore, the identification of individual learning characteristics supports the necessity for multifaceted pedagogical methods in medical education

Purpose

Most academic programs focus teaching toward one type of individual and one domain of learning. As a result, many students fail to learn or retain presented material leaving them at an academic disadvantage. Identification of particular learning styles may demonstrate those individuals who learn best by visualizing within a cognitive domain. Past research suggested that this was how students learned most effectively; however, school curriculums may fail to initiate this form of learning early in one's academic course.

The purpose of this research project was to assess learning styles of various medical professions individually and as a whole. Groups that were investigated included Medical Students (MS), Physician Assistant Students (PAS), Nursing Students (NS) and Emergency Medical Service Students (EMS) against a Grand Valley State University (GVSU) student control group, which served as our General population (GEN). The Kolb LSI-IIa was used to evaluate all study populations. These results were compared with the GVSU control group as well as with a randomized study conducted in 1999 that used the Kolb LSI 3 to assess the general public.

Our desired outcome from this research project was to stimulate discussion in the way medical education occurs. If our hypothesis proves correct, we would like to see medical education vary its teaching style; addressing those who learn by doing, experimenting and feeling, as well as continuing to address those who learn by watching. Our hope is that the other primary domains of learning, psychomotor and the affective domain, are given as much importance as the cognitive domain.

Significance of the Problem

The goal of medical education is to produce highly qualified health care professionals who should have the knowledge, combined with the necessary clinical skills, to assure the best possible patient care. In order to accomplish this goal, medical educators must design a curriculum that allows the student to utilize his/her own best learning style to its fullest advantage. To design educational curriculums and classes of this type, educators must understand the primary learning styles of students in the medical professions.

Selecting the applicants most likely to succeed at integrating knowledge and clinical skills has been an ongoing problem in education and within many of the medical occupations. Perhaps using a learning style inventory to select those students with learning styles most consistent with successful students in previous classes would be a step towards improving the admission preferences upon entering their professions.

The Research Hypothesis

Students from selected health professions learn by utilizing a variety of learning styles. The distribution of these learning styles does not differ among the various health professions, the general education or from the general population.

CHAPTER 2
REVIEW OF LITERATURE AND CONCEPTUAL FRAMEWORK

An Overview of Adult Learning Theories

Many theories have been developed to help us understand how adults process information and learn. For the information covered in this review, the researchers have drawn heavily from Amstutz's article, "Adult Learning: Moving Toward More Inclusive Theories and Practices[3]." Amstutz identifies five primary theories: instrumental, self-directed, perspective transformation, situation cognition and experiential.

Instrumental Learning: Individual experience is the basis of learning. The learner is seen as autonomous during his/her quest for knowledge and personal growth. Learning depends on a rational perspective and analytic ability to absorb and interpret prescribed knowledge. Amstutz identifies three sub-categories of instrumental knowledge as behavioral, humanist and cognitive. Behavioral instrumental learning is the foundation of many competency-based curricula and programs. Through immediate feedback, with positive and negative reinforcement, students acquire the prescribed knowledge. This type of learning promotes standardization. Humanist instrumental learning has as its central goal the production of individuals capable of self-actualization. Learning is more than just a behavioral change; it is also viewed as self-directed and internally motivated. Cognitive instrumental learning places the focus on mental and psychological activities of the mind, as opposed to behavior. Insight, perception and meaning are the primary focus of this theory.

Self-Directed Learning: Adults plan, conduct and evaluate their own learning. Autonomy and individual freedom in learning are important features of this theory.

Perspective Transformation: Learning is the process of examining and changing one's assumptions and beliefs. The learner becomes aware of the manner by which preconceptions shape our perceptions and understandings. The preconceptions are examined and reshaped to become more integrative and inclusive.

Situation Cognition: This theory holds that context is what gives learning and knowledge meaning. One must consider the social context of the knowledge, the tools used for education and the setting in which learning takes place.

Experiential Learning: Learning is acquired from experience and one's reflection upon and interpretation of that experience. Educators select experiences to facilitate an individual's learning. Kolb's experiential learning model is built on this view.

An Overview of Experiential Learning Theories

Experiential learning theory has been gaining popularity in adult education. It is a broad theory in which several different perspectives have been advanced. Because of its potentially broad application, experiential learning has come to mean any kinesthetic-directed learning, most learning often associated with the workplace, most informal learning and some experiences associated with formal education. The primary premise of experiential learning is that learning results from recall and reflective analysis of lived experiences. Fenwick has categorized some of the various perspectives on experiential learning. The following draws from Fenwick's work[4]:

Reflection or Constructivist Approach: This theory states that the learner reflects on lived experiences. He/She interprets information, then forms generalizations based on these experiences. Active experimentation to test these generalizations ensues forming

new experiences from which to learn. Understanding is primarily a conscious, rational exercise. Piaget and Kolb have advanced this perspective of experiential learning.

Interference or Psychoanalytic Approach: This perspective is based on the works of Freud, Jung and other psychoanalytic theorists. Learning comes from inner conflict created when conscious thought is interfered with by unconscious thought. The unconscious mind contains desire for and resistance to certain knowledge and objects. The conscious mind must come to terms with this desire and resistance. Personal conflict is the result of this process and learning takes place as a result of this conflict. The unconscious cannot be known directly, however, it can be known indirectly by how it interferes with ones perception of direct experience.

Participation or Situative Approach: This approach is based on the belief that learning is rooted in the situation itself rather than within the learning. Adults do not learn from experience, but rather, they learn within it. By participation, learners acquire knowledge.

Resistance or Critical Cultural Approach: This approach believes that sociocultural power interaction is the basis of learning. "Politics" are central to cognition, activity, identity and meaning.

Co-emergence or Enactivist Approach: Cognition and environment are inseparable according to this approach. Learning and change occur in both learner and environment as a consequence of their interaction with one another. As a result, learning becomes a continuous invention, which permits further exploration of the relationship between learning and environment.

Kolb's Experiential Learning Model

According to David A. Kolb's Experiential Learning Theory, the four stages of learning are: concrete experience (CE), reflective observation (RO), abstract conceptualization (AC) and active experimentation (AE). Although a continuous cycle, each stage of the experiential learning theory can be described as follows:

Concrete Experience (CE) acts as the foundation for the three proceeding forms of learning. The first stage of experience emphasizes personal involvement in which the student relies more on feelings than on a systematic approach to problems and situations[5]. People are thought to learn through experience and the process is conceived as a four stage cycle: 1) Immediate or concrete experience, which provides the basis for; 2) Observations and reflections; 3) These observations and reflections are assimilated and distilled into a theory or concept, however informal, from which new implications for action can be drawn; and 4) These implications are then tested and serve as guides in creating new experiences[6].

Reflective Observation (RO) describes those students who learn primarily through demonstrations or viewable lectured material. Ideas and situations are assessed carefully prior to initiating any action. Through various forms of mental imagery, information retention is successfully achieved with the best responses associated with visual aids.

Abstract Conceptualization (AC) pertains to those students who learn best by listening to presented information. Logic and ideas are best instructed through verbal communication whether from themselves or by others. Theory development thus becomes a means toward problem solving.

Active Experimentation (AE) refers to those individuals who prefer to receive information through tactile stimulation (i.e., kinesthetic). A more active roll is, therefore, achieved as ideas are realized through trial and error methods.

Research indicates that students are characterized by significantly different learning styles: they preferentially focus on different types of information, tend to operate on perceived information in different ways and achieve understanding at different rates[7]. Curry states that students will be more likely to learn if the mode of teaching matches the student's learning style[8]. Kolb's model emphasizes that all new learning will proceed through the four stages and when applied instrumentally, will allow for statistical measurement of experiential learning.

Further explanation of Kolb's learning model reveals four learning style types: divergers, assimilators, convergers and accommodators. Figure 2.1 summarizes Kolb's learning cycle and each is defined as follows[6]:

Kolb's Experiential Learning Model

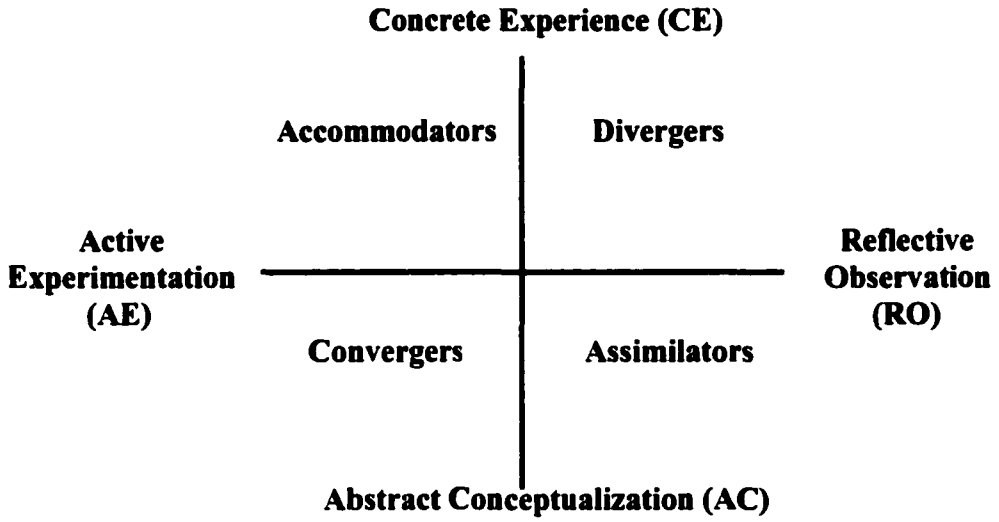

Figure 2.1: Kolb's Experiential Learning Model adapted from: Kolb, David A. 1984. Experiential Learning: Experience as the Source of Learning and Development. Prentice Hall, Englewood Cliffs, New Jersey[9].

A **diverger** performs best at the CE and RO levels. Their imaginative ability is key to personal learning. They have broad cultural interests and a greater interest in people as well as to emotional elements. Divergers excel in situations that require the development of new ideas and implications. These individuals often become involved in humanities or liberal arts.

An **assimilator** learns through a combination of RO and AC. Their strengths reside in inductive reasoning and the ability to create theoretical models[10]. An assimilator has less interest in people and lacks awareness when applying practical knowledge. Ideas and practical concepts are of greater concern. This learning method emphasizes basic science and mathematic application, more so than applied scientific instruction.

A **converger's** dominant learning ability combines AC and AE. Problem solving, decision-making and practical application of ideas represents their greatest strengths[10]. Convergers lack overt emotion and prefer to deal with objects rather than other individuals. They are associated with limited technical interests and often perform well on single answer conventional intelligence tests. Physical sciences are often a converger's specialty.

An **accommodator** performs best at AE and CE. Their learning style is kinesthetic in nature and they show marked educational improvement when involved in new experiences. Although they depend on others for information, an accommodator solves problems intuitively. Adaptation to rapidly changing circumstances is most often associated with accommodators; however, they may be perceived as impatient and assertive. Technical or practical fields are usually an accommodator's preference[11].

Academic Learning Models: The Current Approach

The Nursing Model

Using the Neuman Systems Model (NSM) for nursing, the nursing philosophy toward education can be categorized into four semester components. The first semester is comprised of concepts and theories, health assessment, pharmacology, nursing competencies and community health with utilization toward the NSM while in the nursing field[12]. Second semester training focuses upon medical-surgical, psychiatric nursing and clinical rotations, which blend kinesthetic and didactic contact with clinical experience in order to enrich the student's awareness of the patient as a person. Health planning is approached holistically with each patient's internal, external and created

environment evaluated. Problem based learning may be introduced at this stage of nursing education. The third semester, which involves obstetric and pediatrics training, allows for greater developmental emphasis through a combination of Mobility In Nursing Education (MINE) and generic abilities. Finally, improvements in leadership, research, advanced nursing process seminars and advanced medical-surgical nursing courses occur during the fourth semester instruction[12].

As learning progresses, students are able to share experiences, as well as to reflect on opportunities during clinical rotations. Laschiner and Boss found that the majority of incoming and advanced nursing students preferred concrete experience to theoretical learning[13]. Another study conducted by Cavanagh, Hogan and Ramgopal found that the majority of nursing students (i.e., 54%) had a predominantly concrete learning style and that gender, age and educational level did not affect the learning styles[14]. Given proper balance, the synthesis of previous knowledge, with clinical disciplines, problem solving and goal orientation could improve existing nursing strategies.

The Medical Model

The Medical Model comprises both Physician Assistant (PA) and physician education practices. The PA curricular philosophy maintains a program mission of conducting didactic coursework primarily with performance of main clinical rotations secondarily. PA courses evaluate competency-based outcomes, which are usually expressed through stated objectives for individual courses, lectures and clinical rotations[15]. A national certification examination is then completed for professional licensure.

Medical school curriculum consists of a preclinical didactic and clinical component. During the first two years of training, a biomedical foundation is established consisting of the basic sciences, introductory clinical skills and later investigation of specific diseases and organ system sequences. Upon completion of the national licensing examination, the focus of learning shifts from the didactic component to a hands-on, patient care environment. Third and fourth year medical students are integrated into the health care team as they complete their clerkships, as well as able to participate in elective studies, thereby broadening their learning experiences as they devote their time towards areas of interest.

The Emergency Medical Services Model

The National Association of Emergency Medical Service Educators (NAEMSE) instructs its emergency medical personnel using a variety of teaching styles that includes a combination of kinesthetic and didactic formats. Although these techniques are emphasized variably from instructor to instructor, completion of each format is necessary in order to achieve the cognitive, affective and psychomotor objective requirements of the National Standard Curriculum (NSC). Under the current guidelines of the NSC Educational Model, Emergency Medical Technicians (EMTs) can undergo intermediate or paramedic training.

Comparison of the two NSC paradigms reveals a greater emphasis on the completion of prerequisite coursework that includes EMT or EMT–Basic, human anatomy and physiology, mathematics, reading and writing. At the intermediate level, there is a prerequisite of EMT or EMT–Basic. Because of the strong emphasis on

academic course completion within the paramedic model, a didactic approach is initially required with emphasis on the aforementioned disciplines. Although the paramedic course instruction is greater in terms of content and level of assessment, the intermediate curriculum mirrors the paramedic approach once the preparatory stages are completed.

Summary and Implications for the Study

Generally, the purpose of educational research is to characterize the various techniques by which students approach learning. Many have argued that better learning outcomes can be achieved if teaching and learning environments are individually tailored to different cognition and learning styles[16]. As educators of adult professional learning, an increasing consensus continues to move away from instructional methods that promote memorization and regurgitation toward methods that help students learn how to learn, to think critically and be able to solve problems. Knowledge of individual differences could enable teachers to adapt their teaching style to particular learning styles dominant in their students[17]. The difficulty, however, is measuring these attributes reliably.

The authors' emphasize that previous research involving learning styles of health professional students often focused on single cohorts. Many studies observed nursing student's[13], primary care resident's[1] or public health student's[18] intragroup learning styles with little, if any, mention of intergroup/extragroup relationships. Few studies elaborated upon learning variability among multiple health professions, nor were comparisons conducted involving general education students or the general population. Consequently, assessment of multi-group learning styles could only be achieved through extrapolation when interpreting learning style differences.

CHAPTER 3
METHODOLOGY

Study Design

David A. Kolb developed the Learning Style Inventory in 1971 to test learning styles according to his experiential learning model. The original test consisted of nine rows of words arranged in four columns. The four words in each row represented the four learning stages in the experiential learning theory: concrete experience, reflective observation, abstract conceptualization and active experimentation. The subjects were asked to rank the words in each row according to how well each word described his/her learning style. Scoring involved totaling the columns, which gave one score for each learning style. This version was strongly criticized for poor reliability and questionable validity[19].

In 1985, Kolb revised the original LSI. The LSI-I Revised Edition consisted of twelve statements with four possible endings, each corresponding to one of the four learning styles. The subjects were to rank these endings according to what they thought best matched their learning style. Again, the four endings were arranged in columns that could be totaled to yield one score for each of the four learning styles. This revision improved the reliability and validity according to some evaluators; however, others remained skeptical[19-22].

Research by Veres, Sims and Locklear, as well as by Ruble and Stout has suggested that scrambling the order of the four endings in each of the twelve statements improved internal consistency and stability in avoiding set response bias[2,23]. In response, Kolb devised the present LSI-IIa, as well as the LSI 3. Both inventories use

scrambled answers, avoiding the set response bias that was found in the previous two versions.

Other inventories, reviewed by the authors, included the Myers Briggs Type Indicator, the Grasha-Riechmann Student Learning Style Scales and the Gregorc Style Delineator. Although equally valid, these inventories were avoided because of variable instructional confusion and lengthiness in administration time. For our descriptive qualitative study, the Kolb LSI-IIa provided the sought simplicity, validity and reliability.

Study Site and Subjects

Students from five groups of interest (Michigan State University College of Human Medicine Medical Students, Grand Valley State University Nursing Students, Grand Valley State University Physician Assistant Students, Grand Rapids Emergency Medical Services Students and a control group of Grand Valley State University General Education Students) were used in this survey. Between February and March 2001, two campuses were utilized while collecting the data: Grand Valley State University, Allendale, MI and the Grand Rapids Medical Education and Research Center (GRMERC) for Health Professions, Grand Rapids, MI.

Equipment and Instruments

We purchased the LSI-IIa survey, which is the research form of the LSI 3, from Hay/McBer (Appendix B) to be utilized as our learning style measuring instrument. The LSI-IIa is provided in bulk for research purposes with the idea that a third party will compile the collected data. All data was sorted using Microsoft Excel 2000 and the Statistical Program for the Social Sciences (SPSS) for Windows version 9.

Validity and Reliability

Validity and reliability of the Kolb LSI-I has been scrutinized since its development in 1971. Although questioned, a comparative factor analysis of four learning style instruments found that the Kolb was the only one with a match between statistically calculated factors and the learning style categories[6]. Many revisions of the original LSI have been attempted resulting in the LSI-IIa and LSI 3. The LSI-IIa is the research equivalent to Kolb's LSI 3. The LSI 3 survey differs by an enclosed color-coded sheet for personal scoring, which utilizes four colors to reinforce the four stages of the learning cycle[6]. Furthermore, the stage names have become Diverging, Assimilating, Converging and Accommodating to represent a dynamic learner versus one that remains static.

According to Veres et al., the addition of the randomized scoring pattern found in the LSI-IIa and LSI 3 have created greater testing efficacy[24], with improved validity and reliability. In 1991, Leslie Hickox performed a meta-analysis of learning research in many fields: education, psychology, medicine, nursing, accounting, management engineering/sciences and social work, which concluded that 83.3% of the studies provided support for the validity of the Experiential Learning Theory and Kolb's Learning Style Inventory[6]. More so, the LSI has proven applicability in many countries with translations in over six languages.

Reliability can be demonstrated within the test-retest scale scores for Kolb's LSI 3. Among two randomized samples (N = 711 and N = 1042), the mean Kappa Coefficients were: CE .96, RO .97, AC .97, AE .96 and CE .99, RO .98, AC .99, AE .99

respectively[6]. Participant results reflect a dynamic learning style that is individualized, but unchanged after repeated administrations. Thus, randomization of the four learning stages substantially improved the format and internal consistency of the learning style inventory.

Procedure

After approval from the Grand Valley State University Internal Review Board, a control group was selected by first listing all general education classes at Grand Valley State University Allendale Campus. Associated course catalog numbers were then randomly selected through the use of a computer numeric randomization program to generate the GEN student sample. The authors' hope was that through this method of sampling, the greatest variety of pre-professional students, ranging from freshman to senior status would provide a unique blend of student learning. The study groups consisted of four professional student medical organizations. Each graduate program, consisting of the MS, PAS and EMS, was accessible as a sample of convenience through the GRMERC. Nursing Students were surveyed at GVSU's Allendale campus.

One study author attended the randomly selected general education and graduate student classes to introduce themselves and to present the survey. The consent letter (Appendix A) depicted the nature of the study and the purpose for its conduction. A copy of the letter was attached to each of the Kolb LSI-IIa surveys for personal reference. Two forms of introduction were used for survey administration: 1) the use of an audio consent form identical to the written consent; and 2) the written consent. Presentation of the survey in this manner was designed to reduce administrator bias. The administrator

was available primarily for administration of the research project, fielding of additional questions and collection of the learning style inventory.

Administration of the LSI-IIa to any group of students was discussed in advance with their professor for approval of approximately fifteen minutes of their classroom period. Upon visual and auditory explanation of this survey, consent was implied if a student's survey was completed. Assigned to each of the surveys was a random number and Internet web address, which could be used by the student to determine their LSI ranking. Once the survey data was analyzed, the results were displayed on the GRMERC web page with each survey participant's anonymity guaranteed by use of the random number as the only means of identification. Determination of the student's particular learning style acted as an incentive to complete the survey.

Research advantages that exist resided in the locality of academic resources, access to an adequate control group and proximity to an extensive medical profession pool. An additional advantage consisted of the audio format of the letter of consent. Administration of the Kolb LSI-IIa in this manner appeared to reduce the number of potential biases, as well as to eliminate confounders that could misrepresent sought data. No inclusion or exclusion criteria were noted other than the individual must have current student enrollment and fall under one of the five previously mentioned study populations.

Statistical Methods

The distribution of learning styles among the five groups of interest (i.e., MS, NS, PAS, EMS and GEN) was examined using Pearson's Chi-square test. To demonstrate that learning styles of health profession students do not differ from one another, an

increase in statistical power to 95% was used in determining sample size requirements. The mean summed ranks for the four different learning stages (i.e., CE, RO, AC and AE) were compared using analysis of variance (ANOVA) methods with an appropriate adjustment for multiple comparisons.

ANOVA was used to examine the group differences among the five groups of interest by splitting up the total variability in our data into its two constituent parts: variation between groups of interest (resulting from random variation and possibly a group effect) and variation within groups of interest (resulting solely from random variation). By examining the ratio of between-group variation to within-group variation, it was possible to determine whether a group effect was present (whether any of the five groups differ) based on one overall p-value. The presence of a statistically significant group effect was based on observing a standard p-value of less than 0.05, which indicates our methods will incorrectly find a statistically significant group effect less than five percent of the time.

CHAPTER 4
RESULTS/DATA ANALYSIS

Subject Characteristics

Student demographics consisted of both male and female students (n = 265) within the following age ranges: 18-24, 25-32, 33-45 and 46 or older. The majority of students were 18-24 y/o (n = 180) with subsequent declines in the overall male and female populations as age brackets increased (i.e., 25-32 y/o (n = 64), 33-45 y/o (n = 18) and 46 y/o or older (n = 3)). This is no surprise as most students are encouraged to complete collegiate, as well as technical training immediately after the completion of secondary schooling. Overall, more female students were surveyed (i.e., nearly a 2:1 ratio) with significant variability within each category (Table 4.1).

Table 4.1: Student Demographics Compared by Age, Gender and Profession

	EMS		GEN		MS		NS		PAS		Gender Totals		Overall
AGE	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**M & F**
18-24	10	17	31	37	1	3	3	48	7	23	52	128	180
25-32	9	8	0	1	15	9	1	7	5	9	30	34	64
33-45	2	6	1	0	0	0	0	6	3	0	6	12	18
>45	1	0	0	0	0	0	0	0	1	1	2	1	3
M/F	22	31	32	38	16	12	4	61	16	33			
GRP Totals		53		70		28		65		49			

Overall	**M**	90	**F**	175	**All**	265

Gender differences were not assessed in this design. Although female participants were responsible for nearly two-thirds of the submitted data, a gender specific learning style was not expected. The NS group illustrates this point with a female to male ratio of 15:1 and an equally widespread distribution of learning styles when compared with the control group.

Techniques of Data Analysis

Using the Kolb LSI-IIa, an overall 88% response rate was achieved, which as defined, included proper completion of the survey, as well as submission of the participant's demographic questionnaire. The percent value was calculated from the EMS, GEN, NS and PAS populations. Each group size demonstrated above a minimal 80% student participation except for the MS (i.e., 47%). This finding, however, was not an inclusion/exclusion criteria factor. Most students were surveyed during scheduled classroom meetings with achievable population goals. In some instances, the number of participants even exceeded our expectations.

Data analysis was performed using Kolb's LSI-IIa Assessment Tools (Appendix D). Microsoft Excel 2000 was utilized for data entry. Applicable data included the Kolb LSI-IIa survey results, as well each student's demographic questionnaire (Appendix C). The researchers entered all collected data manually with each entry compared individually to verify accuracy. Upon completion, the data was then evaluated using SPSS for Windows version 9 and graphically presented for analysis. Figures 4.1-4.5 represent the overall (n = 265) relative distribution of LSI-IIa survey data collected from the regional EMS Students (n = 53), third and fourth year Medical Students (n = 28), first year Nursing Students (n = 65), second and third year Physician Assistant Students (n = 49) and the General population (n = 70), which served as our local control.

Figure 4.1

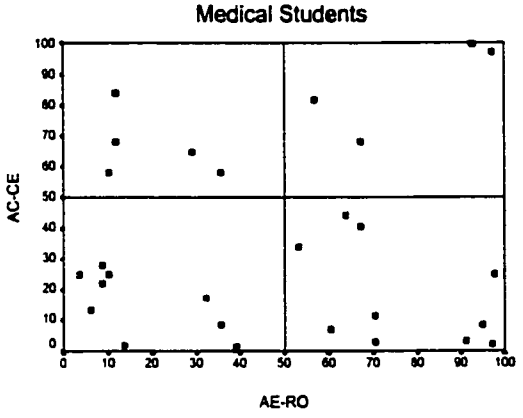

Figure 4.2

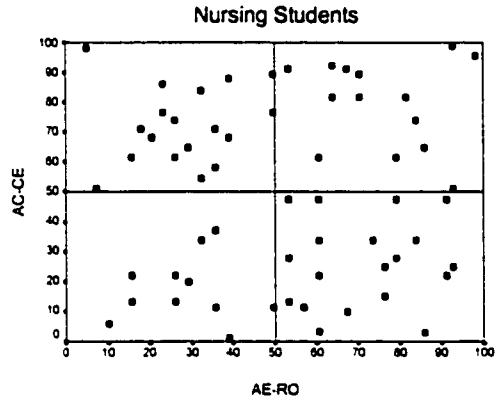

Figure 4.3

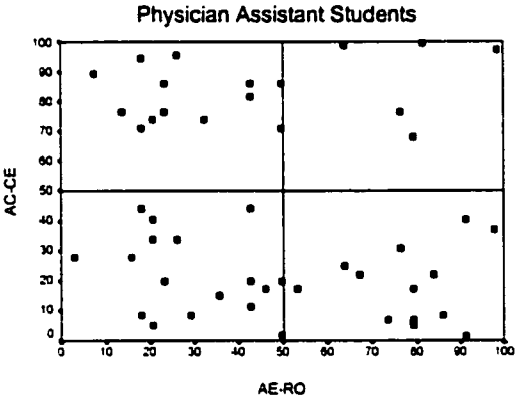

Figure 4.4

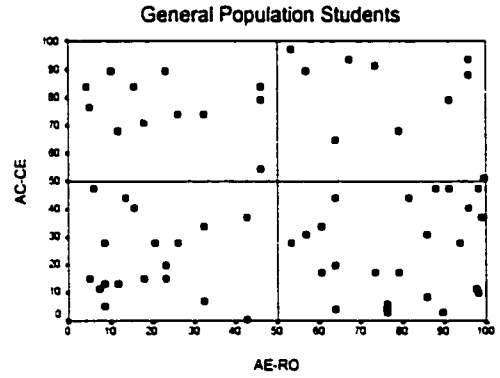

Figure 4.5

Figures 4.1-5: Scatter plots depicting learning style distribution among the four health professional groups and the general student population. Clockwise from top right quadrant: Diverger, Assimilator, Converger and Accommodator.

When comparing the health professional students to the general population no clear learning style can be identified. Considerable consistency exists when comparing each learning stage (i.e., AE-RO and AC-CE) of the experimental groups to the control group. Cross tabulation of the group learning styles further suggests a variety of student learning (Table 4.2). Dominant learning preferences are suggested within each group (i.e., EMS 39.6% Accommodation; GEN 38.6%, MS 35.7% and NS 32.3% Assimilation; and PAS 34.7% Convergence); however, due to widespread intragroup learning style variability there is no single observable learning style among the experimental groups or within the control group (Chi-squared p-value = 0.167). As a result, health professional students cannot be classified into a single learning style category.

Table 4.2: Learning Style Group Crosstabulation*

			GROUP					
			EMS	GEN	MS	NS	PAS	Total
Learning Style	Diverger	Count	9	10	4	14	5	42
		% within GROUP	17.0%	14.3%	14.3%	21.5%	10.2%	15.8%
	Assimilator	Count	11	27	10	21	13	82
		% within GROUP	20.8%	38.6%	35.7%	32.3%	26.5%	30.9%
	Converger	Count	12	21	9	12	17	71
		% within GROUP	22.6%	30.0%	32.1%	18.5%	34.7%	26.8%
	Accommodator	Count	21	12	5	18	14	70
		% within GROUP	39.6%	17.1%	17.9%	27.7%	28.6%	26.4%
Total		Count	53	70	28	65	49	265
		% within GROUP	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

* Percentages are column percents within each group.

The only significant difference observed between the LSI-IIa scores lies within the Abstract Conceptualization (AC) stage. Our data suggests that MS have significantly greater AC scores than EMS and NS (ANOVA p-value = .003). There were no other statistically significant differences suggested from our data.

CHAPTER 5
DISCUSSION AND IMPLICATIONS

Our study reveals that each group demonstrated similar variation in learning styles with no clear identification into a particular style (i.e., diverger, assimilator, converger or accommodator). Unique learning styles were demonstrated by the diffuseness of the plotted data. Similar results were obtained in the 1999 Kolb LSI 3, further supporting that a student's learning modalities are not alike and should, therefore, not be instructed as such.

The normative comparison group for the 1999 Kolb LSI 3 was based on a random sample of 1,446 adults between the ages of 18 – 60[6]. The sample consisted of 638 men and 801 women from multiple ethnicities, various careers and diverse socioeconomic classes. The average education attained by the participants was two years of college. Our population consisted of 265 adults between the ages of 18 and 45 or older. There were 90 men and 175 women who participated in the Kolb LSI-IIa survey. Again, multiple ethnicities, various pre-graduate employment experiences and diverse socioeconomic classes were observed. The average education attained by those surveyed was from a four-year, Bachelors degree, program prior to graduate education enrollment.

Raw scale scores from the 1999 Kolb LSI 3 study were utilized to determine a like-fit between learning stages[6]. The mean values for CE, RO, AC and AE were compared among each group studied. As demonstrated in Figure 5.1, each group's learning stage is concordant with the confidence interval supporting Kolb's reported validity and reliability. No learning style differences were suggested from the calculated results.

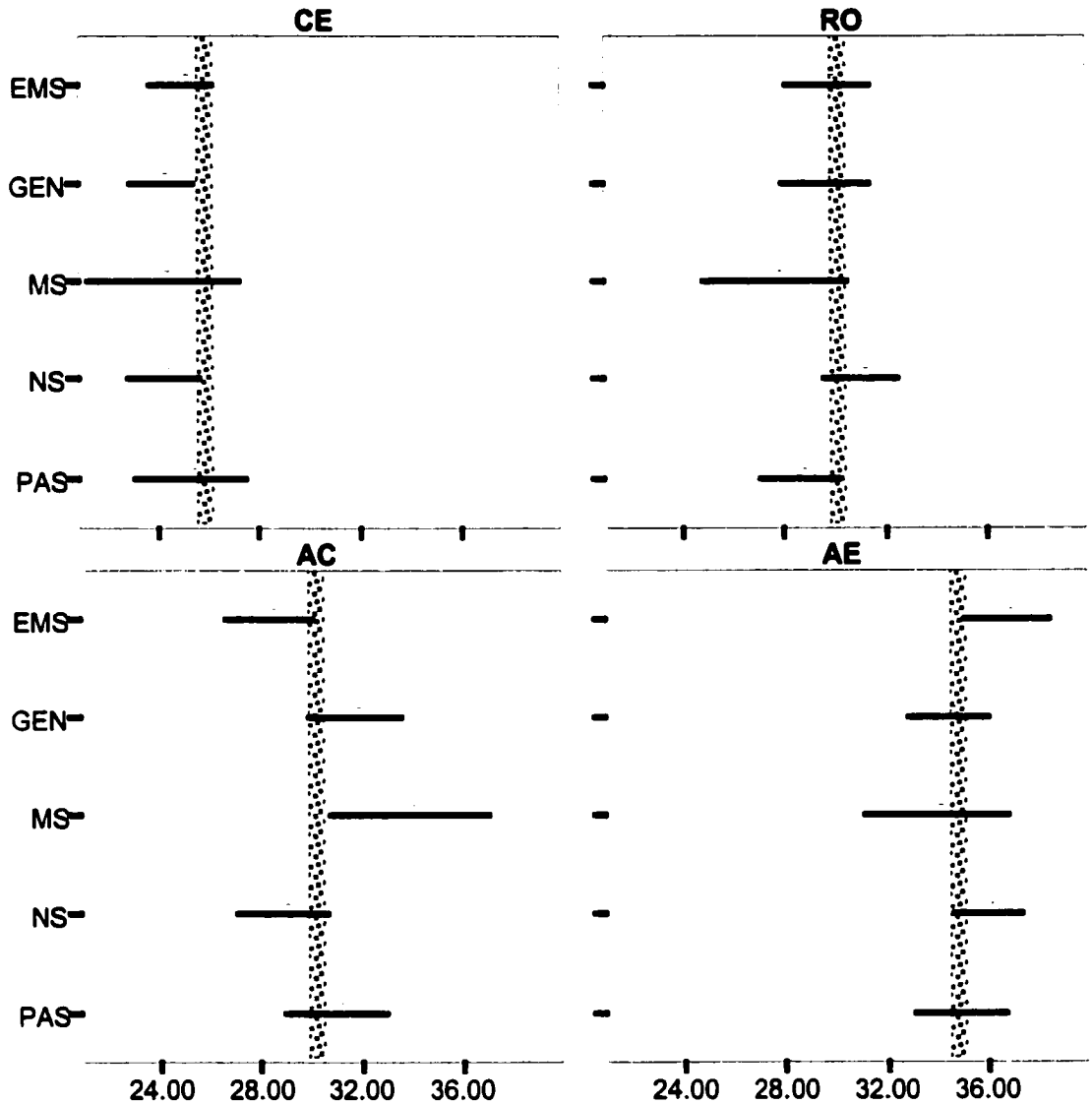

Figure 5.1: Comparative analysis among CE, RO, AC and AE of the current study compared to Kolb's LSI 3 1999. Shaded regions represent 95% confidence intervals from the 1999 Kolb LSI 3.

Application of Practice

Analysis of our data suggests trends that are similar to two previous studies that were administered to health/social science students using the Kolb LSI-II. A study conducted by Piane, Rydman and Rubens on learning styles of public health students

could not identify an even distribution among Kolb's learning style categories, nor were the students predominantly of one learning style[18]. Secondly, Kosower et al. concluded that among their study comparing learning styles between University of California at Los Angeles (UCLA) Medical School pediatric residents and faculty, teachers were in need of alternative teaching/learning strategies in order to make available a variety of environments to accommodate student learning[25]. Preceptors and faculty members should guide a student's ability to learn through self-directed, independent study. College educators, counselors and instructional development professionals must make a directed effort to encourage instructors to institute alternative teaching techniques in an attempt to actively engage all students[10].

Many educational models now exist, such as problem-based learning, discussion groups within the classroom and instructional multimedia applications (e.g., computer simulations, telemedicine and instructional videos), which aid, not only the audiovisual learner, but also the conceptual and kinesthetic learner. Students leaving the conventional classroom lecture pursue more individualistic study in order to achieve a higher level of learning according to their preferential style(s) of learning. Thus, combining these models with traditional instruction would facilitate greater learning.

Research shows that students are often characterized by their individual learning style. Statistically, most students, who attend science classes, are visual learners while the majority of artists are perceived as reflective and experienced. Instructor centered classrooms (i.e., lectures and demonstrations) result in limited short-term memory recall

versus student centered (i.e., problem solving and discussion) classes, which improves comprehension over the long term, information recall, general problem solving, scientific attitude and subsequent interest. Preferentially, a student may focus on a plethora of information; however, they will only achieve understanding at their own rate when utilizing their personal style. Successful learning style compatibility is thus a function of teaching style match[7].

Limitations

One of the primary difficulties with our research is our use of a sample of convenience. We used students from Grand Valley State University's Nursing program and Physician Assistant Studies program, local Emergency Medical Service Students and the MSU Medical Students available through GRMERC. This makes generalization to statewide or nationwide populations less reliable. More research is needed drawing from larger random statewide or nationwide populations within these categories or samples from randomly selected regions containing enough individuals in each group.

Another weakness identified in the sample of convenience is evident in the size of our MS population. Our sample of MS was nearly half the size of the other groups. Thus, the conclusions about the MS learning styles may be less reliable. Repeating this study with a larger sample would strengthen the results.

Our research consisted of a single learning style inventory, Kolb's LSI-IIa. We have shown good reliability and validity for this measure through comparative results with the 1999 Kolb LSI 3. However, using only one learning style measure increases the

chance of introducing bias. Repeating this study with other learning style measures would help to uncover bias that may exist in our study or further verify our results.

An additional complication resides within the graduate school instructors themselves. Emphasis is generally placed upon the method by which they were academically instructed. Consequently, their instinctual teaching methods predominate and a continuous cycle of unipolar learning is maintained. Lefrancois states, "To instruct is to exercise control over some of the learner's experience in a deliberate and thoughtful attempt to influence learning[26]." Kolb suggests that individuals must fulfill each style of learning in order to master a topic's full understanding; however, each style does not have to progress precisely according to the Kolb experiential learning model order. Many past studies support this finding and is suggested within our study as well.

Suggestions for Further Research

Future research could focus on the application of the Kolb LSI-IIa to other less studied groups such as high school students, students of higher graduate education or medical professionals themselves. Another suggestion may involve a long-term prospective study that follows a group of students from high school until their completion of postsecondary education. The Kolb LSI-IIa could be used each year to assess for changes or patterns in student learning. The identification of learning styles at an earlier age may improve study techniques and increase the likelihood that a student would succeed in their academic endeavors. Furthermore, variations in learning ability may also suggest when certain styles are more influenced leading to a more dynamic teaching approach in education.

Conclusion

Our research supports the hypothesis and found no significant learning style difference among the students of the selected health professions, within the students of general education or from the general population. These groups have similar distributions of problem-based learners, book learners, lecture learners and kinesthetic learners. This suggests that focusing education on one particular learning style would place students, requiring other learning formats, at a disadvantage. Educational programs should design their curricula to address all learning styles and to insure that all students receive an equal opportunity to learn.

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APPENDIX A

Consent Form

Consent Form

Dear Student,

We are conducting a study concerning the different learning styles of various students. Evaluating particular teaching methods is necessary in order to improve student learning. The Kolb Learning Style Inventory IIa (LSI-IIa) is a survey designed to help people understand how they process information and to establish their learning preferences. By design, the inventory is constructed to determine your best learning style and describes your current behavior as you approach new learning experiences.

A researcher will proctor the LSI-IIa in the following manner: A written consent form, questionnaire and learning style inventory will be distributed to each of you. The consent form will then be presented to you in an audio format. Upon completion of the survey, the consent form with the attached randomized number and web address is yours to keep. The researcher will then collect each questionnaire and survey.

Participation in this study is completely voluntary. Our goal is to collect 300 surveys for statistical analysis. If you choose not to participate, please return the survey unmarked. Through the use of audible and written instruction, completion of the questionnaire and survey will imply your informed consent.

Please take a moment to complete the questionnaire and survey. All responses are confidential and anonymous. Please do not sign any of the provided documents. No attempt will be made to establish a correlation between a survey number and an individual. If you are interested in the results of your LSI-IIa, please refer to the accompanying randomized number and web address during the month of May 2001. Your survey results will correspond to a particular learning style.

We encourage your participation in this survey in order to improve the effectiveness of teaching, as well as to understand the particular ways in which we learn. If you have any questions pertaining to this research study or questionnaire please contact:

Dennis C. Gregory PA-S
Steve Huisman PA-S
GRMERC Internship Program
251 Michigan NE
Grand Rapids, MI 49503
(616) 662-4908
(616) 842-0179

For any questions pertaining to a subject's rights, please contact Paul Huizenga, Chair of Human Subjects Review Board, at Grand Valley State University. He may be reached at (616) 895-2472.

Thank you for your time and cooperation.

Sincerely,

Dennis C. Gregory PA-S
Steve Huisman PA-S

APPENDIX B

Kolb LSI-IIa Survey

LEARNING-STYLE INVENTORY

The Learning-Style Inventory describes the way you learn and how you deal with ideas and day-to-day situations in your life. Below are 12 sentences with a choice of endings. Rank the endings for each sentence according to how well you think each one fits with how you would go about learning something. Try to recall some recent situations where you had to learn something new, perhaps in your job or at school. Then, using the spaces provided, rank a "4" for the sentence ending that describes how you learn *best*, down to "1" for the sentence ending that seems *least* like the way you learn. Be sure to rank all the endings to each sentence unit. Please do not make ties.

Example of completed sentence set:

1. When I learn: 2 I am happy. 1 I am fast. 3 I am logical. 4 I am careful.

Remember: 4 = *most* like you 3 = *second most* like you 2 = *third most* like you 1 = *least* like you

	A		B		C		D	
1. When I learn:	___	I like to deal with my feelings	___	I like to think about ideas.	___	I like to be doing things.	___	I like to watch and listen.
3. When I am learning:	___	I tend to reason things out.	___	I am responsible about things.	___	I am quiet and reserved.	___	I have strong feelings and reactions.
5. When I learn:	___	I am open to new experiences.	___	I look at all sides of issues.	___	I like to analyze things, break them down into their parts.	___	I like to try things out.
7. I learn best from:	___	observation.	___	personal relationships.	___	rational theories.	___	a chance to try out and practice.
9. I learn best when:	___	I rely on my observations.	___	I rely on my feelings.	___	I can try things out for myself.	___	I rely on my ideas.
11. When I learn:	___	I get involved.	___	I like to observe.	___	I evaluate things.	___	I like to be active.

APPENDIX C

DEMOGRAPHICS QUESTIONNAIRE

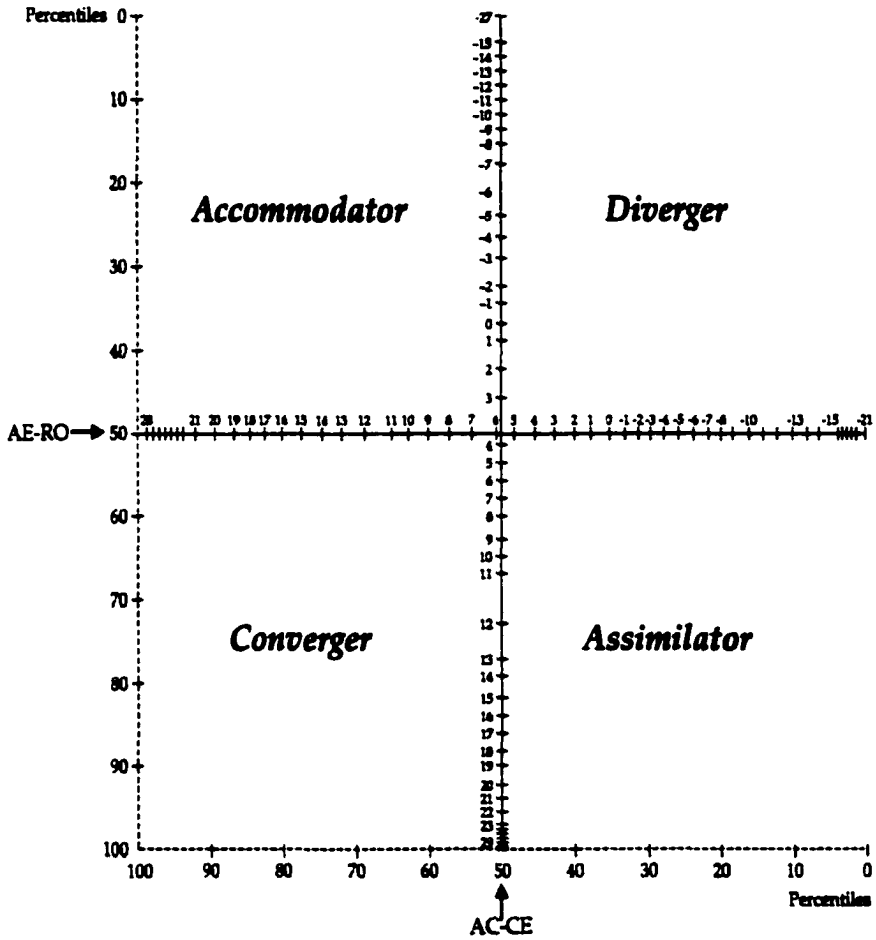
Please indicate the following: (circle only one item per inquiry)

Age:	18-24	25-32	33-45	over 45
Gender:	M	F		
Graduate Program:	Nursing Student			
	Medical Student			
	Physician Assistant Student			
	Emergency Medical Technician Student			
	Other			

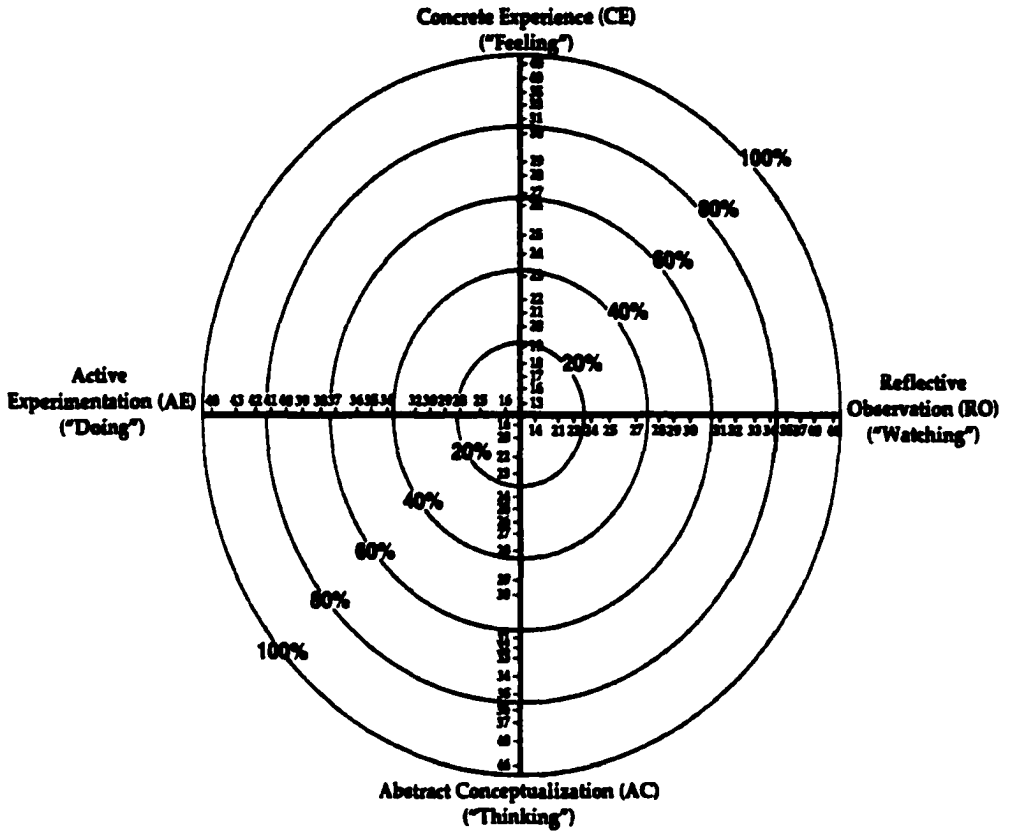
APPENDIX D

Kolb LSI-IIa Assessment Tools

LEARNING-STYLE TYPE GRID



THE CYCLE OF LEARNING



_ +	_ +	_ +	_ +	_ +	_ +	_ +	_ +	_ +	_ +	_ +	_	= ☐
1A	2C	3D	4A	5A	6C	7B	8D	9B	10B	11A	12B	CE Total
_ +	_ +	_ +	_ +	_ +	_ +	_ +	_ +	_ +	_ +	_ +	_	= ☐
1D	2A	3C	4C	5B	6A	7A	8C	9A	10A	11B	12C	RO Total
_ +	_ +	_ +	_ +	_ +	_ +	_ +	_ +	_ +	_ +	_ +	_	= ☐
1B	2B	3A	4D	5C	6D	7C	8B	9D	10D	11C	12A	AC Total
_ +	_ +	_ +	_ +	_ +	_ +	_ +	_ +	_ +	_ +	_ +	_	= ☐
1C	2D	3B	4B	5D	6B	7D	8A	9C	10C	11D	12D	AE Total