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A survey of the thinking preferences and hemispheric learning strategies (methods) of freshmen and senior associate degree nursing students and the thinking preferences of associate degree nursing faculty.

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A SURVEY OF THE THINKING PREFERENCES AND HEMISPHERIC LEARNING STRATEGIES (METHODS) OF FRESHMEN AND SENIOR ASSOCIATE DEGREE NURSING STUDENTS AND THE THINKING PREFERENCES OF ASSOCIATE DEGREE NURSING FACULTY

A Dissertation Presented

by

GEORGE JEROME LESLIE

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A SURVEY OF THE THINKING PREFERENCES AND HEMISPHERIC LEARNING STRATEGIES (METHODS) OF FRESHMEN AND SENIOR ASSOCIATE DEGREE NURSING STUDENTS AND THE THINKING PREFERENCES OF ASSOCIATE DEGREE NURSING FACULTY

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ABSTRACT

A SURVEY OF THE THINKING PREFERENCES AND HEMISPHERIC LEARNING STRATEGIES (METHODS) OF FRESHMEN AND SENIOR ASSOCIATE DEGREE NURSING STUDENTS AND THE THINKING PREFERENCES OF ASSOCIATE DEGREE NURSING FACULTY

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Within the context of an Associate Degree Nursing Program, the author attempted to assess the Thinking Preferences (Brain Dominance Characteristics) of Student Nurses and Nursing Faculty, and to discern whether Nursing students used either Left- or Right-oriented Hemispheric Learning Strategies (Methods) to successfully complete their Nursing courses. Nursing students and Faculty were administered the Herrmann Participant Survey Instrument, while students also completed a Hemispheric Learning Strategies (Methods) Questionnaire, devised by the researcher.

Multiple Analysis of Variance tests revealed that there were no significant differences between overall Left or Right, Cerebral or Limbic Thinking Preference (Quadrant) scores for students or faculty. For Male

students overall, 43 percent had Left-, and 75 percent had Right-oriented Thinking Preferences, and for Female students overall, 45 percent had Left-, and 55 percent had Right-oriented Thinking Preferences. Fifty-percent of Nursing Faculty had Left- and 50 percent had Right-oriented Thinking Preferences.

Analysis of Variance tests revealed that there were no significant differences between student groups for the use of Left- or Right-oriented Learning Strategies (Methods), with a moderately-strong Left-, and slightly-moderate Right-oriented Learning Strategy emphasis by students in their Nursing courses. Fifty-five percent of all students had Thinking Preference orientations that were incongruent to their Learning Strategy orientations. Chi-Square analysis revealed that there were significant differences between Freshmen and Senior Females ($X2=4.306$, $df=1$, $p<.05$), and between Senior Males and Females ($X2=5.588$, $df=1$, $p<.05$), in their Thinking Preference-Learning Strategy usage.

An awareness of the students' Thinking Preferences could help Nursing Faculty nurture the growth and accessibility of the 'weaker', less used and preferred modes of thinking by students. This may add greatly to the development of their critical and creative thinking and problem-solving skills and to their potential for learning and success.

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INTRODUCTION

One of the biggest challenges to community colleges, which Cross (1981) calls the "new frontier" in higher education, is dealing effectively with the educational diversity of adults of all ages, abilities, backgrounds and purposes who are entering the learning force, without compromising quality, excellence, content, credibility and standards of attainment and respect in educational settings. It has become apparent that the use of traditional (conventional) strategies, methods, objectives and philosophies may not be effective or flexible enough to accomodate the diverse thinking and learning modes found in heterogeneous community college student populations. In addition, educators must be ready to anticipate, adapt to, and reflect the changing demands of our technologically-based society by helping students develop and access the critical and creative thinking and problem solving skills needed to cope with these changes.

Meissner (1986) suggests that in a Nursing curriculum, attention to procedures, management and administrative detail, unrealistic study loads, and adherence to rigid behavioral guidelines in order to 'cover' all the material needed to pass the State Nursing

Boards, without allowing for individual learning style and thinking differences, and the importance of nurturing creative and idealistic ideas and talents, contributes heavily to frustration, burnout and withdrawl of otherwise capable Nursing students. With the combination of rising attrition rates, a decline in traditional 18-19 year-old students with a concomitant rise in the 22-34 year-old groups (O'Keefe, 1985), together with the increased numbers of minority (Blacks and Hispanics) students (Hodgkinson, 1985), educational systems are going to feel an increased burden to develop remedial efforts for a great number of students without compromising the above-average student.

Different cultures develop different ways of thinking and different forms of intelligence and human skills which need to be developed and allowed free expression. Walizer (1986) suggests that "insistence on emphasizing verbal and mathematical skills as the most, if not the only, acceptable form of educational achievement is inevitably exclusive. It devalues those students whose intelligence is articulated in other forms, whose intelligent skills are better expressed visually, musically, mechanically or in motion. Worse yet, it often fails students from different cultural backgrounds. We can not genuinely honor the diverse learning styles of our students and still expect them all to commit to an identical content in a curriculum, no matter how much time we give them to do so."

Within the last couple of decades, neuroscientists have learned that the inner world of the mind is far more complex and resourceful than was ever imagined and, therefore, if viewed with caution, holds great promise for educators concerned about the enormous task of coping with diverse student cognitive backgrounds and rising attrition rates. An awareness of the Thinking Preferences (brain dominance characteristics), learning styles and creative potential of students seems essential so that educators can be in better 'tuned with', and be ready for, these diverse cognitive abilities, and be in a more flexible position to help these students succeed, rather than fail, in college.

In recent years, there has been a substantial amount of research published on the relationship between cognitive style and academic achievement, utilizing many models and instruments to measure successful learning. However, there are not many studies that survey and elucidate the Thinking Preferences (brain dominance characteristics), as a type of cognitive style, of Nursing students and Nursing Instructors at the community college level, nor discuss whether the Nursing curriculum is congruent to the Thinking Preferences of student Nurses. In addition, it isn't well known how students must adapt their Thinking Preferences and Hemispheric Learning Strategies (Methods) to successfully complete the Nursing courses in the curriculum.

This survey study was initiated in order to provide sufficient data to inaugaurate some different modes of thinking about Nursing instruction and evaluation methodology, and promote an increased awareness of the thinking skills and preferences that influence the way community college Nursing students think, learn and solve problems. The decision about which teaching and evaluation methods to use could be made more wisely if the instructor knew some of the brain dominance/cognitive factors that influenced the way their students learn, and whether or not the students were learning from their preferred (optimal) mode of thinking required for the situation or were forced to use those cognitive strategies which for them have been underdeveloped and little used successfully in learning situations.

If the right hemisphere plays an important role in emotion, general activation and arousal (Schwartz, 1975), then getting a student emotionally aroused, alerted and involved in his/her work, will help to more fully activate his/her left hemisphere and assure that both sides will participate in the educational process regardless of the subject matter. Sinatra (1983) suggests that when words and sentences are used to describe concrete experiences, nonverbal, right hemispheric conceptualizations or schemata provide the referents or 'blueprints' for the language meaning, which if they continue to develop during the early years of school, may be the cornerstone for later literacy learning in verbal modes during the higher grade levels.

Similarly, Pallrand and Seeber (1984) found that training in visual-spatial/graphic ability in community college physics students led to significant improvement in the general visual-spatial abilities of their students in the areas of perception, orientation and visualization of the concepts of their subject. Galyean (1978) also found that by promoting guided (visual) imagery activities in class, students were better able to sharpen their mental attentiveness and performance, work more cohesively with others, attended classes more frequently, and did more of whatever work was assigned.

As Joyce (1985) suggests, the skills of reading, the study of values, the analytic tools of scholars, and the nurture of intuition are compatible, and we can and should teach them together. An appropriate awareness by students and educators of their own and others' strongest (primary) thinking and learning modes, with facilitation of both hemispheres, then, may improve the environment and potential for teaching and learning.

Rationale for the Study

Western society tends to educate in ways which foster typically accepted left-brain (analytical; logical; orderly) development at the expense of the many unique experiences requiring capabilities which utilize right brain (holistic; simultaneous; visuospatial) processing. The work of Galin and Ornstein (1974), Samples (1975,(a);(b)), Hunter (1976), Piatt (1979), Grady (1981), McCarthy (1981), Herrmann (1981, 1982,(a);(b)), Edwards (1982), and Hatcher (1983), among others supports this contention, although, according to Levy (1983) evidence from research studies disputes this idea. A general analysis by the researcher, in conjunction with the Nursing division chairperson, of the Nursing curricula as it reflects the behavioral objectives (competencies) of the National League for Nursing, confirmed this left-brain orientation of the program.

If more effective use could be made of right cerebral activity (Druart, 1983), or, taken a step further, if a balanced, whole-brained based Nursing curriculum that better matched the strongest Thinking Preferences of Nursing students could be developed, perhaps it could not only help to foster the further growth of the stronger (primary) neural areas that a person prefers to use, but also it could help challenge the weaker, less preferred used areas, and the potential for their possible development and usage could be raised (Hunter, 1976; Toepfer, 1982). This is particularly important for community college Nursing instructors to take into account in light of the amount of information that needs to be learned in a two-year program, as well as the fact that many of the minority and returning 'older' students do not have extremely strong academic backgrounds.

In discussing the problems of older (> 24 years) undergraduate physical science students, Webb and Carras (1981) indicate that "not all of these students have the necessary knowledge and skills to succeed in traditional physics and chemistry courses. In developing teaching strategies for such students, it is essential to keep in mind that their maturity, aspirations and needs differ from those of recent high school graduates."

Based on sixteen years teaching experience in the Biological sciences and through observations and discussions with both day and evening community college Nursing, allied health, and liberal arts transfer students, as well as from confirming data from numerous research studies, Nursing journals, and discussions with Nursing Faculty, administrators, graduate and student Nurses, this researcher believes that in order to obtain a better 'profile' on the strengths and weaknesses of associate degree Nursing students, and to help these students discover a measure of success that a left-brain-biased system might not have offered all of them, even though they may be otherwise qualified, it is important to assess the extent that the Nursing students, are, in fact, accessing and preferring a particular neural mode of thinking as reflected by the Herrmann Brain Dominance Instrument, and the extent that these preferences are congruent to the Thinking Preferences of Nursing Faculty.

Since individuals with different brain dominance patterns tend to approach a learning or problem situation differently, an awareness of the differences would help Nursing Faculty and students to better understand and appreciate both their own unique perspectives as well as the value and validity of the viewpoints, perspectives, preferences and inputs of other students and faculty.

With the Nursing Faculty using a team teaching (modular) approach to instruction, the data gathered on the Thinking Preferences of students and instructors could be used to make better use of assigning instructors to those students who have similar Thinking Preferences. In addition, there have not been any studies on the Thinking Preferences of students or faculty at Springfield Technical Community College, and the present study is appropriate to starting to fulfill the recommendations of the 1984 Nursing accreditation team who pointed out a need to assess individual learning characteristics, to express all classroom and clinical objectives in measurable terms, and to revise the evaluation tools so that they contain specific criteria for measuring student achievement.

Background of the Study

Whatever modalities are used in the contemporary classroom, it is important that more of an individualized approach to instruction and evaluation be stressed to an ever increasing degree, which is of particular importance when considering the adult community college student. The relatively unrestricted opportunity for entry in many areas results in a broad spectrum of academic abilities, ages, background and purposes in the student population. In addition, the importance of education for the rapidly expanding number of older adults will continue to be an important role for the community college in helping to integrate older adults into community life, in promoting their creative potential, and in meeting their basic educational needs. Ostrow (1984,1986) concluded that for baccalaureate Nursing students, a personalized system of instruction was a powerful instructional method that resulted in higher examination scores and higher satisfaction with this method than lecture. It was an instructional method that helped all students regardless of cognitive style or cumulative grade point average. Bratt and Vockell (1986) found that Nursing students who used Computer Assisted Instructional materials mastered the objectives of the curriculum more effectively than those students not using the system. This system provided useful feedback in pinpointing and correcting their weaknesses that helped them master the factual information and obtain higher test scores.

The Nursing curriculum at Springfield Technical Community College (STCC) is planned to prepare men and women to be professional Nurses who will be competent to render safe and effective Nursing care to people within the normal life cycle, both in health and illness. The student who successfully completes the prescribed curriculum earns the degree of Associate in Science and is eligible to take the licensing examination to qualify as a Registered Nurse. The program is approved by the Massachusetts Board of Registration in Nursing, and also has full accreditation by the National League for Nursing (NLN). Prerequisites for admission to the Nursing Program call for the applicant to be a high school graduate or equivalent. The candidate must also have completed courses in algebra 2, chemistry and biology. Scores in the 450 range on both the verbal and math portions of the SAT's are required for admission.

Courses in the Nursing program for Freshmen in the Fall semester include General Psychology, Anatomy and Physiology I, Anatomy and Physiology I lab, Nursing I, Nursing I lab, Nursing Math Module and Computers in Health, and must be successfully completed in order to meet the Level I Behavioral Objectives (Competencies) of the first semester. Courses in the Spring and succeeding Fall semester must be successfully completed in order to meet the Level II Objectives. For the Spring semester, Freshmen courses include Abnormal Psychology, English Composition I, Anatomy and Physiology II, Anatomy and Physiology II lab, Nursing 2 and Nursing 2 lab. Students must achieve a minimum grade of 'C' for the general education courses, and a minimum grade of 'C+' in the Nursing courses in order to pass and accomplish the Level

I,II, and III Behavioral Objectives set up by the Nursing Faculty, and the Terminal Objectives set up by the NLN.

Students are expected to be able to 'digest' and remember an enormous amount of information that is presented to them in a very compressed time frame, which forces students to learn to organize and memorize isolated facts without giving them enough time to assimilate and make practical applications of these facts and knowledge. Students who do not readily learn in a 'cramming of the facts' thinking framework would seem to be at a disadvantage if evaluated in this manner, and may not succeed even though they may be otherwise qualified. Based on their studies, Webb and Carras (1981) suggest that, in general, older physical science students lack confidence, and experience considerable anxiety, particularly at the beginning of a college program, which in many cases disguises an underlying competence.

New understanding of brain function that has resulted from major breakthroughs occurring in the last twenty years has resulted in an enormous amount of literature that clearly established that the two cerebral hemispheres process information in different ways and manifest themselves in different modes of behavior (Geschwind and Levitsky, 1968; Sperry, 1964, 1968, 1982; Carpenter, 1977; Galin and Ornstein, 1974; Gazzaniga et al., 1975; Noback and Demarest, 1975; Herrmann, 1981, 1982,(a),(b)); Kandel and Schwartz, 1982; Gazzaniga and Smylie, 1984; Restak, 1984). In addition to the cerebral cortical loci, subcortical neural areas, such as the limbic lobes (system) has recently been implicated as significantly affecting the thinking and learning process (Adams and Victor, 1981; Benderly, 1981(b); Herrmann, 1981, 1982,(a),(b); Kandel and Schwartz, 1982; Herbert, 1983; Reynolds, 1983; Restak, 1984).

What these and other researchers have found is that for the great majority of people, the left cerebral hemisphere is far more dominant in performing logical, analytical, time-dependent and mathematical tasks, particularly those involving linear and sequential strategies for processing information. Whereas, in distinct contrast, the right cerebral hemisphere is dominant in non-verbal ideation, intuition, holistic, synthesizing and time-independent information processing activities and tasks, particularly those involving spatial, emotional, aesthetic, visual and simultaneous processing. In other words, the left hemisphere is more inclined towards language, arithmetic, and in planning, scheduling and organizing events, and in seeking out detail rather than perceiving wholes. The right hemisphere, on the other hand, is musical and artistic, sees the "forest" instead of the "trees", specializing in nonlinear functions, whose forte is images, pictures, faces, spatial and holistic patterns, and is perceptual, intuitive, and perhaps the seat of creativity.

The evidence supporting this differentiation of function from many research areas establishes that dominance is the human condition, and that for most people, one of the two halves of the brain is the dominant one in terms of our preferred mode of processing. Even though we all use both hemispheres, most of us develop a greater dependence on one side of the brain and exhibit behavior traits and needs characteristic of that dominance (McGee-Cooper, 1986). However, this concept of dominance should not be thought of as a dichotomy, but rather as a continuum in which the dominance is distributed in varying intensities between both halves of the brain, typically on the basis of a primary and secondary relationship (Herrmann, 1981, 1982,(a);(b)).

The primary distinction between the two cerebral hemispheres is best interpreted in terms of information processing strategies rather than information content differences, since the same content (i.e. verbal vs. nonverbal) can be processed via each hemisphere (Bunderson, Olsen, and Herrmann, 1981). Therefore, for the majority of individuals within this culture, there would be a brain dominance condition in which the two hemispheres would be working together, but with one clearly taking the lead and being more efficient and effective for particular tasks at particular times. This would be reflected by a person having a preference for thinking and learning in a particular cognitive mode under varying learning conditions. For example, a person could approach the world in a logical, analytical and mathematical way; a second person could use an organized, planned, step-by-step approach; a third person could use an intuitive, insightful, holistic strategy; while a fourth person could use an emotional, sensitive, interpersonal and extroverted approach (Herrmann, 1982,(a);(b)). Differences exist between a preference (choice) and a capacity (competency) for left and right hemispheric thinking. Everyone with a normally functioning brain has the capacity for all manner of thinking reflected by these four approaches, even though they may not be aware of it, or prefer to do so. Furthermore, an individual's competency in using these approaches is not fixed and can be achieved and changed through motivation and involvement in skill training, life experiences, and educational experiences designed to stimulate growth in both left and right modes of thinking

(Herrmann, 1982).

Bunderson, Olsen, and Herrmann (1981) metaphorically compare brain dominance "to focusing the light of consciousness in consistent and preferred ways in various areas of the brain space. At any point in time, an individual could focus the light of consciousness in any of the various regions of the brain, but each individual will likely use a consistent and preferred focusing strategy. The focusing strategy might involve for some persons an integrated highlighting of several areas of the brain."

The key to how the left and right hemispheres eventually achieve coordinated verbal and nonverbal interchange appears to be primarily in the maturation of the corpus callosum, the major connecting fiber system passing between the two cerebral hemispheres and among the major brain systems. This structure, along with other smaller commissures, allow for hemispheric integration and cooperation of the two cerebral hemispheres with each other as well as with the subcortical limbic system and brainstem reticular formation. These lower areas 'drive' and modulate normal "cortical tone" necessary to keep cortical activity normal and in step with the goal-directed behavior of the cerebral cortex. If there is a lack of input from these areas, lower attentional and alertness patterns occur with the result that these subcortical areas are out of 'synch' with what is needed by the cerebral cortical centers, and learning is affected.

It has been found from electroencephalogram (EEG) and other procedures that hemispheric interchange of verbal and nonverbal processing modes does occur during reading and writing (Glasser, 1980). Thus, stimulating the right hemisphere, where stored sensory experiences and nonverbal schemata are aroused in the form of images, is important for language learning and in overall conceptual development. This implies that interhemispheric integration can be facilitated when the right hemisphere is given a commanding role in stimulating the verbal processing modes.

That people have differing styles of learning has been supported by research (Witkin and Moore, 1974; Kolb, 1976,1978; Torrance and Mourad, 1978; Dunn and Dunn, 1979; Torrance and Ball, 1979; Herrmann, 1981, 1982,(a);(b); Torrance, 1981, 1982; Dunn, 1981, 1983; Dunn, et al., 1982). When the curriculum is modified to adapt to learners' preferences, that is, when there is a greater match between the students' and teachers' cognitive style, significant increases can occur in grade point averages and in the learning of school disciplines

(Norris, et al., 1975; Cafferty, 1978; Dunn, 1979 ; Douglass, 1977), although mixed results have been found by other another researcher (Hunter, 1979). While conclusive evidence that matching or mismatching the cognitive/learning style of the student with that of their instructor, and/or, the behavioral objectives of a program, certain of the relevant recent related literature suggests that part of the gain in learning is predicated on the awareness of the students' and instructors' cognitive/learning style, and for certain objectives for either matching or mismatching the cognitive style of the student with that of their instructor (Witkin an Moore, 1974; Kuchinskas, 1979; Hunter, 1976; Claxton and Ralston, 1978; Doebler and Eicke, 1978; Mahlias, 1978; Dunn, 1979; Dunn and Dunn, 1981).

Some evidence has been reported indicating that modification in the tendency to rely on one or the other hemisphere during problem solving is possible through direct, extensive specialized training (Bever and Chiarello, 1974). Reynolds and Torrance (1978) indicate that it is possible to modify a person's preferred style of learning and thinking over relatively brief periods of time (6-10 weeks), including modification in the general direction of changes. At the same time, Torrance (1981) argues that "the weight of present evidence indicates that people fundamentally prefer to learn in creative ways-by exploring, manipulating, questioning, experimenting, risking, testing, and modifying ideas. Teachers generally have insisted that it is more economical to learn by authority. Recent research suggests that many things, though not all, can be learned more effectively and economically in creative ways rather than by authority. It also appears that many individuals have an especially strong preference for learning creatively, learn a great deal if permitted to use their creative abilities, and make little educational progress when we insist that they learn by authority. Such suggestions open exciting possibilities for better ways of individualizing instruction."

Similarly, Gibas (1980) suggests that for older college students it is desirable to have a variety of learning activities in addition to the 'textbook and the lecture' approach to provide direction for students with study skills 'bound in cobwebs'. These learning activities, he suggests, should be designed to build confidence and reinforce understanding of the principles being taught, and that the instructor be approachable, sympathetic and patient enough to minimize student fears and anxieties and to deal with students who combine a weak background with a strong desire to learn.

Statement of the Problem

Modern studies of consciousness and unconscious processes suggest that what we affirm and program into our unconscious belief system, we tend in subtle ways to bring about (Harman and McNeil, 1984). And so, if educators continue to affirm that promoting more right hemispheric modes of thinking in education is not a realistic or worthwhile goal, we unknowingly contribute to the perpetuation of patterns of learning and thinking that do not take full advantage of functionally important creative areas of our brain, nor move toward educating and strengthening both halves of our brain for a more integrated, whole-brained approach to thinking, learning and living. Cerato (1984) found that for graduate Nursing students, the educational environment supported and reinforced existing value systems. All students regarded mastery oriented values and ideological value of services most important, and values associated with the achievement of the profession the least important.

In the context of the criteria for program evaluation and accreditation, Nursing curricula has designed diverse and complex criteria and skills that must be obtained in order to be successful and competent as described by the National League for Nursing. It is primarily a left-brain, analytical, planning and fact-oriented curriculum, with the Nursing Faculty designing the curricula and evaluting the nursing students in a way that meets the NLN criteria for accomplishing the Behavioral Objectives, and, thus, if these students graduate, are qualified to take the Nursing Boards. In the past, STCC Nursing curriculum and instruction has not taken into account the Thinking Preferences and, therefore, the preferred (primary) way that many of the Nursing students were best at using, which may have worked to the students' disadvantage if evaluation and instruction was done in one major format, namely the lecture, followed by objective examination, sequence.

Woodham and Taube (1986) found that Nursing graduates have indicated that a more conceptual approach to course content had prepared them to adapt information to a variety of similar situations on standardized integrated licensure examinations (NCLEX-RN) organized in a Nursing Process framework. The ASN program in their study involved co-requisite, supporting courses in the sciences and liberal arts in support of the Nursing courses. All concepts for the program were introduced as overview material and were built upon in subsequent courses. Course content focused on concepts of communication interaction and interpretation, and on concepts associated with chronic problems which influence achievement, sexuality, affiliation needs, and biopsychosocial concepts related to adaptive/maladaptive responses of persons with need interferences associated with nutrition and elimination. They recommended the continued development of the understanding and utilization of the problem solving approach (Nursing process) throughout the Nursing curriculum.

Herrmann (1982) found that graduate practicing Nurses preferred Limbic Right Thinking Preferences, which he describes as involving interpersonal, emotional, musical, spiritual and communicating skills, which seem crucial to the Nurses patient caring role, and which seem to be a dominant factor in Nursing behavior. The two year, associate degree curriculum, as defined by behavioral competencies by the National League for Nursing, is emphasizing a more planning, organizational, administrative and management approach to Nursing, which is a Limbic Left thinking mode, without much emphasis on developing Cerebral Left and Cerebral Right thinking skills.

According to Meissner (1986), Nursing educators, because of the requirements for accreditation by the NLN, set up a "drill sergeant" course structure that requires obedience without thought, assigning unrealistic study loads and written assignments that may seem little related to their clinical activities. As a major concern, their program emphasis seems geared to knowing the facts quickly in order to be able to pin-point a medical diagnosis with specific procedures. Furthermore, some Nurse administrators are emphatic in their calling for all future Nurses to have a doctorate so that Nurses won't lose 'management' rights to health care (Van Meter, 1986). Emphasizing management rights implies concentrating more time and effort to that end and, therefore, giving up direct patient care and contact as a viable and valuable goal, which for many people were some of the reasons that attracted them to the Nursing profession (Thomas, 1986). Aisenstein (1985) wonders how many Nurses have left the profession because of the inflexible attitude of the NLN toward emphasizing titles and ego over ethics, and degrees over expertise.

Schneeberger (1984) found that Nursing programs are long, repetitious, redundant, and often failed to provide professional enrichment and curriculum desired by either diploma or Associate degree registered Nurse students. She also found that there was a vast difference in the priority learning needs as perceived by registered Nurse students and the priority learning needs of registered Nurse students as perceived by Faculty/Nursing experts. Furthermore, Wende (1984) found that there was a lack of congruency between the skills taught in Nursing schools and certain psychomotor skills expected in the marketplace for both baccalaureate and associate degree Nursing students.

Huttmann (1985) recommends that Nursing should reconsider emphasizing 'Nursing Rituals' in practice that result from a 'why change' mentality, or from the inability to apply creativity to Nursing. She suggests that a new willingness to question Nursing procedures and skills being taught and performed may be a significant way of improving patient care and of demonstrating the true worth of Nurses who think and who act based on reason, not ritual.

Other Nurses are calling for more education, but in the humanities, to go along with their scientific training and specialization (Van Meter, 1986). This seems most important in order to have Nurses better understand their patient's needs and their problems, as well as in making themselves better able to influence the Nursing care system and develop the power and influence to affect better patient care after graduation (Estabrook, 1986). Butterfield (1985) suggests that the preparation of the professional Nurse must go beyond the teaching of skills, educating them in a much broader sense to encourage development of the art of Nursing. She suggests that "imagination, creativity, "lateral" as well as "vertical" thinking, and innovation are all factors directly relevant to the art of Nursing and especially to progress in this area."

Kolb (1978) found that undergraduate education was a major factor in shaping individual learning style either by the process of selection into a discipline or by socialization while learning in that discipline, or as is most likely, both. Kolb found that on mapping academic fields using his Learning Styles Inventory, that Nursing fell within the abstract/active quadrant of a 'Converger', including the science-based professions, and most notably including the engineering fields. These academic disciplines or professions train students using discrete, analytical and empirical strategies, emphasizing their identification of component parts in order to later understand wholes, which seems to be in line with the behavioral competencies that the NLN want their students to develop, and require them to follow in the Nursing curriculum.

If there are Thinking Preferences and Learning Strategies that are more conducive to successfully completing the Nursing program, there seems an urgent need to assess the Thinking Preferences and Hemispheric Learning Strategies (methods) of these students in order to give Nursing educators the needed feedback on the degree of incongruity that exists between the Thinking Preferences and Learning Strategies that students prefer to use versus the Thinking Preferences and Learning Strategies that might strengthened and expanded upon and be needed to successfully complete the Nursing courses in the Nursing program.

Goals of the Study

The goals of this study are:

1. To assess the Thinking Preferences of both the Freshmen and Senior class of Associate Degree Nursing students at Springfield Technical Community College, using Herrmann's Brain Dominance Instrument, and to assess the Hemispheric Learning Strategies (Methods) these students used in their courses using the supplementary student survey form, formulated by the researcher.

2. To assess the Thinking Preferences of Nursing Faculty and make comparisons of these findings to those of the Nursing students.

3. Using the data from the Thinking Preferences and Hemispheric Learning Strategies (Methods) of Freshmen and Senior Nursing students, begin to establish additional criteria for developing a brain dominance/Thinking Preference profile of the cognitive competencies (strengths and weaknesses) of these students, which may have relevance in curriculum planning, retention rate improvement, course instruction and evaluation.

Assumptions of the Study

The Herrmann Participant Survey Instrument was used to determine the Thinking Preferences (brain dominance characteristics) of all of the Nursing students and Nursing Faculty in this study. In addition, the Student Learning Strategies (Methods) Questionnaire, designed by the researcher, was used to collect additional data on the students involved. Validation information related to the use of the Herrmann Instrument (Herrmann, 1984), and past utilization of this instrument (Herrmann, 1981, 1982, 1984; Coulson and Strickland, 1983; Bush, 1984, Ironson, 1984; Murphy, 1985; Murphy and Neuhauser, 1985,(a),(b)), suggests that it will be appropriate for this study. In addition, this researcher assumed that the additional data collected with the Student Questionnaire was a measure for what it was utilized to measure and added relevant data collected from the Herrmann Instrument.

The students and instructors who served as subjects for this research were chosen from the Divisional area of Nursing at Springfield Technical Community College. It was the assumption of this researcher that these subjects responded with honesty to the Herrmann Instrument, and to the supplementary Student Survey, and that these subjects represented typical subjects for the Nursing Division that they represented.

It is assumed that a student's classroom learning behavior reflects their Thinking (Neurocognitive) Preferences and the Hemispheric Learning Strategies (Methods) most often preferred to be used in learning situations.

It is assumed that by successfully completing the prescribed courses for the Nursing program that the student Nurses have successfully accomplished the behavioral objectives (competencies) as required of the Nursing program. Therefore, it is further assumed that by evaluating the Thinking and Learning Strategies that Nursing students used to successfully complete these courses, the researcher is, in fact, evaluating those Hemispheric Strategies that were successfully used by the

Nursing students to accomplish the behavioral objectives as required of the Nursing program.

This researcher assumes that knowledge of the importance of the Thinking Preferences (brain dominance characteristics) of student Nurses can promote ideas for applications in developing curricula by community college Nursing educators, that would acknowledge and enhance the overall development of both the right and left Cerebral and Limbic areas of the brain, and acknowledge the different learning styles of their students.

Implications of the Study

Under pressure to solve problems or to learn new facts or skills, even though they are not aware of it, people generally rely upon a preferred mode of thinking and learning, and, therefore acting to accomplish their goals. In an Associate Degree Nursing educational setting, knowing these preferences of students before they proceed too far into a course of study or career, would enable instructors to develop innovative strategies specific for each student and group to bring out and develop their full learning potential and make them more likely to be successful learners and remain interested in learning.

This knowledge could also help the instructor to balance his/her instruction with methods that challenge the development of weaker aspects of students' Thinking Preferences, learning styles and strategies, enabling students to be able to 'fall back' or access more than one strategy for thinking about how to solve their problems and develop a more whole-brained approach to learning. Thinking, learning, and accessing all areas of the brain subsumed by Herrmann's four quadrants would give more potential and viable options for Nurses as they progress through educational systems, in the work place, or in their general everyday experiences. Insight into these Thinking Preferences can also provide guidelines for further curricular and instructional development for the increasingly diverse student population entering the Nursing field.

If a major goal of educational systems is to develop competent, independent, creative thinkers and learners, then in order to facilitate one's learning and thinking style growth, each individual must be made aware of what their Thinking Preferences and learning styles are, and in what areas they can improve and expand their thinking from what they're used to using as the 'only' way of thinking and doing something. It is important that students and faculty recognize that what one <u>says</u> and how one interprets what one <u>hears</u> , <u>what</u> one does and <u>how</u> one does it, as well as how one learns and what one learns, is greatly influenced by one's Thinking Preference (brain dominance) characteristics, and that this is also true of others as well. By affirming the great value in thinking to the "beat of a different drummer" (Konicek,1975), and expressing creative ideas that might not be part of the mainstream thinking, a flood of new ideas may be forthcoming, that in turn, might help students to be able to survive, thrive and learn in a learning environment that is not best for them.

By fostering the use of creative, intuitive, intellectual centers of the brain along with rational, analytical centers, and by encouraging the flow of verbal and non-verbal communication, students experience the joy and sense of expertise that flow in moments of homeostatic harmony within the brain/mind connection (Galyean, 1983). Mental acuity seems to sharpen during integrative learning. By giving Nursing students freedom to explore, experiment, question, and try out a variety of approaches and thus develop and promote divergent thinking and creativity in the teaching-learning experience, they learn to analyze alternatives in developing plans of action while feeling less inhibited in implementing these plans and in being self-directed and accountable in patient care (Stepp-Gilbert and Wong, 1985). Additionally, Nursing educators must be able to identify and develop strategies that increase students' abilities to engage in critical thinking and scientific inquiry, since the conceptual skills of critical thinking, such as problem solving skills, independent decision making and Nursing diagnoses are essential to the provision of Nursing care (Kemp, 1985).

What is needed, then, by instructors are practical, easily used, inexpensive diagnostic devices to determine which avenue of learning is the best for an individual student, so that a clear, definite, unified pattern of instruction and evaluation is possible for that student. The data from this study can begin to address this problem and help develop a procedure that can be used to develop a more detailed 'profile' of community college Nursing students which could greatly assist students, instructors, advisors, administrators and counselors in the Nursing division in course and program planning. This data would also facilitate the instructor's ability to handle diverse groups of Nursing students with varying Thinking Preferences and learning styles, and serve as a 'springboard' for ongoing and future studies on the application of hemispheric specialization theory to Nursing education.

Making the teaching and learning process more brain-compatible could hopefully enhance and motivate students to enjoy learning, to have more confidence when coping with and solving problems, and to remain intellectually curious throughout their lives.

Limitations of the Study

This study is limited to community college Freshmen and Senior day Nursing students and Nursing Faculty in the Divisional area of Nursing at Springfield Technical Community College.

The significance of the data generated from this study, its implications, applications and conclusions were made with reference to the Nursing students, Nursing Faculty and Nursing program surveyed. The results of the study do not portend to imply future success in a Nursing career, nor does it place value judgement on the Thinking Preferences of the subjects surveyed.

In this study, no consideration was given to the intelligence, in the conventional sense, of the Nursing student. Preferred (primary) use of left or right cerebral and/or limbic modes of thinking, used in learning and problem solving was in no way an indication of the intelligence of the person or group in question.

Despite the limitations inherent in self-report instruments, the use of the Herrmann Instrument, as well as the supplementary Student Survey information, will make possible a variety of studies of the role of the Thinking Preferences as they relate to learning in the Nursing program at an urban community college.

Research Questions to be Answered:

1. What are the Thinking Preferences and Hemispheric Learning Strategies (Methods) of Freshmen and Senior Associate degree Nursing students, and to what degree are their Thinking Preferences congruent with their Hemispheric Learning Strategies (Methods)?

2. What are the Thinking Preferences of the Nursing Faculty, and to what degree are their Thinking Preferences congruent with the Thinking Preferences of the Freshmen and Senior Nursing students?

Definition of Terms

Anterior Commissure --A bundle of nerve fibers of the limbic lobes and part of the temporal lobes that interconnect the anterior neocortical and olfactory neural structures of both cerebral hemispheres.

Association Fibers --Nerve fibers that transmit impulses from one part (lobe) of the cerebral cortex to another on the same side, and do not descend to lower levels of the brain, or cross over to the opposite hemisphere.

Basal Ganglia (Cerebral Nuclei) --Deep lying lateral masses of gray matter within the white matter of each cerebral hemisphere which include the caudate nucleus and lentiform nucleus (putamen and globus pallidus).

Brainstem --Lower portion of the brain consisting of parts of the thalamus, the midbrain, pons varolii and medulla oblongata.

Brainstem Reticular Formation --A network of neurons (gray matter) and interlacing fibers of white matter found in the thalamus, midbrain, pons, medulla, and extending down to connect with similarly arranged spinal cord neurons.

Cerebral Cortex --The surface layer of each cerebral hemisphere composed of some 10-14 billion neurons (gray matter).

Cerebral Dominance (Lateralization) --Condition of asymmetry of brain function by which competition between the cerebral hemispheres is avoided by the dominance of one controlling hemisphere.

Cerebral Hemisphere --The left and right halves of the cerebrum, further sub-divided into four lobes-frontal, parietal, temporal, and occipital.

Cerebrum --The largest part of the human brain filling the entire upper portion of the cranial cavity.

Cognitive Competency --State of being capable and skillful in knowing, learning and remembering objects and ideas.

Cognitive Style --Those stable attitudes, preferences, or habitual strategies determining a person's typical mode of perceiving, remembering, thinking and problem solving.

Commissure (Commissural Fibers) --Nerve fibers that transmit impulses from one hemisphere to the other.

Commissurotomy --The surgical disconnection of the cerebral hemispheres, usually by severing the corpus callosum by means of a split-brain operation.

Community College Students --Students who were enrolled in Fall, 1986, courses at Springfield Technical Community College.

Contralateral --Originating in, or affecting, the opposite side of the body.

Corpus Callosum --Nerve fibers that traverse the mid-plane interconnecting the neocortex of one hemisphere with that of the other hemisphere; the largest commissure in the brain.

Gray Matter --Collection of nerve cell bodies inside the central nervous system (brain and spinal cord), and comprising the outside layer of the cerebrum and cerebellum.

Hemisphericity --A term that refers to the localization and specialization of functions in the left or right hemispheres of the brain; often used interchangeably with lateralization and dominance.

Hemispheric Specialization Theory --The theory that posits that the hemispheres of the brain specialize in certain mental functions.

Ipsilateral --On the same side, or affecting the same side of the body.

Learning Style --A consistent way of responding to and using stimuli in the context of learning.

Left-Brain Thinking --A state of information processing characterized as linear, verbal, analytic and logical.

Limbic System --Includes the limbic cortex (part of the medial frontal and temporal lobes, ie., the cingulate, parahippocampal gyrus and uncus) and associated subcortical structures, such as hypothalamus, anterior thalamic nuclei, amygdaloid complex; often called the visceral brain; includes emotional centers that also may play a major role in learning and memory.

Memory --The process whereby information is stored for recall when needed at any time.

Neocortex --The newest (evolutionarily speaking) and most highly evolved cortex of the cerebrum of man; has a relativley minor controlling influence on the limbic system.

Right-Brain Thinking --A state of information processing characterized as spontaneous, holistic, spatial and relational.

Thinking Preference --The preferred mode of awareness, perception and memory in which people feel confident and comfortable, and use to process information, which is affected by the differential activation of cortical and/or subcortical (limbic) neural areas.

Whole-Brain Thinking --A cognitive style that favors neither verbal/analytical nor visuospatial/holistic information processing modes, but rather tends to view the environment and learn new material using an integrated (symmetrical) approach.

Summary

There is growing evidence that differences in cognitive processing, Thinking Preferences, learning style, instructional methods and strategies, and other factors affect learning. This researcher attempted to assess the hemispheric specialization and Thinking Preference theory within the context of a limited community college population of student Nurses and Nursing Faculty to discover what the Hemispheric

Preferences were for student Nurses and Nursing Faculty, and to see whether the data were to reveal a possible association between the tendency to prefer a more Right- or Left-thinking mode and to use either Right- or Left-oriented Hemispheric Learning Strategies (Methods) to successfully complete the Nursing courses in the Nursing program. Such a finding could increase our understanding of community college Nursing student learner needs that might suggest means of promoting optimal learning.

Knowledge of the relationships between the Thinking Preferences of students and Nursing Faculty within community college Nursing programs by Nursing Faculty could assist them to capitalize on these biological characteristics and realign their efforts to support, promote, and match the support systems with the preferred Thinking and Hemispheric Learning Strategies (Methods) of students. Steps may then be taken to help nurture the growth and accessibility of the 'weaker', less used and preferred modes of thinking, that may add greatly to the potential for student learning and success.

CHAPTER II

REVIEW OF THE LITERATURE

Introduction

There has been a vast amount of literature over the past twenty years that concerned itself with the concept of cerebral dominance, cerebral asymmetry, or lateralization of cerebral functioning in both human and sub-human subjects, including studies of normal, abnormal, and/or surgically altered (split-brain) patients. Numerous behavioral, anatomical and physiological tests have been devised to try to measure the degree and incidence of left and right brain functioning with suggested relationships between these findings and factors such as gender, handedness, age, native tongue, eye/ear/foot preference, academic achievement, career choice and other variables.

While most of the results portend to imply significant implications for being either 'right-brained' or 'left-brained', there has not been enough evidence to conclude with confidence that being classified in either category guarantees much more than being included as a statistic when practically applying this information into educational policy and instructional design. Since there are many questionnaire instruments being used on many of the same groups, it is difficult to draw consistent conclusions from these varied results and to decide which ones are the more relevant and most meangingful to a particular area of study. What is needed is a more universally-acceptable way of discussing and evaluating those factors that relate to brain functioning and learning that can be evaluated more consistently and which is based on the knowledge that the brain is differentially activated at different times for different activities, promoting different Thinking and Learning Preferences and behaviors.

Though there has not been a plethora of research investigating the Thinking or Neurocognitive Preferences of community college Nursing students and its relationship to academic achievement, per se, there has been substantial numbers of studies done and hypotheses put forth that are related to this analysis that suggest that further study in this area is warranted and needed.

This chapter will describe briefly some of the findings of brain research as it relates to the thinking and learning process, and review some of the congruent and incongruent relationships which appear to exist in some of the work that has been done within the past twenty years.

Evolution and the Brain

In the course of evolution, man has seemed to have acquired a mind of three minds. This "triune" concept of brain function was formulated by Paul MacLean and is summarized as follows: "In the course of evolution the human forebrain has expanded to a great size while retaining the basic features of three formations that reflect an ancestral relationship to reptiles, early mammals and recent mammals. Radically different in structure and chemistry, and in an evolutionary sense, countless generations apart, the three formations constitute a hierarchy of three brains in one" (MacLean, 1978).

The first and oldest formation is the reptilian or R-complex located in the midregion of the brain, and includes the thalamus, corpus striatum (caudate nucleus and putamen), globus pallidus, and the lower brain stem (midbrain, pons varolii and medulla oblongata) (Figure 1). Among its functions, it influences primal patterns of behavior in mammals, such as territorial siting and marking, hunting, fighting, greeting, grooming, mating, breeding, establishes social hierarchies and other similar activites related to survival value. In humans, such behavior may take the form of impulses, compulsions,

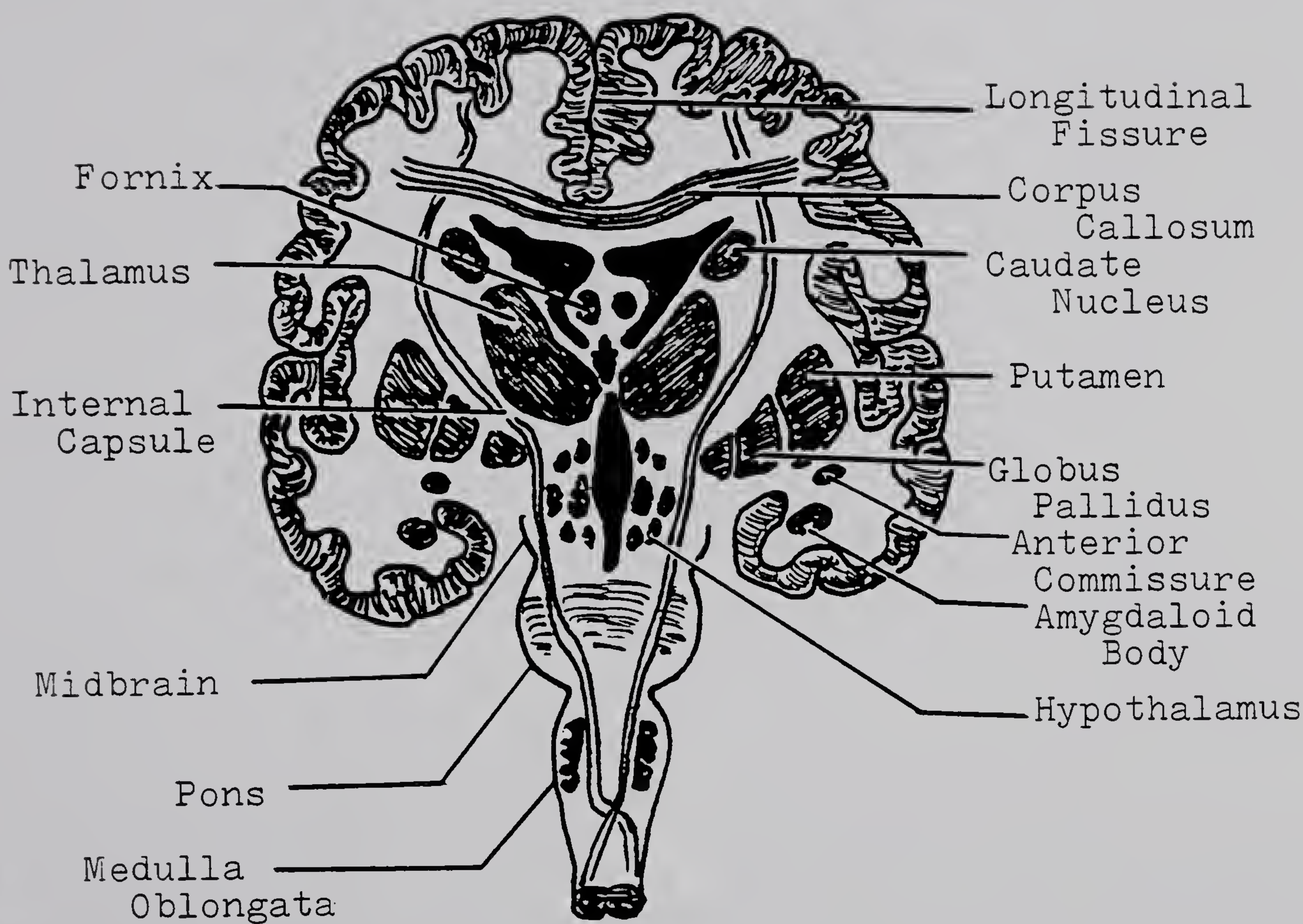


Figure 1

Frontal Section of Brain
Showing Principal Internal Parts

habits such as dressing, eating, sleeping, superstitious acts, following fads and fashions, mass hysteria, violence, and displacement reactions, such as nail biting, throat clearing and head scratching.

The layer surrounding the midbrain is the limbic system, a phylogenetically older system than the neocortex, and is otherwise known as the "visceral brain", or old mammalian brain. It has an essential role in processing neural input which influences the activity of the endocrine system, and the autonomic and somatic nervous systems, which thereby adds a visceral component to learning. These influences act to suppress or to enhance those expressions which we interpret as emotional behavior.

The amygdaloid body and hippocampal formation are among the most prominent of the processing stations of the limbic system, and are implicated in the memory for recent events (Figure 2). In addition, the amygdala is related to producing feeling tones of fear, anxiety, rage, emotional memory, and the rearrangement of memory images as in imagination. The hippocampus seems to be involved in the decision to 'tape and store' information for future recall. In other words, the limbic system is a link between emotional and cognitive mechanisms, prolonging neural input long enough to generate a

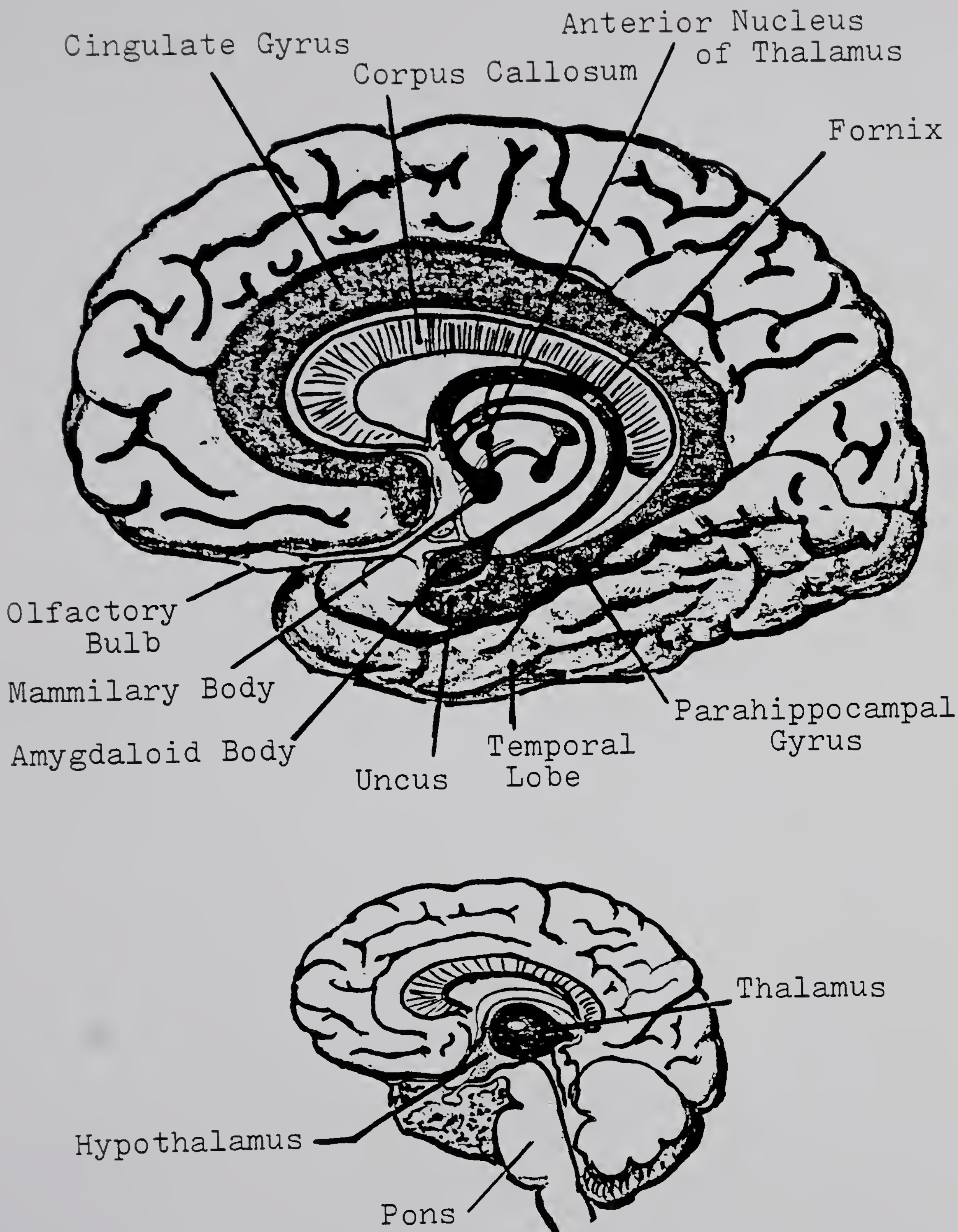


Figure 2

Medial Aspect of the Brain in Sagittal Section
(Adapted from Kandel and Schwartz, 1982)

visceral and cortical response (Noback, 1975).

The third or outer formation of the brain, called the neocortex or new mammalian brain, is divided into right and left cerebral hemispheres, with its outer 'shell' of gray matter called the cortex. The neocortex is the source of thought, reason, linguistic expression, verbal memory, visual and auditory perceptions, and anticipation of the future and reflection of the past. It can control and strongly influence the R-complex and limbic systems through its interconnections with these areas, and can assimilate and transfer varying bits of sensory information into abstract thought, ideas, language and writing, while making cold, reasoned decisions required for day-to-day survival.

Limbic/Memory Connections

The idea that different anatomical structures in the limbic system have different memory functions has received support from animal studies. Herbert (1983) reports that psychologist Mortimer Mishkin suggests that from his work on selectively cutting either the hippocampus or the amygdala that these two regions are involved in parallel but distinct memory circuits. In the first circuit, the hippocampus is involved with the neocortex and thalamus in the processing of spatial memories, storing information necessary to give an image a geographical context. In the second circuit, the amygdala is involved with the neocortex and thalamus in the storage of emotional memories.

Bower (1981) has found that memories, thinking, learning, and perceiving are bound up with the type of emotion felt at the time that learning takes place, and that there may be difficulty in recovering these memories if, when trying to remember something, we are in an emotional state that is different than the one in which we were in when we initially learned something. In addition to this "state-dependent" effect for memory, Bower also discovered that the more intense the emotional experiences were, the more likely it was that something will be remembered. Laboratory subjects that were put in a sad mood remembered 80% of the words they had learned previously while in a sad mood.

Some memories, however, do not seem to depend upon the person being in a mood similar to the one in which the person was in when the event took place. Under certain circumstances, a particular class of memory and a special memory mechanism is thought to imprint whole incidents in the nervous system. These "flashbulb memories" follow for events first learned or experienced under very surprising, consequential or emotionally arousing circumstances (Benderly, 1981,(b)). Psychiatrist Seymour Kety suggests that these mental events are associated with the release of certain neurotransmitters such as norepinephrine, and various pituitary, hypothalamic and adrenal cortical hormones which have a capacity to affect the synthesis of RNA or of protein, which in turn are needed if a global 'now-store' order for whole events is to be executed (Benderly, 1981,(b)).

Baskin (1985) reports of extensive research on the mapping and distribution of neurotransmitter peptides in cortical and subcortical areas such as the limbic system, the emotion-mediating area of our brains, and the thalamus, which filters information from our senses and interconnects most areas of the brain with one another either directly or indirectly. Oke, et al.(1978;1983) report evidence of significant, naturally occurring chemical lateralization in the distribution of neurotransmitters, particularly norepinephrine, in the human thalamus of postmortem patients, and Reynolds (1983) found that a highly significant increase in dopamine in the left amygdala was found in postmortem samples of people who had died of schizophrenia.

That the neurotransmitter dopamine does play an important role in the normal functioning of the basal ganglia in regulating locomotion and mood has been recently demonstrated by Garnett, et al., (1983). Using positron emission tomography, they demonstrated an equal distribution of this neurotransmitter in both the left and right striatum (caudate nucleus and putamen) and to a lesser degree in the anterior cingulate and frontal cortices in a normal patient. Dopamine deficiency in the nigrostriatal system is a characteristic of Parkinson's disease, and a disturbance of dopamine metabolism is held to be responsible for the syndrome of schizophrenia (Adams and Victor, 1981). Though different people have different thresholds for triggering the release of neurotransmitters which affects how they perceive pain, pleasure, or how they remember, a normal dynamic production and balance is needed in order for the limbic-neocortical connections to work properly.

Historical Background for Cerebral Laterality

The key philosphical theme of modern neural science is that all behavior is a reflection of brain function. According to this view, the mind represents a range of functions produced by the brain, the action of which underlies not only relatively simple behavior such as walking and smiling, but also elaborate affective and cognitive functions such as feeling, thinking, and writing a musical score.

The cerebral hemispheres, capped by the cerebral cortex, are concerned with higher perceptual, cognitive and motor functions. The organization of the cerebral cortex is characterized by having each hemisphere concerned primarily with sensory and motor processes of the contralateral side of the body, and although they appear largely symmetrical in structure, the hemispheres are not completely symmetrical nor equivalent in function (Figure 3).

At the end of the nineteenth century, there was compelling evidence that discrete areas of the cerebral cortex were involved in specific behaviors. In 1861, Pierre Paul Broca discovered that patients with lesions in the posterior portion of the left frontal lobe (now called Broca's area) could understand language but had lost the motor ability to speak coherently. Rare exceptions to left hemispheric localization of speech occurred in left-handed patients, which led to the generalization that there was a crossed relationship between hemispheric dominance and hand preference. In 1870, Gustav Fritsch and Edward Hitzig discovered that characteristic movement of the limbs could be demonstrated by stimulating small and discrete loci of the precentral gyrus in front of the central sulcus of the frontal lobe of the cerebrum. A further step was

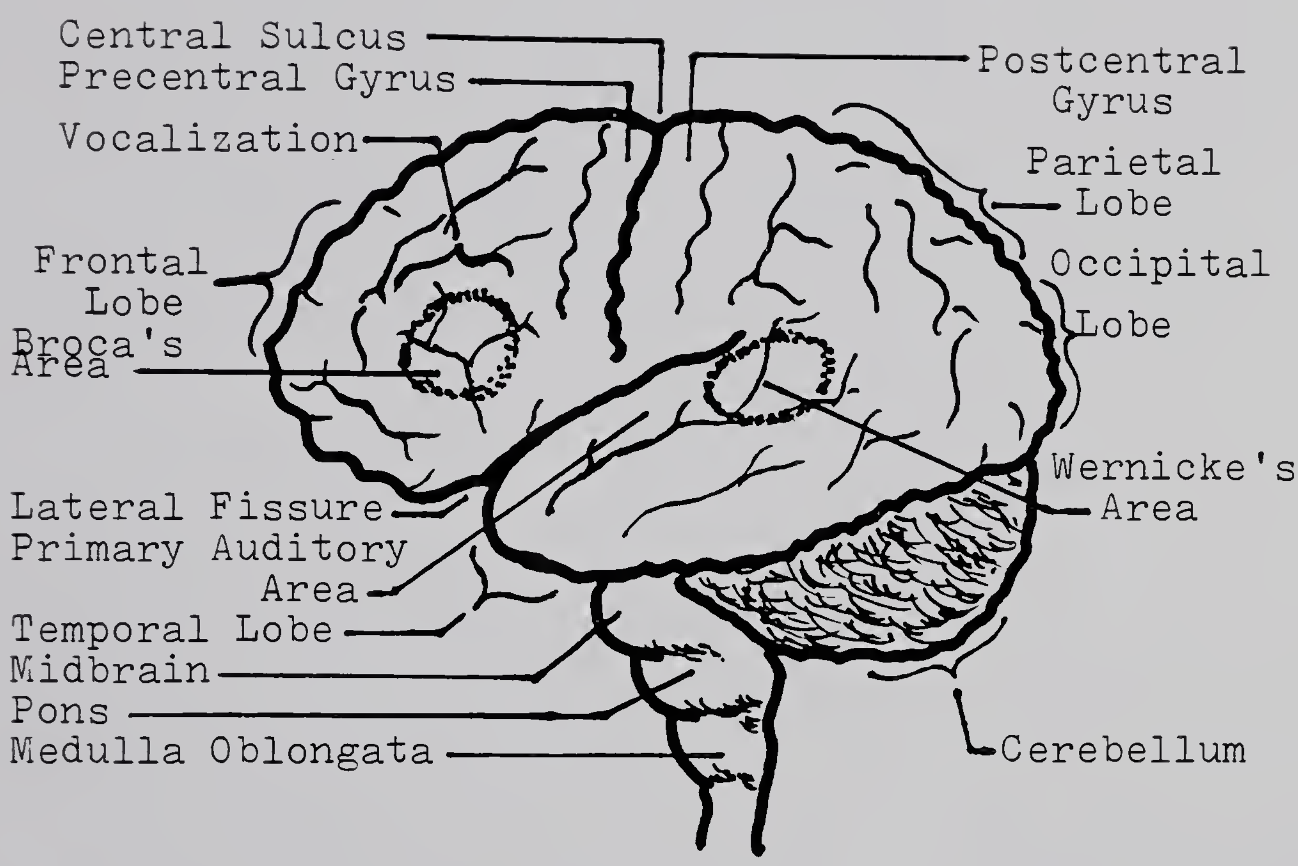


Figure 3

Lateral Aspect of the Left
Side of the Brain Showing Principal Parts
(Adapted from Kandel and Schwartz, 1982)

taken in 1876, when Karl Wernicke discovered that damage to the posterior part of the left temporal lobe resulted in patients that could not recognize and comprehend spoken or written language (Kandel and Schwartz, 1981).

At the beginning of the twentieth century, Karl Lashley, in looking for a specific learning center and, finding none, concluded that learning did not have a special locus and therefore could not be related to specific, individual neurons and loci, but rather what was important was brain mass, not neuronal architecture. According to this train of thought, disorders of language could not be attributed to specific lesions in specific loci, but resulted from alterations of almost any cortical area regardless of site.

In the late 1950's, Wilder Penfield, searching the cortex for areas that produce language disorders within the brain of conscious patients undergoing brain surgery, dramatically confirmed the localization indicated earlier by findings of Broca, Wernicke, and Fitsch and Hitzig, and devised a detailed topographical map, or motor homunculus which strengthened the evidence for further functional localization within the cerebral hemispheres (Noback, 1975; Kandel and Schwartz, 1982) (Figure 4).

Even in light of compelling evidence for localization of cognitive functions related to language,

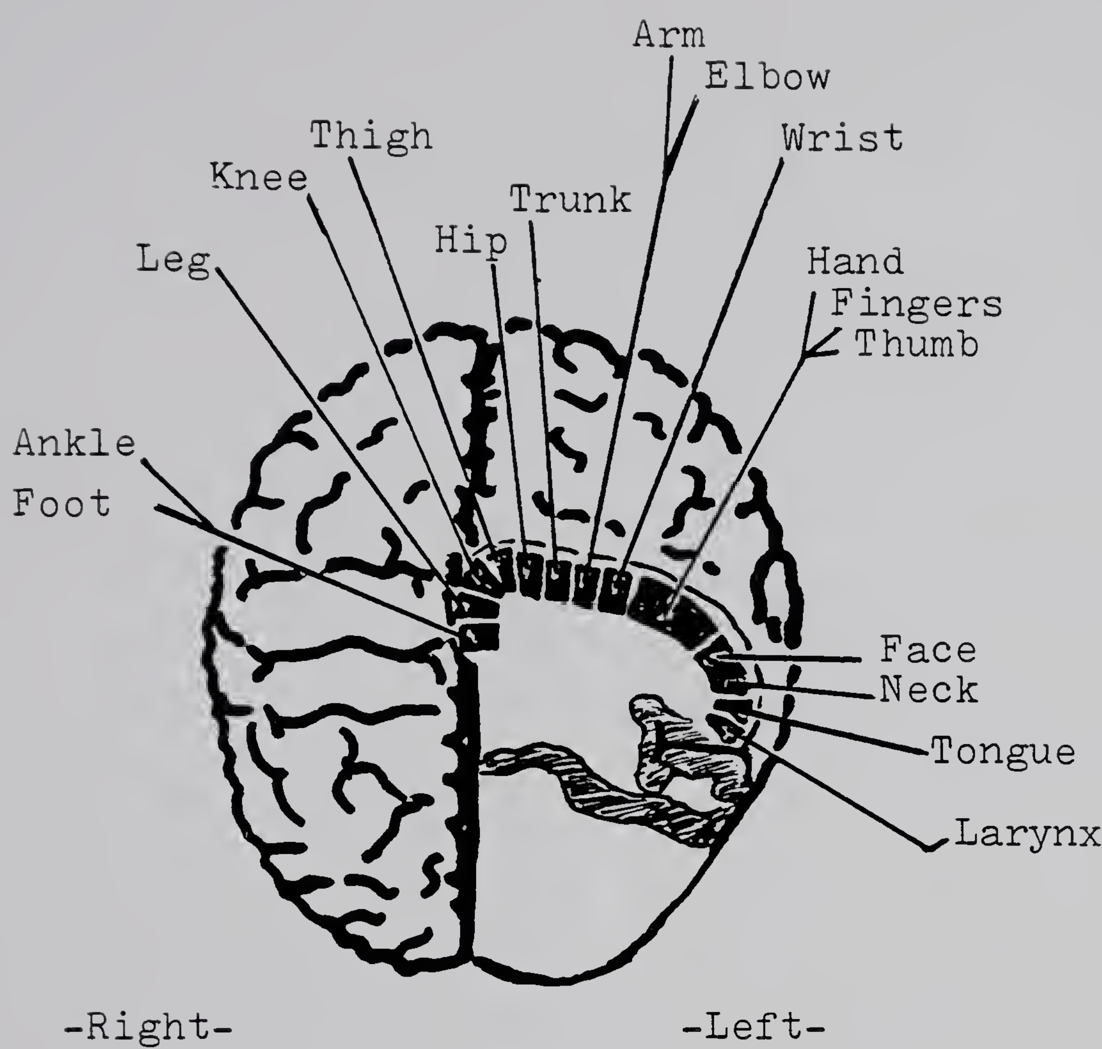


Figure 4

Functional Motor Areas of the Left Frontal Cerebral Cortex in Frontal Section
(Adapted from Kandel and Schwartz, 1982)

the idea still persisted that affective or emotional functions were not localizable, and were expressions of the function of the whole brain. Recently Ross (1981) found that the affective aspects of language, musical intonation of speech (prosody), emotional gesturing, prosodic comprehension, and comprehension of emotional gesturing are represented in the right hemisphere and that their anatomical organization mirrors that for propositional aspects of language, represented in Broca's and Wernicke's areas in the left hemisphere. Ross (1981) found that damage to the right temporal area homologous to Wernicke's area in the left hemisphere leads to disturbances in the comprehension of the emotional aspect of language, whereas damage to the right frontal area homologous to Broca's area leads to difficulty in expressing the emotional aspects of language.

That the two hemispheres can differ in their vision of the world and that each in some respects formulates its own separate and distinct emotional vision of what it sees was confirmed by Dimond, et al.,(1976). They found that the right hemisphere adds its own emotional dimension, which is usually suppressed, and which represents the thing perceived as more unpleasant and horrible and thus aligns itself more with the characteristic perception of the depressive patient than that of the normal individual. They suggest that normally, the left hemisphere's perception dominates over the right's perception, yet the right hemisphere may provide a source for emotional appraisal of the environment and unconscious motivation within the brain. The right hemisphere still has access to consciousness, but its role is one of contributing an alternative voice to mental action at the conscious level, which is more aligned with the left hemisphere. These studies are supported by the observations of Bhatnagar and Andy (1983), whom evaluated language function in the nondominant right hemisphere in relation to various tasks that entailed different degrees of processing complexity in three patients undergoing cortical resection for intractable seizures. From their findings they suggest that the right, nondominant language system is anatomically and functionally tied to the left, dominant language system and does possess basic language function. However, its functions are considered to be primarily rudimentary or simple and passively involved in normal conditions, in contrast to the more actively involved left hemisphere.

Though there are many theories about the functional advantages of brain lateralization, Irving Kupfermann suggests that "lateralization may reflect the ultimate extension of a principle that seems to organize neurons into progressively larger functional units because of an evolutionary adaptation that minimizes the amount of 'wiring' and maximizes the speed of communication between neurons that are likely to work in concert" (Kandel and Schwartz, 1982). Since many functions, particularly higher mental functions, are divided into subfunctions that are redundantly represented, neural processing for a given function is seen as being distributed within the brain and handled in parallel at several sites. The potential to rearrange and form new neural circuits has been shown to be successful in the treatment of Parkinson's disease by replacing deficient levels of the neurotransmitters dopamine and epinephrine (Lenard, 1983).

The potentialities for all human behavior of which humans are capable are built into the brain under genetic and developmental control. Environmental factors and learning bring out these latent capabilities by altering the effectiveness of pre-existing pathways, thereby leading to the expression of new patterns of behavior. That differences in cognitive functioning result in different learning preferences in different people for varied learning tasks using various methods of learning, has been shown to be related to specific differential arousal of neural loci in the cerebral hemisphere (Levy, 1983). Thus, when presented with a task that is similar to one given to another person, some people are better able to achieve success using strategies of learnig that are based on the extent of the neural arousal that underlies their performance.

Evidence for Lateralization and Specialization of Function

Much of the evidence concerning the localization of higher cognitive functions, or for specialized strategies for information processing, has been obtained from the study of patients with damage to certain areas of the brain due to trauma, cerebrovascular disease, tumors, or in patients who have undergone brain surgery. In addition, other evidence has been obtained from non-invasive clinical and behavioral tests, as well as from invasive physiological tests.

Sodium Amytal Test Evidence

This method was developed to determine which hemisphere was dominant for speech functions, so as to avoid neurosurgical procedures that might destroy language ability in a patient. Although speech functions appear to be lateralized to the left hemisphere in most people, this is not universally true. When sodium amytal is injected into either the left or right internal carotid artery, the drug preferentially anesthesizes the hemisphere that is dominant for speech and the conscious patient stops speaking.

Using this technique, Branch et al.,(1964) discovered that almost all (90%) right-handed people had left-hemispheric speech, and the majority (64%) of left-handed people also had left-hemispheric speech; but a significant number of left-handers (20-40%), had right-hemispheric speech. Furthermore, some left-handed people (30%) appeared to have control of speech in both the right and left hemispheres, indicating a weaker lateralization for speech in a sizable percent of the population. Bogen and Gordon (1971) found that in right-handed patients, anesthesizing the right hemisphere grossly affected singing but spared speech, while Risse and Gazzaniga (1978) demonstrated a selective deficit in verbal memory following left hemisphere anesthesia.

Branch et al.,(1964) also found that anesthesizing the left hemisphere produced a brief depressive mood, while right hemisphere injections tended to produce euphoria, the finding of which is in agreement with Ross (1981), who suggested that functions related to mood or affect may be lateralized in the human brain.

Commissurotomy (Split-Brain) Evidence

With the development of surgical procedures in the 1960's, Roger Sperry and associates brought a new awareness of the dichotomy of functions that each cerebral hemisphere participates in. Their early work was with patients who had had their corpus callosum and anterior commissures cut (commissurotomy/split-brain operation) in an attempt to prevent the spread of epileptic seizure activity from one side of the brain to the other. The results of this work led to the generalized acceptance of the concept of cerebral dominance, whereby each cerebral hemisphere was thought to perform its own functions, relatively independently from one another, with one hemisphere, usually the left, being in control (dominant) for most of neural functions and directing the individual's behavior, particularly for language-related functions. Involvement or participation of subcortical (e.g. limbic) areas in these dominant functions, however, was not elucidated.

This work revealed that each hemisphere had its own separate and private sensations, perceptions, concepts, and impulses to act with related volitional, cognitive, and learning experiences, and often had their own separate chain of memories inaccessible to recall processes of the other hemisphere. In addition, even though the right hemisphere was shown to be largely mute and agraphic, it was able to comprehend, at a moderately high level, words spoken aloud, and was able to read printed words flashed to the left visual field (Sperry, 1964,1968,1982; Milner,1968; Nebes, 1974; Damasio et al., 1975; Gazzaniga et al., 1975; Gazzaniga and Smylie, 1984).

The left hemisphere has been shown to partially duplicate the right hemisphere's functions for motor and sensory functions as well as for higher cognitive functions in a right-hemispherectomized or otherwise right-hemisphere damaged patient (Sperry, 1968, 1982; Damasio et al., 1975; Stiles-Davis, 1983). Gazzaniga and Smylie (1984) suggest that in the developing right-handed child, the right hemisphere normally might be deferring problem solving and rational thinking to the left hemisphere, while concentrating on other visuo-spatial tasks. That the right hemisphere's language capacities are normally suppressed by the left hemisphere has been documented by several studies (Nebes, 1974; Damasio et al., 1975; Gazzaniga et al., 1975; MacLean, 1978; Kinsbourne, 1982; Gazzaniga and Smylie, 1984).

Using a special scleral contact lens occluder technique, Sperry (1982) found that the right hemisphere was competent in self-recognition, social awareness, in generating appropriate emotional reactions, had a sense of time, an appreciation for schedules, dates, the future and personal losses. Gardner (1981) and Handel (1984) found that the right hemisphere can relate and tie together different parts of the theme of a story and supply the punch-line for a joke. It appears, then, that although the emotional, affective components of language are generalized by lateralized input and confined mainly to the right hemisphere, these components normally go across to influence neural processing in the left hemisphere via commissural fibers. These findings indicate the need for further study and analysis as to the extent that the right hemisphere can influence the cognitive processing in the left hemisphere.

Visual Half-Field (Tachistoscopic) Evidence

This technique uses brief visual stimuli presented to either the left or right visual hemifield and usually involves either a visuospatial (e.g. face recognition) or a verbal (e.g. word recognition) task.

Using this technique, Hellige (1983) found that visual laterality preference was influenced by visual feature similarity. When the masking stimulus contained features identical to those of the target letter to be identified, there was a left visual field-right hemisphere advantage for target recognition. When the target and mask contained extremely different features, there was a right visual field-left hemisphere advantage for target recognition. The two hemispheres appear to identify letters in qualitatively different ways, with the visual field advantage depending on which mode of processing is the more efficient for a given level of target-mask similarity.

When asked to vocally respond to the similarity of faces, Geffen (1971) found no significant differences or advantages of presenting the material in either the left or right visual field. However, when asked for a manual identification, the information from the left visual field (going to the right hemisphere) resulted in a faster reaction time in identification than when the target was projected to the right visual field (going to the left hemisphere).

Segalowitz (1979) found that the sexes contributed unequally to this visual half-field efficiency, with females exhibiting a lesser degree of visual half-field asymmetry on measures involving left visual field-right hemisphere processing (visuospatial tasks) than do males, and they exhibited smaller asymmetry for linguistic functions. Perhaps females are more likely to make use of more than one strategy and hemisphere in determining physical and/or linguistic similarity when presented with a task.

Evidence from Dichotic Listening Techniques

The dichotic listening test exposes subjects to two separate similar or dissimilar spoken (or other) stimuli simultaneously in both ears, and allows researchers to study differences and/or similarities in the way that the two hemispheres handle speech and/or other auditory stimuli.

It has been discovered that presenting auditory information to one ear results in major connections of auditory stimuli with the contralateral cerebral hemisphere, and only minor connections with the ipsilateral hemisphere. When sound enters both ears at the same time, there is a competition for attention by each hemisphere for that information, with the optimal path (to the contralateral hemisphere) being reinforced and sustained, while the other pathways (ipsilateral to the side of entry) being inhibited along the way (Noback, 1975).

Bever (1974), Henninger (1982), and Snyder (1982) found that musically sophisticated listeners could recognize the entire sequence and isolated excerpts from a tone sequence better in the right ear than the left, whereas, musically naive subjects could recognize the tone sequence better with the left ear, though they could not accurately recognize isolated excerpts from tone sequences. Kimura (1968) also found right ear-left hemisphere advantage for spoken words even if the speech was played backwards dichotically. Melner et al.,(1968) found that when presenting different verbal stimuli dichotically to callosal patients, they could not report verbal input to the left ear, which went to the right hemisphere. However, when asked to use their left hand to retrieve objects that were named through the left ear, these same patients showed a stronger preference for the left ear input than the right ear input, as long as they did not have to 'say' what they had heard. This suppression of ipsiateral input in the presence of a competing stimulus from the contralateral ear seems to provide clear behavioral evidence of the dominance of the contralateral and auditory projection system in man.

That the right hemisphere can subserve some language function was found by Schwartz and Tallal (1980). When they extended the exposure time of a certain class of sounds (phonemes) from 40 to 80 milliseconds, subjects produced more left ear (right hemisphere) responses than they did with the 40 second duration. In this case, the right ear (left hemisphere) advantage for verbal material may reflect superiority of the left hemisphere for processing rapidly changing acoustic features important for speech, yet when exposed for longer durations, the left ear (right hemisphere) recognizes these sounds better than the right ear (left hemisphere). The level of language complexity attainable by the right hemisphere may be considered to be ontogenetically determined and subsequently subject to the relative integrity of the genetically determined left dominant language area (Bhatnagar and Andy, 1983).

Sibatani (1980) cites research by Tadanobu Tsunoda, who claims that the language one learns as a child shapes the neurophysiological pathways of the brain and influences the way in which the brain's right and left hemispheres develop their special talents. Using a dichotic listening test, Tsunoda found that in the brains of right-handed Westerners, Koreans, Chinese, and Bengalis, vowel sounds usually got processed in one side of the brain (right) if they occur in isolation, but in the other side (left) if the vowels occur in spoken context, that is, if they are surrounded by consonants. But right-handed Japanese and Polynesians were found to depend on their left brains for processing nonverbal human sounds that express emotions, such as laughing, crying or sighing. Tsunoda concludes that the Japanese brain is not triggered to use the left hemisphere by simply learning to read and write Japanese, but rather by listening to the language and speaking it. Therefore, some of the differences in brain function affecting one's perceptions, cognitions, mental acts, and social behavior, are conditioned by the mother-tongue, rather than by genetic factors of ethnic origin.

Does the bilingual brain handle language differently from the brain that manipulates only one language? Benderly (1981,(a)) suggests that bilinguals who learn a second language very early in life, take a more semantic or left-hemispheric approach to understanding the language. Those who become bilingual later in life seem to judge language more on the basis of physical features of the words, like melodies, or combinations of sounds, which are strategies more related to the right hemisphere. Benderly (1981,(a)) cites Warren Ten Houten who suggests that socially subordinate individuals generally show greater right-hemisphere involvement in language, although in contrast, Benderly (1981,(a)) has found that other researchers report that bilinguals, generally, including Native Americans, appear to process both their languages on the same side. Normally, then, both hemispheres cooperate to give a fuller, blending of meaning to the sounds we hear, yet each hemisphere may 'color' this meaning differently.

Evidence from Conjugate Lateral Eye Movements (CLEMS)

It was first reported by Day (1964) that when parts of the left cerebral hemisphere were stimulated with verbal questions, the first eye movement to occur was a movement of both eyes to the right, while the opposite eye movement occurred when the right cerebral hemisphere was stimulated by spatial questions. Subsequent research has found that the average individual consistently makes about 75% of his/her Conjugate Lateral Eye Movements (CLEMS) in one direction, with women being less consistent than men in this respect (Bakan, 1971(a); Tomer and Mintz, 1980).

Do CLEMS accurately reflect hemispheric processing or momentary hemispheric shifts in neural activity? Bakan (1971(a)), Galin and Ornstein (1974), and Kinsbourne (1974), suggest that asymmetrical activation of neural loci by different types of questions was responsible for the differences in gaze shifts, although Day (1964) and Bakan (1969), in earlier reports, did not report any differential strength to move the eyes more one way than the other when different types of questions were used. However, when put under stress to answer a question, subjects preferentially used one hemisphere regardless of the question type (Gur, 1975). This preference to use the 'usual' hemisphere for problem solving occurred even if it was not the optimum strategy to use at the time. Gur (1975), Kinsbourne (1972), and Kinsbourne (1974) found that left-handers, as a group, showed little consistency in their eye movements in either direction on either verbal, spatial or numerical problems. Furthermore, Erhlichman (1974) found that the effects of verbal and spatial questions on the direction of eye gaze shifts were reliable only for the vertical but not the horizontal dimensions. Galin and Ornstein (1974) found that ceramacists made more UP and fewer DOWN movements than did lawyers for spatial questions, and lawyers had more DOWN movements than ceramacists to verbal questions.

Schwartz et al., (1975) found that in normal right-handed people tested, questions requiring both spatial and emotional processing elicited greater right hemispheric activation than comparable non-emotional, non-spatial questions, with more left CLEMS than right CLEMS. In addition, they found that spatial questions elicited more STARES (no movement) than did verbal questions. If STARES were indicative of bilateral movement, as suggested by Galin and Ornstein (1974), then some spatial questions and tasks elicit greater bilateral activation of both hemispheres than some verbal questions.

Day (1964) and Bakan (1971(a)) found that the electroencephalogram (EEG) records of left-movers showed greater amplitude and lower frequency than those of right-movers, which suggested to them to indicate a direct relationship between moving the eyes to the left, high alpha waves, and increased hypnotic susceptibility with right hemisphere involvement. EEG alpha waves associated with relaxed, low-arousal, dreaming, hypnosis, meditation and day-dreaming states are found in greater quantity over the right hemisphere, and which are usually characterized by the absence of logical verbalization (Bakan, 1971(a)).

As Kinsbourne (1974) and Ehrlichman (1978) suggest, there is still a need to investigate and identify which questions, if any, reliably elicit left or right CLEMS, and therefore, by inference, induce activation of one or more of the cerebral hemispheres.

Evidence of Laterality from Physiological Techniques

A problem for researchers of brain function is to find ways of studying the contribution made by each area of the brain to behavior in a normal, intact brain.

Patients who have had brain damage or have had neurosurgery, do not provide a picture of how the normal brain functions, and where, in the brain, the locus(i) of control may be for a particular behavior.

The neurophysiological activity of the cerebral cortical neurons induces variations in the electrical potentials that can be recorded with electrodes placed on the surface of the scalp. This record, the electroencephalogram (EEG), is thought to record the extracellular current flow associatd with the activity of the individual cells underlying the electrodes. The EEG of an adult is characteristic for the individual, ie., whether in a drowsy, alert, startled, dreamy, or deep sleep state, and varies from one area of the brain to another and from one person to another person (Noback, 1975). Alpha waves and rhythm (8-13 cycles per second) are present when one is awake and relaxed, but when one is alert, during states of attention and problem solving, this rhythm is replaced by a more rapid rhythm called beta rhythm (13-30 cycles per second) (Noback, 1975; Kandel and Schwartz, 1982) (Figure 5).

Attempts to clarify whether the EEG can be used as a useful index of laterality of cerebral functioning has yielded disparate results under varying methodological laboratory conditions. Butler and Glass (1974) found

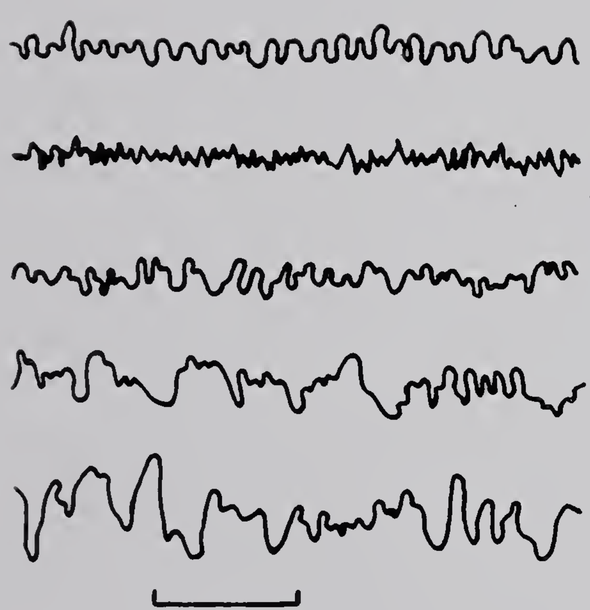


Figure 5

Kinds of Waves Recorded
in an Electroencephalogram (EEG)
(Adapted from Kandel and Schwartz, 1982)

greater activity in the left parieto-central areas among 32 right-handers when they were engaged with mental arithmetic tasks, but decreasd activity for the same type questions in the same areas among left-handers. Likewise, Galin and Ellis (1975) also found increased left hemispheric activity for verbal tasks and increased right hemispheric activity for spatial tasks, implicating those areas for those functions. Gevins et al., (1979), however, challenged this interpretation and were unconvinced that the EEG findings were indicators of particular cognitive processing activities.

EEG recordings have been shown to vary for processes that mediate attention arousal, and which therefore presumably involve the reticular formation in its circuitous loop with the limbic system and the cerebral cortex. Using lateralized visual stimuli in six right-handed males and six right-handed females, Heilman and Van Den Abel (1980) found that the right parietal lobe attended to stimuli presented to both the right and left hemifields, whereas the left parietal lobe mainly was activated when stimuli was presented to the right visual hemifield.

The use of Positron Emission Tomography (PET) techniques enables the researcher to obtain and compile a three-dimensional quantification of changes in the activity of neural networks in the living brain by detecting the emission of radioactive particles from within the brain (Greenberg, 1981; Miller, 1981; Phelps and Kuhl, 1981; Buchsbaum, 1982). Miller (1981) found increased activity in the visual areas when subjects observed complex versus simple scenery, and they also used the right hemisphere more when remembering a melody, and the left hemisphere more when plotting notes on a music staff. Snyder (1982) and Gur et al., (1983) found increased left hemispheric metabolism (therefore activity) during verbal tasks, relative to the right, and increased metabolism in the right hemisphere for spatial tasks, relative to the left hemisphere. These results are consistent with increased blood flow to those areas performing the activity (Gur et al., 1982), as well as with the data that shows that the right hemisphere is activated over a wider area than the left hemisphere, which corresponds with the higher percentage of white matter and more diffuse distribution of gray matter in the right hemisphere (Gur et al., 1983). These studies confirm results from earlier studies done with tachistoscopic hemifield techniques by Geffen (1971), as well as from work using dichotic listening techniques (Kimura, 1968).

As an adjunct to EEG recordings, using the

Computerized Axial Tomography (CAT) technique, Sananman (1983) found that for focal structural lesions, the CAT scan was more sensitive in detecting the abnormality than the EEG, although the EEG complements and is more effective than the CAT scan in detecting neurological activity and decreased perfusion without structural alteration.

Handedness and the Brain

According to Geschwind and Levitsky (1968), more than 90% of us are right-handed and have our faculties of speech represented in the left cerebral hemisphere. Are there any benefits from being either left or right-handed, or does it really matter at all which hand you prefer to use most often?

The generally accepted range for the incidence of left-handedness in western culture is 8-10%, but recent reports by Spiegler and Yeni-Komshian (1983) have yielded estimates ranging from 11-16% among college students and young adults. They also found that males were more likely to be left-handed than females, that most left and right-handers came from right-handed families, and that paternal left-handedness was significantly associated with left-handedness for sons but not for daughters, while maternal left-handedness was associated with an increased incidence of left-handedness for both sons and daughters.

It is generally agreed that for approximately 70% of left-handers, the left cerebral hemisphere controls expressive language, as in right-handers, with the remaining 30% having the right hemisphere control or share control with the left hemisphere. However, according to Levy and Nagylaki (1972) approximately 53% of sinistrals have language dominant left hemispheres, while 47% have language dominant right hemispheres. In addition, clinical studies indicated that 35% of right-handers had no aphasia at all or recovered fully following lesions in the speech area of the left hemisphere, and 65% of sinistrals or ambidextrals suffered no aphasia or recovered completely under these conditions.

The etiology of handedness is generally considered in the light of cultural, genetic and pathological variables. If the choice of hand preference was arbitrary, we should expect to find some culture with a left bias, but as Coren and Porac (1977) indicate, no such culture has been found. Teng, et al., (1976) studied over two thousand Chinese students and found that social pressure was highly effective in changing hand use in writing and eating, yet it showed little transfer effect on hand use in other activities.

Levy and Nagylaki (1972) postulate that one gene controls which hemisphere becomes language dominant and another gene decides whether hand control is contralateral or ipsilateral to this hemisphere, respectively. Dart (1949) postulates that the alleles relevant to hand control entered the gene pool about two million years ago, and Kimura (1973(a)) suggests that human linguistic skills might have adapted evolutionarily from gestural systems for communication purposes.

Bakan (1971(b), 1977) is in disagreement with these theories and suggests that left-handedness is not an adaptation, but rather an accident everywhere it is found, and that all left-handers have mild brain damage due to anoxia at birth, with most problems occurring during high risk (first and fourth or later) pregnancies and births to older mothers. Schwartz (1977), however, using a handedness questionnaire developed by Crovitz and Zener (1962), found that the distribution of laterality in high risk and low risk pregnancies were virtually identical. Similarly, Hicks et al.,(1977) failed to find a relationship between birth order and handedness for males and females with his own research and even when he pooled his data with that of Bakan's (1971(b)), and thus failed on two accounts to replicate Bakan's data.

Individuals also differ with respect to the handwriting position which they adopt during writing. Most people use a straight or "non-inverted" posture, with the hand below the line of writing and with the writing instrument pointing toward the top of the page. A consistently appearing minority of individuals, however, write with a hooked or "inverted" posture, with the writing instrument pointing toward the bottom of the page (Levy and Reid, 1976). From tachistoscopic tests, Levy and Reid (1976) further found that in straight (non-inverted) writers, language skills were predominantly localized in the hemisphere contralateral to the writing hand, while visuospatial abilities were in the ipsilateral hemisphere, with this pattern being reversed for inverted (hooked) writers.

Much controversy still exists concerning the value in using handedness and handwriting positions for predicting cerebral organization for language or other cognitive functions. McKeever and Van Deventer (1980) found that an inverted writing posture was much more common among left-handers than among right-handers, and left handed-males were more likely to be inverted writers than left-handed females. In addition, evidence from Moskovitch and Smith (1979) suggests that the difference in the neural organization between inverted and non-inverted left-handers lie primarily in the visual system and not wih the auditory system. If Levy and Reid's (1976) hypothesis on hemispheric motor control was correct, inverted and non-inverted writers would show opposite sensory field advantages in each modality on reaction time tests. That Moskovitch and Smith (1979) found such differences only in the visual modality seriously challenges this hypothesis as well as the models of Levy and Nagylaki (1972) and Levy and Reid (1976). Similarly, Tapley and Bryden (1983) used tests employed by Levy and Reid and found no evidence that inverted right-handers had right hemispheric representation of language and left hemispheric representation of visuospatial abilities, with the opposite results for non-inverted writers. Additionally, inversion is not thought to be due to the direction of writing, for Shanon (1978) found that for Hebrew students, there were less than 10% of inverters even for left-handers, as compared to a 47% incidence for American left-handers tested.

Bryden (1983) recently found from dichotic listening tests that non-inverted writers showed a clear right ear (left hemisphere) superiority, while inverted writers were inconsistent in performance, with many showing a left ear (right hemisphere) superiority, closer to the direction predicted by Levy and Reid (1976), yet at variance with those findings of Herron, et al., (1979), McKeever and Van Deventer (1980), and Moskovitch and Smith (1979), whom had found no significant differences between inverted and non-inverted left-handers in dichotic listening tests.

Deutsch (1978) found that, overall, left-handed university students made significantly fewer errors in pitch detection (high to low scales) than right-handers, and those who were moderately left-handed were significantly more accurate than the strong and/or moderately right-handed and strong left-handed students. She could not, however, extend the application of this pitch memory superiority to other auditory or musical situations. Nachshon (1978) found that right-handers preferred the left ear for the discrimination of pitch and loudness of digits, and the right ear for digit identification, but like left-handers, had no ear preference for the pitch discrimination of pure tones. These results seem to suggest that laterality effects may partially depend on task complexity.

Herron, et al., (1979) found that at occipital EEG leads, during visual language tasks, the right occipital area was engaged more in straight left handers than in straight right handers and inverted left-handers, thus the relationship of hand position to hemispheric participation in "language" predicted by Levy and Reid (1976), and verified by Moskovitch and Smith (1979), was confirmed. However, there was no difference between inverted and non-inverted left-handed groups in spatial specialization for the occipital leads, which is contrary to Levy and Reid's tachistoscopic data.

Research by LeMay and Culebras (1970) and Hochberg and LeMay (1975) demonstrated a greater opercularization (increased mass) of the parietal lobes on the left side than on the right side in 67% of the right-handed patients studied, versus 21% increase in left-handed patients. In addition, they found that these hemispheral differences in parietal lobe size are present in fetal life. Furthermore, the tendency for hand preference seems to be typically human, for attempts to find lateralization effects and hand preference in 84 adolescent and mature rhesus monkeys failed to produce the asymmetry and dominant hand preferences as in humans (Warren, 1953). Finch (1941) and Marchant (1981) also failed to find evidence that chimpanzees use either hand more than the other on different tasks.

Searleman, et al., (1984) found that there was a small but significant leftward shift in all types of lateral preference (ie., hand, foot, eye, ear), and increased incidence of hand inversion in groups of individuals, particularly males, who have had specific forms of birth stress. For females, an inverted writing posture seems to be associated with more right-sided preferences for hand, foot and eye. These findings suggest that hand writing position is predictive of the pattern of lateral preference for foot, eye, ear and hand use, and that left-handed male inverters differ in preferences from left-handed female inverters.

Can handedness be used as an indicator of success for someone wishing to choose a career? Peterson and Lansky (1974, 1977) found more left-handers among architect students (10.8-18.0%) and architects (29.4%) than would be "normally" expected (8-10%) in the general population. They discovered that the left-handed students clearly outperformed the right-handers and proportionately more left-handers completed their six-year architecture program than did right-handers. Greenfield (1984) found significant relationships between hemisphericity, sex, and college major in affecting student achievement, while none of these variables considered alone had much affect at all on achievement. Similarly, Way (1981), failed to find significant differences in handedness in occupational choice among college students.

Gender and social class status may account for differences in the distribution and extent of anatomical and functional aysmmetries for hand preference. Way (1981) found a preponderance of weakly lateralized (mixed handed) male students in a college population with a high percentage of minority racial students, yet for 'traditional' white, middle class communiy college students, he found that there were no differences in laterality distributions.

Sex Differences and the Brain

There seems to be sex differences in almost all important behaviors people engage in. Among the hypotheses that have been developed to explain these findings are brain lateralization differences: women show a smaller degree of cerebral asymmetry (ie. are less lateralized) than men on tests of lateralization. Various theories have tried to tie together these differences with differences in cognitive skills, but have not found complete success.

McGlone (1977) studied 55 right-handed men and 47 right-handed women and found three times as more men than women with left hemispheric brain damage were aphasic, and in men, only left hemispheric lesions produced verbal I.Q. deficits, whereas in females, left and right hemispheric lesions were associated with equally mild decrements in verbal I.Q. These results suggest that sex differences may exist in the degree of bilateral speech representation and/or regional specialization and neural organization of verbal functions within the left hemisphere. Witelson (1976) suggested that from her study of more than 200 normal six to thirteen year-old boys and girls, that sex differences were not as consistent as in brain damaged patients, yet when differences appeared they pointed toward greater asymmetry (laterality) in males.

Concerning visuo-spatial abilities, Inglis and Lawson (1981) found a greater drop in scores in visuo-spatial tasks for males than for females after right hemispheric damage. Similarly, Nichelli, et al., (1983) found that for tachistoscopic visuo-spatial tasks, a left visual field (right hemisphere) advantage was present in males, but half the females showed a left visual field advantage and half a right visual field advantage. Ray, et al., (1976) also found that males showed increased right hemisphere EEG activity for visual tasks and increased left hemisphere activity for verbal tasks, but there were no differences in usage of either hemisphere for females. These results suggest that females, while being proficient as males in a given task, can nevertheless show a different (more balanced) asymmetry in performance. It is, therefore, not necessarily true that a better degree of performance follows greater lateralization of function for a task.

What accounts for the differences between men and women in brain lateralization? Sexual differentiation in each half-brain may mature at a rate according to the way they respond to gonadal hormones, which is usually apparent well before puberty. Unless modified by male sex hormones, the brain becomes a female brain through the influence of female sex hormones (Restak, 1984). High concentrations of androgens in the male are thought to enhance the development of the right side of the brain and body, while high concentrations of estrogens in the female enhance the development of the left side of the brain and body, although the degree of development varies with gender and handedness. Levy and Levy (1978) found that for adults, and children under six, right-handed males had larger right feet, but right-handed females had larger left feet; left-handed males had larger left feet, while left-handed females had larger right feet. The preference for developing the left side of the brain and body in females was demonstrated by Hines (1981) when females were exposed to the synthetic estrogen substitute, diethyl stilbestrol (DES).

The fact that the brain may need a certain level of hormones at critical times for normal development was corroborated by Hier and Crowley (1982), whom discovered that males who did not have adequate testosterone levels early in life and therefore did not go through normal male puberty, had scores equivalent to females (usually less than males) on visuo-spatial tests, and they did not improve their scores after androgen-replacement therapy. In investigating the relationship of handedness to learning disorders, Galaburda, et al., (1978) and Geschwind et al., (1982) found evidence of slowed and reduced development of the left hemisphere in a male dyslectic patient who died in an accident. Marx (1982) suggests that although dyslectics may stutter, have trouble reading, or have other speech-related deficits, their spatial talents may be much better than average.

Gur, et al., (1982) found that right-handed males and females had greater left cerebral blood flow for verbal tasks, and greater right cerebral blood flow for spatial tasks. In left handed males, both hemispheres had similar blood flow patterns for verbal tasks, but slightly greater flow in the right hemisphere for spatial tasks. The laterality effect was weaker in left-handed females. They also found that the gray matter in the left hemisphere had greater activation than the right hemisphere for both sexes and both handedness groups. Their data seems to show that factors affecting the direction and degree of hemispheric specialization also affect patterns of hemispheric activation during cognitive tasks.

As regard to handwriting position, McKeever and Van Deventer (1980) found that while the overall incidence of inverted positions for left-handers (54%) was roughly similar to that reported by Levy and Nagylaki (1972) (58%), 71% of males and 44% of females used the inverted position, showing a statistically significant ($p<.05$) difference in incidence in the two sexes.

A factor that may account for some of the differences in cognitive task results between the sexes could be the development of the corpus callosum, which matures up to three years earlier in girls than in boys (Herrmann, 1984). This would imply that on the average, more girls are able to access both hemispheres through this commissural link than are boys of the same age, which may make a significant difference in the thinking preferences and cognitive abilities in pre-adolescents. Additionally, since the effects of left-hemispheric damage on language functions are more readily apparent in men than women (McGlone, 1977), greater plasticity of the female brain in response to developmental disorders and other dysfunctions is possible.

If the brains of boys and girls are differentially developing in early life, then these differences could affect how either a boy or girl develops and learns reading and other cognitive skills. Bunch (1983) found that children with mixed dominance patterns (less lateralized) were weaker in reading achievement than children with unilateral dominance of either hemisphere. Therefore, these results show that although the potential to use both hemispheres may be greater for females, not all females take advantage of it.

If girls can access both hemispheres better than boys, then why, as Benbow and Stanley (1980) report, do seventh and eighth grade girls excel in mathematical computation, but are not as proficient as boys on tasks requiring mathematical reasoning ability? Kolata (1980) suggests that social factors play some role in mathematical reasoning ability. Block (1981) stresses that access to experience and the chance to actually confront the world influences cognitive and personality development of both boys and girls. Benbow and Stanley's (1980) data show that sex differences in mathematical reasoning ability are noted before either sex chooses to take different courses, and before the intense socialization effects operate during puberty. Therefore, it would seem that at the very least, genetically (hormonally)-based sex differences may account for most of these differences, though keeping in mind that one's potential needn't be narrowly determined with no chance of improvement because of these differences. Perhaps, educators should do as Tomizuka and Tobias (1981) suggests; "If spatial visualization contributes to mathematical reasoning, teach it. Improve math teaching overall, and eliminate all the factors in the culture that discourage children of both sexes and all races from pursuing mathematical study with pleasure and reasonable expectations of success."

Learning/Cognitive Styles

How a person learns and the manner that information is most effectively and efficiently absorbed differs greatly from individual to individual. Since there is such a diversity in approaches to learning, to obtain the best outcome, it is very important to determine which students learn best under what conditions. Most people have a consistent way of responding to and using stimuli in the context of learning, that is, they have a particular, preferred "learning style" that they use most often.

Different researchers use different constructs to explain their idea of the dimensions of learning style. Dunn (1981,1983) for example, suggests five categories of elements that she says encompasses the definition, and that include environmental, emotional, sociological, physical and psychological elements. Recently Dunn et al., (1982) has found that students who tend to be left-brained (analytical) preferenced learn in very different conditions from those who are right-preferenced (global). Cullen (1980) suggests that for community college mathematics students, the greater the dependence on the left hemisphere, the more comfortable the students would be in the lecture classroom setting, and those students whom are more right-hemisphere dependent might best learn using a different mode of instruction. From Thornell's (1976) point of view, teachers must recognize that there are more advantages in analytic style versus a global style in the performance of many different learning tasks in the classroom. The way an individual acts, reacts and adapts to the environment is often used synonymously with learning, teaching and administrative style (Kuchinskas, 1979).

In analyzing varying approaches to individualization of biology teaching ranging from highly structured to highly unstructured, Norris et al., (1975) found that the task of determining the right amount of structure appropriate for each student was a challenging task, and that knowledge of the students' cognitive and hemispheric styles/preferences was an essential element in making individualized teaching a success. Griggs and Price (1979), and Alvino (1981), found that gifted students were less teacher motivated, more persistent, liked some sound in their environment when studying or concentrating, did not like auditory learning, preferred discussion over lecture, and preferred to learn alone. Non-gifted students, on the other hand, were more teacher motivated, less persistent, liked quiet when studying, preferred auditory learning, showed a strong preference or tolerance for lectures, and did not want to learn alone. Other environmental factors have also been explored as influencing student performance (Glass et.al.,1973; Dunn and Dunn, 1979; Griggs and Price, 1979; Dunn, 1981,1983), as well as non-cognitive factors (Hunter, 1978) and differences in learning preferences between men and women (Brainard and Omen (1977). It therefore seems that both the more open, nondirected classroom and the traditional classroom thus provide suboptimal conditions for one group or the other, and it would seem inappropriate to use only one scheme of individualization if the class has a variety of cognitive styles.

Brekke (1986) found that by designing Nursing curriculum and lesson plans based on McCarthy's 4MAT System, that integrates the four basic learning styles described by Kolb (1978) with current knowledge of left and right brain functioning, that Nursing students felt comfortable with at least a portion of the presentations, and they demonstrated a high level of enthusiasm and motivation to learn.

Davenport and Davenport (1986) found that a statistically significant positive relationship existed between sex and educational orientation, with female university students being more andragogically oriented than males. They suggested that instructors who work with adults should be familiar with andragogical (adults) and pedagogical (children) concepts and instructional strategies associated with these concepts, as well as knowing their own educational orientation as part of their own self-awareness as to how their personal orientation may affect their teaching. They further suggest that in order to adapt their teaching styles to the orientation of their adult classes, instructors should blend andragogical and pedagogical techniques, since few, if any, groups are primarily andragogical or pedagogical.

McCabe (1983) found that baccalaureate Nursing students preferred the lecture method of instruction, did not want to read, did not prefer self-instructional methods, but preferred to work with people. Lassan (1984) studied registered Nursing students and generic student Nurses and found that both groups had similar learning styles and more closely resembled each other as they progressed from junior to senior level. As seniors, both groups tended to become more able to learn by a variety of methods rather than by assuming a permanent learning style. Results of data analyses supported similarity rather than diversity of course design as an acceptable base upon which design for the education of both types of students in their senior year would be appropriate. Perhaps, then, that having available and using a variety of instructional strategies and methods in the first two or three years of a Nursing program might be more important to accomodate a student population with more diverse learning styles, but is not as important in the senior year when most students have found that learning style that has worked best for them. Given the realities of most formal institutional learning settings, coupled with the backgrounds and needs of the learners, one or more combination of instructional models may be needed, all of which must recognize that the adult learner needs to be involved more or less directly in decisions regarding the instructional process (Tracy and Schuttenberg, 1986).

However, Fischer and Fischer (1979) suggests that the term "style" can be a double-edged sword, either used to clarify and analyze teaching or learning, or simply used to "paper over" inadequate and confused thinking. Their view of "style" is one of a pervasive quality in the behavior of an individual, a quality which persists though the content may change over time and from learning situation to learning situation. To them, style is not to be identified with method, for they hold that people infuse different methods with their own style or flair. With this thought in mind, for example, lecturing would not be a style, but a method of instruction, within which one infuses ones' own unique abilities and qualities that make each person who "lectures" different.

The major portion of research on learning styles has been done on what is called "cognitive styles", which Witkin has defined as the "cognitive characteristic modes of functioning that we reveal throughout our perceptual and intellectual activities in a highly consistent and pervasive way (Witkin and Moore, 1974). They represent a person's own "personal style", their typical mode of perceiving, remembering, thinking and problem solving.

Though there has been substantive research done on learning and cognitive styles, not until recently has there been a renewed interest in articulating the findings and applying these theories of cognition to college teaching. One of the cognitive styles, the field dependence/independence style, identifies the perceptual components of processing information. Relatively field-independent people tend to experience part of the field as discrete from the surrounding field even when the field is so organized as to strongly embed that part, that is, they perceive analytically. Field-independents show greater interest in the more impersonal, abstract aspects of their surroundings. Perception of relatively field-dependent people, on the other hand, is guided by the organization of the field as a whole, viewing any part of the field as being continuous with all else around it, that is, their perception is global. Field-dependent persons are particularly attentive to the social field and skills and in defining their own attitudes, taking into account the points of view and emotions of others (Witkin and Moore, 1974; Goodenough, 1975). Therefore, these "personal styles" are seen as labels for clusters of both cognitive and personal characteristics of how people orient themselves to their surroundings.

Field-dependent people take the organization of material they are required to deal with as given, often lacking structure, rather than attempt to impose an organization of their own. This results in their having difficulty in learning material presented in a way that requires them to organize in order to learn. However, field-independent people are better able to provide from within themselves the structures and strategies that are needed to facilitate learning of material that is unorganized, and are less reliant on someone else suggesting how to learn the material. On the other hand, when the material is presented in an already organized form, so that structuring is not particularly called for, field-dependent and field-independent people are not likely to differ in their learning (Witkin and Moore, 1974).

It has been found that among high achieving students in Nursing, the more field-dependent chose Psychiatric Nursing, while the more field-independent chose Surgical Nursing. Women have been found to be more field-dependent than men, with men choosing careers that call for analytic skills, while women choosing work that calls for more interaction with others (DeRussy and Fitch, 1971; Cagley, 1984). Women who are field-independent tend to score at the masculine end of scales that measure masculinity and femininity (Witkin and Moore, 1974).

Students who are field-dependent shift majors more often than field-independent students. Field-independents may be comfortable in both social science/humaniites and/or the more technical areas of study, like math/science courses, probably because the skills required in math are very specific, analytic skills. Field-dependents are more comfortable in social science/humanities courses, since those skills needed in the social science/humanities are more broad-ranged (DeRussy and Fitch, 1971; Witkin and Moore, 1974; Fazio and Zambotti, 1977). These findings do not agree, however, with those of Lotwich, Simon, and Ward (1980), who found a higher incidence of field-independence in male education (multi-disciplinary) students than in male science and engineering students.

According to Claxton and Ralston (1978), there is little research done on the field-dependence-independence dimension with college and university teachers. Field-dependent teachers prefer discussion methods of teaching, while more field-independent teachers prefer the lecture method. Field-independent teachers tend to be more direct in attempting to influence students, whereas, field-dependent teachers are more inclined to use democratic procedures in the classroom. Teaching preferences do not indicate significant differences in teaching competency, but seem to indicate a difference in approach to the teaching situation, either of which does not necessarily make for better achievement than the other. When students and teachers were matched and mismatched in terms of this construct, the matched subjects described each other positively, while the mismatched described each other negatively. When the teachers described their students' abilities, they valued more highly the attributes of students who were like themselves. Similarly, the students felt more positively about the teachers who were like themselves in terms of cognitive skills (Kuchinskas, 1979; Claxton and Ralston, 1978; Mahlias, 1978). Cranston and McCort (1985) suggest that the greatest single advantage in using a learner analysis instrument, analyzing learning/cognitive styles, is that the teacher becomes more aware of each student as an individual learner, and by applying this knowledge to instructional methods, increased student performance will result.

What are some of the implications of these findings? Witkin has concluded that matching students and teachers in terms of field dependence-independence brings about greater mutual attraction between them, but he is not certain whether it brings about increased student learning (Witkin and Moore, 1974). He suggests, furthermore, that people apparently become aware of other people's style very quickly, and hence, the way teachers and students view each other may be set by the end of the first class session. A study by Siegel and Siegel (1965) suggested that learners with certain cognitve styles were either facilitated or hampered by the particular teaching methods to which they were exposed. They further suggested that cognitive style not only operates to influence how well a student learns, but also what kind of content he/she would rather ignore or get out of the way as fast as possible.

Purposely matching or mismatching may be valid, but it would depend on the teachers' purpose for doing so to reach a certain goal or accomplish a certain learning task. For example, the purpose may be "instrumental", whereby the students may wish to develop a particular skill (computation; writing) and that matching may seem called for. On the other hand, the purpose may be "developmental", whereby students may wish to achieve greater personal flexibility and autonomy. This may be achieved through discontinuity of learning experiences that forces him/her to reappraise his/her attitude and feelings and adjust to new concepts (Claxton and Ralston, 1978).

Is it wise to match students and teachers for cognitive style? Witkin suggests that there may be some negative effects associated with matching (Witkin and Moore, 1974). He suggests that:

1. For some kinds of learning content, a contrast in styles between teachers and students may prove more stimulating than would similarity;

2. Heterogeneity leads to more diverse viewpoints

and may therefore enliven the classroom;

3. The discussion approach favored by field-dependent teachers provides little of the structure needed by field-dependent students; and,

4. Field-independent teachers are more likely to provide feedback to student performance in the classroom which would benefit field-dependent students; these students would not get as much of this feedback if they had a field-dependent teacher.

Scerba (1979) studied community college students and found that the attempt to match students and their learning styles to teaching styles did not produce any significant interaction effects between learning styles and teaching styles on grades earned, achievement test scores, teacher and course evaluations, or attrition rates. In other words, learning was not enhanced by matching student learning styles to teaching styles, yet there was no way of accounting for other variables that may have affected the outcome. A number of research studies have found that the greater the match between the students' and teachers' cognitive style, the higher was the student's grade point average (Douglass, 1979; Cafferty, 1980). Brennan (1984) found that there were no significant differences between hemispheric preference groups (left/right), cognitive style groups (analytic/global) or between male and female tenth grade geometry students in a mathematical achievement test. However, she did find significant differences across Time (Pretest, Posttest, Delayed Posttest) for all groups, and found higher achievement test scores when instructional materials (analytic/global) matched the students' cognitive style (analytic/global), but scores were not significantly higher at the 0.05 level.

Doebler and Eicke (1978) and Dunn (1979,1981) suggests that the positive effects of matching can be obtained while avoiding the possible negative effects by simply sensitizing the teacher to, or making him/her aware of, the implications of cognitive styles and of the style of each student and how it relates to his or her own style. Turner (1979) holds that because students vary greatly, that all teachers be skilled in at least one effective teaching style, preferrably in several.

Hunter (1979) evaluated 300 community college students and found that students receiving A's tended to reject reading and accept listening and direct experience as preferred modes of learning. They also seemed to reject independence and accept organization and detail as preferred conditions of learning. Since these preferences were related to A grades, could it be that traditional college learning activities such as reading and independence may be on the decline, which could be accounted for by their cognitive preferences?

Without developing 'cognitive style flexibility' for functioning in styles other than one's own "preferred" style, Kirby (1979) suggests that people will miss at least part of reality in their lives. She suggests that by acquiring and developing cognitive transfer skills, people will have more options for responses to situations, increase chances of success, improve communication between persons of varying cultural backgrounds, and will increase interpersonal tolerances of differences between theirs and others' styles and skills. Coop and Brown (1970) suggested that college-age students may be very adept at acquiescing their cognitive styles depending on the instructional settings in which they find themselves, and that the cognitive style of college students does not predispose students toward learning a particular type of subject matter content. Froyen (1970) concludes that a combination of approaches and a variety of "angles" from which the subject matter is viewed, is needed to help people augment their cognitive style. Hammes and Duryea (1986/1987) recommend teaching methods that involve students in small groups, discussions and problem-solving methods in learning to help develop independent and critical thinking abilities, and to stimulate the acquisition of a body of knowledge and motivate the application of this knowledge in the resolution of health decision-making conflicts.

Collectively, these studies represent a sampling of some of the research findings on the role of cognitive style in student learning preferences. They suggest that students tend to prefer distinctive learning styles and behaviors related to their own dominant cognitive style. It is not that one "style" may result in consistently superior learning, but rather that certain approaches may be better suited to certain tasks and situational factors.

Thinking (Neurocognitive) Preferences

In our society we have developed what is considered a cultural gap between two styles of thinking. One is characterized by an orderly mentality- epitomized by professionals such as lawyers, accountants and scientists, who are concerned with facts and who grasp an analytical, verbal approach to life. The other style is characterized by an attempt to avoid order and logic- as with artists and musicians, being emotional, holistic and creative (Samples, 1975(a), 1976). It is not surprising then that this division is associated with radically different lifestyles, tastes, thinking preferences, personality characteristics and ways of expression (Garrett, 1976; Druart, 1983).

Ornstein (1973) refers to the linear, logical, left cerebral hemisphere as synonymous with lightness, and thought processes that we can articulate, while the right hemisphere is related to darkness and thought processes that are mysterious, unable to be articulated, for most of us in the Western world. Our left hemisphere cannot articulate explicitly what our right hemisphere knows implicitly perhaps because we do not give it a chance to be known (Mintzberg, 1976; Brandwein and Ornstein, 1977; Leaffer, 1981). Only in sleep, daydreaming, fantasy, relaxed states or states of extended consciousness, are thoughts of the right hemisphere allowed to become known (Konicek, 1975).

Those people who have become accustomed to thinking in a left-hemispheric fashion are more confortable and competent in doing so, more than others who may not prefer this mode of thinking. It follows then, that if given a choice, whether we are aware of doing it or not, most people think about things in a way that they feel confident and comfortable with, that is, they have their own preferred style of thinking. This preference, however, may only include a very limited amount of the total capacity or potential of our brains that can be used at any given time.

Herrmann (1981, 1982(a;b)), has devised a paper and pencil questionnaire that is constituted around the brain's cerebral and limbic systems, that yields data along discrete portions of the brain dominance continuum, identifying left and right specialization of the brain, as well as the preferred mode of thinking in terms of location of the processing in the brain (thinking (neurocognitive) preference). The results yield data in four quadrants: cerebral-left, limbic-left, limbic-right, and cerebral-right. In addition, a primary, secondary, or tertiary score is yielded in each quadrant indicating whether an individual or group prefers left- or right-hemispheric, as well as cerebral or limbic, modes of thinking (Herrmann, 1981, 1982(a;b); McKean, 1985; Ironson, 1984; Policoff, 1985). As Herrmann suggests, an individual's placement within the four quadrants is not fixed and can be changed through motivation and involvement in educational experiences designed to stimulate growth in both left and right modes of thinking, and therefore, develop functional cerebral symmetry.

Using Herrmann's Instrument, Coulson and Strickland (1983) found that chief executive business officers had a higher average right-hemispheric dominance score than left, and therefore, preferred right-hemispheric modes of thinking over left, while the opposite was true for superintendents of schools. They suggest that the executive officers would more likely be able to respond effectively in crises since they think more in a creative, cerebral right mode, while the superintendents would not, since their major preference is a conservative, limbic left mode of thinking. Similarly, Kerensky (1983) found that left-dominant school principals have a high concern for task, while right-dominant principals showed a high concern for people. Using Herrmann's Instrument, Bush (1984) found that the population of computer professionals he studied exhibited a pronounced left hemispheric cognitive style, and he suggested that the apparent process by which individuals are educated, trained and selected for careers as information systems professionals mitigates against the success of right hemispheric style individuals in the profession.

Mintzberg (1976) holds that organizational effectiveness in business or education does not lie in the narrow-minded concept called "rationality", but in a blend of clear-headed logic and powerful intuition. Most people can become "whole-brained", that is, have the flexibility to work with both left and right modes of thinking, and can thereby increase his/her effectiveness in activities that require whole-brained thinking (Bever and Chiarello, 1974; Reynolds and Torrance, 1978; Murphy, 1985; Murphy and Newhauser, 1985 (a);(b). Bunderson, Olsen, and Herrmann (1981) found that it was possible to motivate people to attempt to shift from left to more right-modes of thinking, though it was easier than trying to motivate right-thinkers to learn the skills of left-modes of thinking.

According to Herrmann (1981, 1982(a);(b)), Edwards, (1982), Ironson (1984), and Policoff (1985), it is important for teachers to know the thinking preferences of their students since differential brain activation greatly affects a persons' learning style because this neurocognitive activity determines one's preferred mode of thinking. If any of the different modes of thinking, characterized by Herrmann's four quadrants, is unavailable for situational application, then the learning process tends to fall apart or to be sub-optimized, and the creative outcome is never attained (McCallum and Glynn, 1979; Samples, 1975(a);(b), 1976; Garrett, 1976; Morton, 1978; Reynolds and Torrance, 1978; Torrance and Ball, 1979; Herrmann, 1981, 1982(a);(b); Murphy and Newhauser, 1985 (a);(b)).

Recent brain research shows parallels among Piaget's theory of cognitive development, brain growth spurts and hemispheric specialization. These parallels may explain why some students, whose primary mode of processing information is visual, inductive right-brained oriented, do not have the mental capability to perform certain tasks in left-brain oriented classes and schools that tend to favor verbal, deductive styles of learning. "Brain incompatible" instruction may contribute to students' poor performance in problem solving, which requires dual hemispheric engagement. Levy (1983) suggests that differential instructional levels based upon hemispheric cognitive styles may best be useful for the initial presentation of content to students. Once the concept is learned, she suggests that it must be expanded upon both academically and intellectually, if a student is to be truly educated. Greenfield (1984) suggests that since higher intellectual learning levels require cognitive tasks such as synthesis and evaluation, that for students to achieve those higher intellectual levels of learning, they must be able to process concepts efficiently using both hemispheres in an integrated fashion.

Neurological and behavioral development both adhere to principles of growth, differentiation and organization. Epstein (1978,1979,1980,1984) has found that the chronology of brain growth spurts is congruent with Piaget's (1964,1972) model of cognitive developmental stages. Epstein holds the position that the proposed changes in the growth of the brain may structurally set up the neurobiological possibility for the occurrence of a change in cognitive functioning, and that for development of reasoning capacities, such changes can best occur in the face of appropriate instructional intervention and/or experience. There is significant differences in brain growth spurts between the sexes, with girls at age eleven having twice the brain growth as compared to boys of the same age, while the converse being true of the brain growth spurts for each sex at around age fifteen. The failure to recognize the need for higher-level challenges for girls around age eleven may deprive them of the needed cognitive stimulation and development on which to build their subsequent intellectual growth at a later (and intellectually more important) age at which Arlin (1975,1977) has shown that creative thinking emerges.

The rates at which children pass through each of Piaget's four stages of cognitive development (Sensorimotor (0-2 years); Preoperational (2-6,7 years); Concrete Operational (7-11 years); Formal Operational (11-15,16 years)), differs, with these ages varying from society to society and from such factors such as language and verbal skills, and the types of activities that have been available to them for exploration (Piaget, 1964,1972; Kolberg and Gilligan, 1971; Dasen, 1972).

Piaget's mental schemes must be developed through the active process of equilibration, the continual organizing and reorganizing of cognitive structures, assimilating newer experiences and accomodating cognitive structures to better adapt to the newer particular experience of reality. Allowing students to actively participate in the learning experience is central to this equilibration model of cognitive development of Piaget

(McKinnon, 1971; Renner and Lawson, 1973,1975; Kolodiy, 1974,1975; Lawson and Renner, 1974,1975 (a);(b); Lawson, 1975; Mallon, 1976). Failure to provide opportunities for students to be free to confuse concepts, to confront the confusion, and then to separate the ideas on their own, may leave these concepts undifferentiated in their minds (McDermott, et al.,1980). Producing disequilibration is necessary for accomodation to take place and for the eventual assimilation of the new concepts by the student.

The assumption is often made by college instructors that incoming freshmen students think logically and are at a level of cognitive development to the point that they can be treated as abstract verbal learners, capable of comprehending new concepts and proportions directly, without the aid of concrete models (Ausebel, 1964). Among white secondary twelfth grade students, it was found that 65-66% were concrete thinkers and from 5-39% were in a formal operational level (Lawson and Renner, 1974,1975,(a);(b)). At the college level, incoming regular freshmen were found to range from 50-76% on the concrete level and 24-32% at the formal level (McKinnon, 1971; McKinnon and Renner, 1971; Towler and Wheatley, 1971; Renner and Lawson, 1973; Sayre and Ball, 1975; Kolodiy, 1975; Arons, 1976,1977; Garcia, 1979; McDermott, et al.,1980), while 84% of remedial students were in the concrete level and 16% in the formal operational levels (Garcia, 1979). In addition, Nordland, et al.,(1974) found that only about 13-15% of seventh to twelfth grade black and Spanish science students demonstrated any formal reasoning ability.

McKinnon and Renner (1971) and Renner and Lawson (1973) suggest that some of the lack of formal reasoning development can be traced to inappropriate instructional strategies and materials at the secondary and college levels. Concrete operational thinkers are not permanently locked at this level, however, for Renner and Lawson (1975) found that an inquiry-experimental approach to college instruction was quite successful in promoting formal reasoning abilities more than their control groups.

Most individuals have the potential for achieving cerebral integration by developing one's imagination and visual thinking skills (Ornstein,1973; Samples, 1975,1976; Brandwein and Ornstein, 1977; Andrews, 1980; Stewart, 1985). However, using both hemispheres is important since Banks (1980) found that the use of right-hemispheric modes of thinking by itself did not have a positive relationship with creative ability. If, as Tegano (1981) suggests, that the potential for divergent thinking increases with increasing age, cognitive growth, and physiological maturation of the corpus callosum, then the increase in ability for visual, creative thinking might help free the right hemisphere from the control of the left, which would help the individual move more freely and efficiently from one mode of thinking to another, and gain some degree of control over one's methods of processing information. In fact, Wittrock (1978) reports that you can strengthen "weak" left-hemispheric processes by teaching students to visualize and use imagery, presumably right-hemispheric conditions, to improve reading comprehension.

Visuo-spatial aptitude has been strongly linked to obtaining academic mastery of several science disciplines and may be very critical to higher cognitive functions. Unfortunately, it has been found by McGee (1979) and Lord (1985(a)) that over one-half of the adult population in this country has trouble manipulating and controlling iconic images. Roe (1952) reported that when perceptual-spatial measures were administered to sixty-four eminent scientists, each and every one recorded superior scores in visuo-spatial accuracy. Siemankowski and Macknight (1971) and Rosenthal, et al., (1977), found that science majors scored higher in visuo-spatial tests than non-science students, and similar results have been found in students of physics

(Pallrand and Seeber, 1984), chemistry (Baker and Talley, 1972), biology (Bishop, 1978; Lord, 1985(b)), and astronomy (Bishop (1978).

Nursing education programs include many psychomotor skills which students need to learn quickly and efficiently. Eaton and Evans (1986) found that for Nursing students who had low ability to form mental images of the objects and procedures required for a task, when exposed to nonspecific imaging practices, they showed considerable improvement in their ability to form mental images which enhanced their Nursing skills.

In order to assist students to get the most out of their learning experiences, it is important that the learning points and teaching strategies are sequenced across the brain-dominance spectrum represented by Herrmann's four quadrants. This could be be done by presenting the same material from a left and right mode of thinking and interpretation, and by answering left-brained questions with left-brained answers while including a right-brained paraphrased answer, and doing the reverse for a right-brained question (Herrmann, 1982(a);(b)). By realizing the distinct characteristics and differences in left and right modes of thinking, we are in a better position not to ignore their inclusion in developmental and other learning experiences (Hudgens, 1979). For any creative achievement and successful learning experience, these two hemispheric modes must be inseparable and be synergistically integrated. An individuals' full potential for affective and aesthetic development and expression cannot take place if a dis-integration between these two modes of thinking and consciousness exists (Andrews, 1980).

It would seem that the two cerebral hemispheres, including the limbic system and other neural areas, while working together in a fully integrated, whole-brained manner, are better than either hemisphere or area alone, or even better than the sum of the capacities of each individual side or area. In researching the limbic-neocortical connection, MacLean (1978) and Gray and LaViolette (1982) found that when an image of success is imprinted in the limbic brain, the persons' actions will follow positive directions. As Konicek (1975) suggests, synergy is real and alive in the minds of people.

Levy (1983(b)) suggests that normal brains are built to be challenged, and they operate at optimal levels only when cognitive processing requirements are of sufficient complexity to activate both sides of the brain. Leaffer (1981) concludes that a proper balance of ambiguity, confusion and sensuality facilitates hemispheric interaction, which contributes to heightened aesthetic appreciation and creativity, and to a higher level of consciousness, and integration of functions of the mind. Getting a student emotionally aroused, alerted, and involved in his/her work will help to assure that both sides of the brain will participate in the educational process regardless of the subject matter (Schwartz, 1975).

Gray (1980) poses an important question and comment: "What is our loss when schools stress the more measurable left-hemispheric mathematical and verbal skills which are referred to popularly as "the basics" and, at the same time, ignore the development of right-brained intuitive thinking? It is a worrisome thought that we could produce young adults who can calculate but cannot conceptualize, and who can master formulas but do not know how to apply them." As Joyce (1985) and Shallcross (1981) suggest, the nurture of intuition, another 'basic' to learning, must be encouraged and promoted in order to allow full development of the thinking ability of students. That teaching skills can be enhanced successfully to accomplish this, based on the recent knowledge of brain functioning, has been reported by Finch (1983) and Fall (1984). The answers to many of the questions that have puzzled educators in the past may be clarified in the future from the results of recent brain research. It is now encumbent upon educators to become better acquainted with and to better understand the thinking (neurocognitive) preferences of themselves and their students in order to provide optimally-timed, whole-brained learning experiences that can accomodate individual learner differences and provide new ideas for a brain-based approach to teaching effectiveness.

C H A P T E R III

DESIGN AND METHODOLOGY

Chapter III provides a description of the data source, the instruments used and presents methods for analyzing the data.

Introduction

This was a descriptive research study designed to utilize the validated Herrmann Participant Survey (Brain Dominance) Instrument as a means of determining the specific primary, secondary, and tertiary Thinking Preferences, as well as the overall profile of the thinking mode most often used, of Associate degree Freshmen and Senior Nursing students and Nursing Faculty.

This study also made use of a student survey questionnaire devised by the researcher, to collect data regarding the Hemispheric Learning Strategies (Methods) used most often by Freshmen Nursing students for courses taken before entering the Nursing program, and used by Senior Nursing students for their Nursing I and II courses.

Data from The Herrmann Instrument and the student Learning Strategies Questionnaire was used to generate a more complete profile of how both Freshmen and Senior Associate degree student Nurses learn, of what Thinking Preference and Learning Strategies were used most often by successful students, as well as to ascertain the congruence that existed between the Thinking Preferences and the Hemispheric Learning Strategies (Methods) of each student group. Data from The Herrmann was used to make an overall comparison of the Thinking Preferences of student Nurses with their Nursing Faculty, as well as to ascertain whether there was an overall tendency for a specific Thinking Preference to be found with a specific age, sex and handedness preference of the Nursing students.

Population, Sample Selection and Testing Procedures

The population used for this study was drawn from Freshmen and Senior, Day community college Nursing students, as well as Nursing Faculty, in the Nursing Division during the Fall semester, 1986, at Springfield Technical Community College, in Springfield, Massachusetts.

In order to insure a standard presentation and instruction format for all students, once permission was secured from the students, and at a time that was appropriate for the Instructor, the researcher administered the Herrmann Participant (Brain Dominance) Survey Questionnaire Instrument and the student Learning Strategies (Methods) Questionnaire to each class separately, at the very beginning of the Fall, 1986, semester. Total time required to complete both Instruments was approximately 45 minutes. The Nursing Faculty were asked to complete the Herrmann Instrument within that same time period at their convenience. Fifty-nine out a class of 64 (92%) of all Freshmen, and 50 out of a class of 64 (78%) of all Senior, Male and Female students, completed both questionnaires, while all 12 (100%) of the Nursing Faculty completed the Herrmann questionnaire.

Freshmen and Senior Nursing students, as well as the Nursing Faculty, were assigned their own computer letter and number code that was used in keeping the scoring of the Instruments and the evaluation of the data consistent and to maintain anonymity of subjects surveyed. Freshmen and Senior Males and Females were subdivided into the smaller age-groups that included the 20-and-Under, 21-25, 26-30, 31-35, 36-40, 41-50 and 51-or-over age-brackets, in order to study the possibility of trends toward age-group variations of Thinking Preferences and Learning Strategies of Associate degree Nursing students. Nursing Faculty were subdivided into two groups according to whether they taught Freshmen or Senior students, in order to have data available for comparison of the Thinking Preferences of Freshmen and Senior students with their respective section instructors. Student and instructor names were used to tabulate the data from the Herrmann Instrument, which was scored off-campus by Mr. Mansfied Elkind, Polaroid Corporation, Norwood, Massachusetts. However, the names were not used in the final tabulation of results and final draft of this study. The tabulation and statistical analysis of the data on Key Descriptors, Work Elements, Handedness Profiles, and data from the supplementary Learning Strategies Questionnaire for comparisons to Thinking Preferences were analyzed with the SPSS Statistical Program at Springfield Technical Community College.

Instruments Used in the Study

The Herrmann Participant Survey Form was used to ascertain the Thinking Preferences of each student in each group chosen, and the Thinking Preferences of the Nursing Faculty (Appendix, Table 17).

The Herrmann Instrument measures thinking (neurocognitive) characteristics generally associated with brain hemispheric specialization, and is constructed around the brain's cerebral and limbic systems. It yields data in four quadrants: Cerebral Left (logical, analyzer, mathematical, technical, problem solver); Limbic Left (controlled, conservative, planner, organization, administrative); Limbic Right (emotional, spiritual, musical, talker, interpersonal); and, Cerebral Right (creative, synthesizer, holistic, artistic, conceptualizer).

A primary, secondary, or tertiary score is yielded in each quadrant. These scores indicate whether an individual or group prefers left or right hemispheric as well as cerebral or limbic modes of thinking. A quadrant score of 67 or higher indicates a primary area of thinking preference, with a 90 or above indicating a very strong preference that is used most often and is obvious to those around you. A quadrant score of 34-66 indicates a secondary area where you feel comfortable in using the quadrant modes when situationally needed, but it is not a first preference. A score of 33 or lower indicates a tertiary quadrant score of modalities that you will hardly prefer to use at all and avoid using if possible.

Explanation of Profile Codes, which indicate either primary, secondary or tertiary Thinking Preferences in a particular quadrant, starting from the upper-left, Cerebral Left Quadrant and continuing counter-clockwise to the upper-right, Cerebral Right Quadrant, and explaining the significance of the graphic representations of the Total Left/Right Hemispheric Scale Scores, were generated by Ned Herrmann (1981) and were obtained by the researcher from handouts presented at a Brain Dominance Workshop, directed by Mr. Mansfield Elkind of the Polaroid Corporation, Norwood, Massachusetts.

The Hemispheric Learning (Methods) Strategies Questionnaire was devised by the researcher in order to supplement the Herrmann Instrument with data regarding the Hemispheric Learning Strategies (Methods) that were actually used by Freshmen and Senior students within their courses, and that were not explicitly asked in the Herrmann Instrument (Appendix, Table 18). Though not a validated questionnaire, the statements reflect concepts that have been found by researchers to be associated with some of the cognitive functions of the cerebral hemispheres. The data derived from this questionnaire assisted the researcher in generating a better working overall neurocognitive profile of both of the student Nursing group samples, yet did not interfere with the validity of the Herrmann Instrument results. Pilot studies of the questionnaire were done with four groups of Biology students during the 1986 Summer Sessions at Springfield Technical Community College in order to check for clarity and understanding of question statements and directions.

Analysis of Data

Data gathered in this study will be used to answer the following research questions:

1. What are the Thinking Preferences and Hemispheric Learning Strategies (Methods) of Freshmen and Senior Associate degree Nursing students, and to what degree are their Thinking Preferences congruent with their Hemispheric Learning Strategies (Methods)?

2. What are the Thinking Preferences of the Nursing Faculty, and to what degree are their Thinking Preferences congruent with the Thinking Preferences of the Freshmen and Senior Nursing students?

In order to begin to answer the two research questions, composite Thinking Preference data, generated by the results of The Herrmann Instrument, on each student group by gender, class and age, as well as on each faculty group by instructional section, is presented in the following four major areas listed and described briefly below. Data on the Learning Strategies of each student group is presented in the fifth section.

Primary emphasis in this study was placed on generating data on student Thinking Preference and Learning Strategy characteristics. Pearson-Product Moment Correlation tests were used to ascertain the relationships that Thinking Preference Quadrant Scores, Key Descriptors, Work Elements, Handedness Profiles and Learning Strategies of students had with one another in influencing the overall Thinking Preferences and Learning Strategies of students. A simple Analysis of Variance test was used to ascertain whether there were any significant differences in Left- or Right-oriented Learning Strategy use by students, and a Multivariate Analysis of Variance test was used to see whether there were any significant differences in frequencies of Total Quadrant Scale Scores between and within Freshmen and Senior, Male and Female students and Freshmen and Senior Faculty groups. Chi-Square tests were used to ascertain whether there were any significant differences betweeen student groups that used a Learning Strategy with a different hemispheric orientation than their Thinking Preference orientation. Data was presented in either Table or Graphic form including brief explanations of results.

Part 1 :

Key Left and Right Hemispheric Dominance Descriptors :

Data was generated by having each person select from a list of twenty five adjectives the eight which best described him/her. In addition, from that list of eight, each person selected his/her number one Key Descriptor. Data was presented as averages for comparison purposes. Data indicated whether, on the average, each group of Freshmen and Senior students by gender, class and by age-group, as well as the Nursing Faculty, by instructional section and overall as a group, described him/herself (themselves) as left- or right-mode thinkers.

Part 2 :

Left and Right Hemispheric Dominant Work Elements :

Data was generated by having subjects select from a list of sixteen Work Elements, that are rated on a five point scale, those that represent work done worst of all (1), across the scale to those that represent work done best of all (5). The values displayed are averages of the individual ratings, with minuses signifying the four lowest ratings, and the pluses the four highest. Data indicated whether Freshmen and Seniors by gender, class and by age-group, and Nursing Faculty, by instructional section and overall as a group, preferred left- or right-mode Work Elements in their work.

Part 3 :

Composite Thinking Preference Data: Rank Order of Quadrant Preferences; Overall Quadrant Mean Scale Scores; Graphic Group Profiles :

The Ranking of Quadrant data is depicted in graphic form and indicates the frequencies (%) of people/group that chose one of the Quadrant factors from that Quadrant, either first (most often), second, third or fourth (least often). Total Quadrant Scale Score data is also depicted in graphic form and indicates the Left/Right Quadrant Preference strengths and overall Thinking Preference bias.

Thinking Preference Profiles were generated by summing all information gathered in the Herrmann Instrument for each quadrant, and generating a computer-driven graphic profile from these Quadrant Scale Scores displayed in a visual format. This profile was used to document the Thinking Preferences of each individual student and each student group by gender, class and age-group, as well as for each individual faculty member and faculty group by instructional section. Each Profile Figure indicates the average primary, secondary and tertiary Thinking Preferences of each student and faculty group, and also indicates the degree to which individuals are either Cerebral or Limbic Thinkers.

Part 4 :

Handedness Profiles :

Overall Handedness Strength preference and Hand-writing Position preference was generated for each student by gender, class and age-group, and is depicted in Table form and indicates overall frequencies and percentages of usage for handwriting and handedness strengths.

Part 5 :

Hemispheric Learning Strategies (Methods) Questionnaire :

Data gathered from the student Hemispheric Learning Strategies (Methods) Questionnaire assisted in answering the second part of research question number one (Appendix, Table 18). The questionnaire involved having the student complete the thirty-two randomly arranged, Left- and Right-hemispheric-oriented, researcher generated Hemispheric Learning Strategies (Methods) Survey Questionnaire. Left-and Right-hemispheric-oriented statements were placed in random order on the questionnaire, with the correct orientation key known only to the researcher for calculation purposes.

Respondents were asked to rate each statement according to the following scale: 1=Never Did; 2=Did Rarely; 3=Did Sometimes, but Less Than 50% of the Time; 4=Did 50% of the Time; 5=Did Frequently, more than 50% of the Time; 6=Did Very Frequently, but not Always; and, 7=Always Did. A total of all the Left- and Right-answered statements were tallied, averaged and calculated by percent and analyzed in order to yield a composite overall Hemispheric Learning Strategy profile of either Left, Right or Integrated mode. Analysis of Variance tests were then done to discern whether there were any significant differences in the usage of either Left- or Right-oriented Learning Strategies between or within student groups. Individual statement scores and overall scores for all 16 Left- or Right-oriented statements closer to One (1), indicated a weak bias (strategy least used) for that statement or for all 16 Left- or Right-oriented statements. Scores closer to Seven (7) indicated a strong bias (strategy most used) for that statement or for all Left- or Right-oriented statements. Scores closer to Four (4) indicated a neutral bias for that statement or for all Left- or Right-oriented statements.

Comparisons of students who used a Learning Strategy that was of a different hemispheric orientation than their Thinking Preference orientation was analyzed by Chi-Square tests.

Validity of the Herrmann Instrument

The Herrmann Participant Survey Form had been developed in 1976 and refined over a five year period and validated by Ned Herrmann on more than 4,000 adult individuals from a wide variety of occupational and professional fields. Validation included literature reviews of brain research, as well as applied research and factor analysis from an earlier study of over 400 college students and General Electric Personnel, which was designed to confirm predictions on the relationships between brain dominance measures and measures of cognitive processes, personality types and learning style. As of January, 1986, close to 200,000 participants have completed the Herrmann Brain Dominance Instrument.

The Herrmann Instrument uses preference ratings for adjectives or phrases descriptive of persons and of work and leisure activities. Unlike other Instruments used to assess personality, styles, and so on, this Instrument combines biographical data and self-reports on activites with preference ratings for adjectives and statements. This Instrument has been used extensively for identifying different brain dominance classifications and cognitive and personality styles among management education workshop particpants and other groups (Herrmann, 1981, 1982,(a);(b); Coulson and Strickland, 1983). It has also been used in educational settings to provide teachers with information about learning styles, and thinking and personal preferences of students (Herrmann, 1982, (a);(b); Bush, 1984).

In providing individual reports to each participant group tested, Herrmann (1983) found that the data has helped them to appreciate and value their own profile and that of others who may be different. In demonstrating significant similarities and differences in communication, thinking, and learning, it helped provide the basis for design of whole-brain programs of study.

Studies conducted by WICAT, INC. (Orem, Utah), and the University of Texas at Arlington, Texas, using Electroencephalogram (EEG) techniques produced test data that confirmed not only the specialization of the brain, but also the ability of the Herrmann Instrument to measure brain activity that is directly related to particular individual and group behaviors.

The Herrmann Instrument goes beyond other Left-Right forced-choice questionnaires, taking into account not only the cortical areas of the two cerebral hemispheres, but also the specialized functions and interactions of the subcortical left and right limbic hemispheres with other neural areas. The results of the composite cerebral-limbic scores are meaningful and relevant in depicting those neural areas actively involved and preferred to be used in a variety of learning, thinking and problem solving environments. The Herrmann Brain Dominance Instrument provides a learner or teacher the information about the particular strengths, weaknesses and preferred styles and strategies of learning and communicating of each individual and of the total group.

C H A P T E R IV

RESULTS

Presentation of the Data

To provide a forum for the analysis, comparison and discussion of the Thinking Preferences and the Hemispheric Learning Strategies (Methods) of a limited group of community college students, and the Thinking Preferences of community college Nursing Faculty, the author selected both Freshmen and Senior, Male and Female, Nursing students, as well as the Nursing Faculty that teach each individual group of students, as subjects for this study. These student groups were chosen because of the similarity of entrance and graduation requirements and the relatively equal numbers of students that could be analyzed in both groups. In addition, one-half of the Nursing Faculty taught Freshmen while the other half taught Seniors, setting up a framework for a comparison of the Thinking Preferences between each faculty group and the students they taught, while comparing these results with the Learning Strategies used by both student groups.

In order to answer the research questions, data was compiled on some of the specific parts of the composite Thinking Preference data that related to specific Key

Descriptors, Work Elements and Handedness Preferences that both students and faculty chose as preferences on the Herrmann Instrument. Primary emphasis was placed on the overall composite Thinking Preference profiles that were generated from total Quadrant Scale Scores for all students and faculty that encompassed these parts and other components on the Herrmann Instrument. Hemispheric Learning Strategies (Methods) data of all Nursing students was generated from the results of the Learning Strategies Questionnaire devised by the author, and data on the Thinking Preferences for Nurses in the general population were obtained from personal communication with Ned Herrmann.

Data for overall groups will be analyzed in this chapter, while some specific detailed data by age-groups for students, as well a copy of both Instruments used in this study, will be presented in the appendix (Tables 17-99; Figures 35-54). The composite Thinking Preference data and data on specific parts of the Thinking Preferences of all student Nurses and faculty will be presented by representative Tables and Figures. This data was subject to general and statistical analyses in five major categories: Key Left and Right Hemispheric Dominance Descriptors; Left and Right Hemispheric Dominance Work Elements; Handedness Preference Profiles (students only); Composite Thinking Preference Profiles, Rank Order of Quadrant Preferences, and Quadrant Mean Scale Scores; and, Hemispheric Learning Strategy (Method) Preferences (students only). Since the main emphasis of this study was to survey the Thinking Preference and Learning Strategy characteristics of the students, more detailed analyses were done in those two areas for research question number one with the student-generated data, than with Thinking Preference data derived from the faculty for research question number two.

Since some data are relevant to answering both of the research questions, the same Figures, Tables and data may be used more than once in answering different aspects of the research questions.

The total sample that comprised this study from which different component Thinking Preference parts were analyzed, was made up of 59 Freshmen (51 Female; 8 Male) and 50 Senior (42 Female; 8 Male) community college Nursing students; 12 (6 Freshmen; 6 Senior) community college Nursing Faculty; and, with survey summary data (Grand Mean Quadrant Scores) on 1000 Nurses in the general population. Since some students incorrectly labelled some sections of the Questionnaires, total numbers in some data sections may vary slightly from one another. General distribution of subjects by class and groups is found in Table 1.

Table 1

Distribution of Community College Nursing Student, Faculty and General Nursing Population Groups Surveyed by Class

Group	Class						
	Fr Ms	Fr Fs	Sr Ms	Sr Fs	All Ms	All Fs	All Stdts
20-Und.	-	6	-	3	-	9	9
21-25	1	16	-	12	1	28	29
26-30	4	12	3	11	7	23	30
31-35	1	11	4	10	5	21	26
36-40	2	4	1	3	3	7	10
41-50	-	2	-	2	-	4	4
51+	-	-	-	1	-		1
Totals:	8	51	8	42	16	93	109

Fr. Fac.: 6

Sr. Fac.: 6

Gen. Population of Nurses: 1*

* One set of Four Quadrant Mean Scale Scores for the General Population of Nurses was obtained from Ned Herrmann and represents Grand Mean Scores for 1000 nurses surveyed in the General Population by Ned Herrman.

Research Question #1:

What are the Thinking Preferences and Hemispheric Learning Strategies (Methods) of Freshmen and Senior Associate degree Nursing students, and to what extent are their Thinking Preferences congruent with their Learning Strategies?

Data gathered to answer this question was divided into two sections; the first involved Thinking Preference data, and the second involved Learning Strategies data, both of which made use of Tables, Figures, general and statistical analyses to answer the question.

Thinking Preference Data-Students

This section includes the Key Hemispheric Descriptors, Hemispheric Work Elements, Handedness Profiles, Thinking Preference profiles, Rank Order of Quadrant Preferences and Overall Left/Right Quadrant Mean Scale Scores for Freshmen and Senior, Male and Female Nursing students.

I. Key Left and Right Hemispheric Descriptors-Students

Table 2 presents data on the frequency of Key Left and Right Hemispheric Dominance Descriptor Quadrant choices for Freshmen and Senior, Male and Female, Nursing students. Each individual selected from a list of 25 adjectives the 8 which best described him/her, and then, from that list of 8, selected his/her number one key descriptor that 'best' described themselves.

The discrepancy between the 25 adjectives on the Herrmann Instrument from which the 8 were selected and those shown in the following table was a result of several adjectives being repeated in more than one quadrant. Verbal, reader and intuitive are found in two quadrants, and, therefore, each time an individual selected one of these adjectives, it was coded in both quadrants because each is involved in talking, reading and intuiting. Total frequencies of choice of descriptors within each quadrant for all Nursing students are presented for comparison purposes.

Table 3 presents total frequencies and percentages of 'Overall' Quadrant Key Descriptor choices for Nursing students as displayed on Table 2. Data from Table 3 indicates that collectively, all Freshmen and Senior Students chose Limbic Right Descriptors most often (31.6%), with Limbic Left Descriptors as second choices

Table 2

Frequency of Key Descriptor Choices for All Nursing Students by Overall Groups
N=106
'Overall' Freq.* / 'Best' Freq.+

Key D./Quad.	Groups						
	Fr Ms	Fr Fs	Sr Ms	Sr Fs	All Ms	All Fs	All Stdts
Cerebral Left :							
Analytic	-/-	9/4	1/-	10/1	1/-	19/5	20/5
Logical	5/-	29/5	6/-	29/6	11/-	58/11	69/11
Mathematical	1/-	8/-	-/-	9/-	1/-	17/-	18/-
Rational	4/-	29/3	4/-	25/5	8/1	54/8	62/9
Critical	4/-	12/-	3/-	18/3	7/1	30/3	37/4
Quantitative	-/-	1/-	1/-	1/-	1/-	2/-	3/-
Factual	2/-	8/-	6/-	10/1	8/-	18/1	26/1
Totals:	16/22	96/12	21/0	102/16	37/2	198/28	235/30
Limbic Left :							
Conservative	4/1	23/6	2/1	15/-	6/2	38/6	44/8
Controlled	3/1	20/3	5/1	17/3	8/2	37/6	45/8
Sequential	3/-	9/-	-/-	6/-	3/-	15/-	18/-
Detailed	2/-	14/-	4/-	14/-	6/-	28/-	34/-
Dominant	-/-	11/1	-/-	8/1	-/-	19/2	19/2
Verbal(Art.)	3/-	25/3	6/2	26/2	9/2	51/5	60/7
Reader(Tech.)	5/1	26/4	3/1	24/2	8/2	50/6	58/8
Totals:	20/3	128/17	20/5	110/8	40/8	238/25	278/33
Limbic Right :							
Reader(Pers.)	5/1	26/4	3/1	24/2	8/2	50/6	58/8
Verb.(Talker)	3/-	25/3	6/2	26/2	9/2	51/5	60/7
Intuit.(Feel.)	3/-	23/5	1/-	31/5	4/-	54/10	58/10
Symbolic	1/-	13/-	-/-	8/-	1/-	21/-	22/-
Spiritual	3/1	19/2	1/-	9/1	4/1	28/3	32/4
Musical	2/-	15/1	3/-	6/-	5/-	21/1	26/1
Emotional	5/-	37/5	6/1	27/7	11/1	64/12	75/13
Totals:	22/2	158/20	20/4	131/17	42/6	289/37	331/43
Cerebral Right :							
Spatial	1/-	1/-	-/-	3/-	1/-	4/-	5/-
Simultaneous	1/-	7/-	1/-	9/-	2/-	16/-	18/-
Synthesizer	2/-	5/1	1/-	-/-	3/-	5/1	8/1
Holistic	5/2	23/5	4/-	13/2	9/2	36/7	45/9
Intuit.(Sol).	3/-	23/5	1/-	31/5	4/-	54/10	58/10
Artistic	3/-	11/-	3/1	8/1	6/1	19/1	25/2
Creative	2/-	22/1	4/1	15/1	6/1	37/2	43/3
Totals:	17/2	92/12	14/2	79/9	31/4	171/21	202/25

*Key Descriptors most commonly chosen fo all Descriptors.
+Key Descriptors chosen that 'Best' describes the group.

(26.6%). Virtually all students, except all Freshmen Males, chose Cerebral Left Descriptors as third choices, with Cerebral Right Descriptors chosen last.

To discern whether there were any significant relationships between Key Descriptor Quadrant choices within and between groups, Pearson-Product Moment Correlation Coefficient tests were done and revealed that for All Students collectively, there was a moderately strong negative significant relationship ($r=-.56$; $p<.001$) for Key Descriptor choices between Cerebral Left and Limbic Right Quadrants, between Cerebral Left and Cerebral Right Quadrants ($r=-.58$; $p<.001$), and a less strong negative relationship between Limbic Left and Cerebral Right Quadrants ($r=-.38$; $p<.001$).

There were no significant relationships at the .01 or .001 significance level between Key Descriptor choices for Freshmen or Senior Males. For Freshmen Females, there was a fairly strong negative significant relationship of Key Descriptor choices between Cerebral Left and Limbic Right Quadrants ($r=-.61$; $p<.001$), between Cerebral Left and Cerebral Right Quadrants ($r=-.51$; $p<.001$), and a less strong relationship between Limbic Left and Cerebral Right Quadrants ($r=-.44$; $p<.001$). For Senior Females, there was a fairly strong negative significant relationship of Key Descriptor choices between Cerebral

Left and Limbic Right Quadrants (r=-.55; p<.001), and between Cerebral Left and Cerebral Right Quadrants (r=-.69; p<.001).

Altogether, Key Descriptor choices by Quadrants varied more with Female students than with Males, with definite differences in frequency of choice between Left and Right Key Descriptors. More detailed tables of student Key Descriptor choices and analyses by overall and age-groups are found in the appendix (Tables 19-38).

Table 3

Frequency of Key Descriptor Quadrant Preference for 'Overall' Choices+ for All Freshmen and Senior Students N=106

		Quadrants			
Groups	N	CL/%	LL/%	LR/%	CR/%
All Fr. Ms	8	16/21	20/27	22/29	17/23
All Fr. Fs	51	96/20.3	128/27	158/33.3	92/19.4
All Sr. Ms	6	21/28	20/26.6	20/26.6	14/18.8
All Sr. Fs	41	102/24	110/26	131/31	79/19
All Ms	14	37/24.7	40/26.7	42/28	31/20.6
All Fs	92	198/22	238/27	289/32	171/19
All Stdts	106	235/22.5	278/26.6	331/31.6	202/19.3

+Key Descriptors most commonly chosen of all Descriptors.

II. Left and Right Hemispheric Work Elements-Students

Table 4 presents data on Left and Right Hemispheric Dominance Work Elements of Freshmen and Senior, Male and Female, Nursing students, rated on a five point scale, with one (1) representing work done worst of all, and five (5) representing work done best of all. Values shown are averages of the individual ratings, with pluses (+) signifying the four highest ratings, and minuses (-) signifying the four lowest ratings.

Data from Table 4 indicates that all Freshmen and Senior students as a group chose Limbic Left and Limbic Right Work Elements as the ones that best described their work preferences, with the Cerebral Right their third choice, and the Cerebral Left the least chosen Work Elements. Students most preferred organization and planning in the Limbic Left, and writing and expressing ideas in the Limbic Right Quadrants. They least preferred analytical, technical and financial aspects of the Cerebral Left, and administrative aspects of the Limbic Left Quadrants.

To discern whether there were any significant relationships between Work Element choices within and between groups, Work Element means for each group were analyzed by Pearson-Product Moment Correlation tests. The results revealed that there were no significant

Table 4

Left and Right Hemispheric Work Element Choices of All Students*
N=104

Quadrants/ Elements	Groups						
	All Fr. Ms	All Fr. Fs	All Sr. Ms	All Sr. Fs	All Ms	All Fs	All Ss
N:	8	50	6	40	14	90	104
Cerebral Left:							
Analytical	3.3	2.9-	2.5-	3.0-	3.0	2.9-	3.0-
Technical Aspects	2.8-	2.7	2.8-	3.0-	2.9-	2.8-	2.9-
Problem Solving	3.1	3.6	3.9+	3.4	3.5	3.5	3.5
Financial Aspects	2.4-	3.0	2.6-	2.6-	2.8-	2.5-	2.7-
Limbic Left:							
Organization	3.8+	4.0+	3.1	4.1+	4.0+	3.4	3.7+
Planning	2.9-	3.9+	3.9+	3.9+	3.9+	3.4	3.7+
Administrative	2.3-	2.7-	4.0+	2.8-	2.8-	3.1	3.0-
Implementation	3.3	3.4	3.9+	3.6	3.5	3.6+	3.6
Limbic Right:							
Teaching/ Training	3.0	3.5	3.0-	3.7+	3.6+	3.0-	3.3
Writing	4.3+	3.5	3.6	3.3	3.4	3.9+	3.7+
Expressing Ideas	3.8+	3.7+	4.1+	3.6	3.6+	3.9+	3.8+
Interpersonal Aspects	3.4	3.7+	3.8	4.1+	3.8+	3.6+	3.7
Cerebral Right:							
Integration	3.6+	3.0	2.8-	3.1	3.0	3.2	3.1
Conceptualizing	3.6+	3.3	3.1	3.2	3.3	3.4	3.4
Creative Aspects	3.6+	3.7+	4.1+	2.7-	3.2	3.7+	3.5
Innovating	3.1	2.8-	3.3	3.0-	2.9-	3.2	3.1

* A rating of one (1) represented work done worst of all and a five (5) represented work done best of all. The values shown are averages of the individual ratings. The pluses (+) signify the four highest ratings; the minuses (-) the four lowest.

relationships at the .01 or .001 significance levels between Work Element Quadrant choices for Freshmen Males, but there was a very strong negative significant relationship of Work Elements for Senior Males between the Limbic Left and Cerebral Right Quadrants ($r=-.90$; $p<.01$).

For Freshmen Females, there was a small significant negative relationship between the Cerebral Left and Limbic Right Work Element choices ($r=-.38$; $p<.01$)), whereas, for Senior Females, there was a small significant negative relationship between the Cerebral Left and Limbic Right Quadrants ($r=-.43$; $p<.01$), as well as between the Limbic Left and Cerebral Right Quadrants ($r=-.41$; $p<.01$).

Altogether, Work Element choices by Quadrants varied more with Females than with Males, with most differences between the Cerebral Left and Limbic Right Quadrants, and between the Limbic Left and Cerebral Right Quadrants. Detailed tables and analyses of student Work Element choices by overall and age-groups are found in the appendix (Tables 39-42).

III. Handedness Profiles

Collectively, the data on Table 5 indicates that 89.8% of all students were Right-handed, with 88% using a Right-Straight handwriting position, while 9.2% were Left-handed, with 6.4% using a Left-Straight position. Of All Students surveyed, 2.8% used either a Left- or Right-Inverted Handwriting Position, and only 1% used both hands equally.

To discern whether there were any significant relationships within and between student groups for Handwriting Strength and Position, the data was analyzed by Product Moment Correlation tests. The results revealed that for Freshmen Males, there was a very close positive relationship between Handwriting Strength and Position ($r=.94$; $p<.001$), with no significant relationships for Handedness factors for Senior Males.

For Freshmen Females, there was a very strong positive relationship between Handwriting Strength and Position ($r=.76$; $p<.001$), and for Senior Females, there was a moderately-strong positive relationship between these two Handedness factors ($r=.64$; $p<.001$).

Altogether, data for All Students considered as a group, showed a moderately-strong positive relationship between Handedness factors ($r=.69$; $p<.001$). Detailed accounts and analyses of student Handedness profiles by

Table 5

Handedness Profiles for All Students-Frequency of Handedness Choices
N=109

Strength and Direction of Handedness **
Ways of Holding a Pencil-Handwriting Position **

Group	N	P-L	L-I	PL-SR	L-S	Both=	R-S	PR-SL	R-I	P-R
All Fr. Ms	8	0	1	1	0	0	7	2	0	5
All Fr. Fs	51	3	2	3	3	0	45	15	1	30
All Sr. Ms	8	0	0	0	0	0	7	5	1	3
All Sr. Fs	42	1	0	2	4	1	37	17	1	21
All Ms	16	0	1	1	0	0	14	7	1	8
All Fs	93	4	2	5	7	1	81	32	2	51
All Fresh.	59	3	3	4	3	0	52	17	1	35
All Srs.	50	1	0	2	4	1	44	22	2	24
All Stdts	109	4	3	6	7	1	96	39	3	59
Strength -%:		3.7		5.5		1.0		35.7		54.1
Position -%:			2.8		6.4		88.0		2.8	

-Overall L-Bias- | -Overall R-Bias-

** Abbreviations :

Strength :
PL=Primary Left; PL-SR=Primary Left-Some Right;
PR-SL=Primary Right-Some Left; PR=Primary Right;

Position :
L-I=Left Inverted; L-S=Left Straight;
R-S=Right Straight; R-I=Right Inverted

overall and age-groups are found in the appendix (Tables 43-46).

Thinking Preference Data-Students

This section includes data on the overall Thinking Preferences via graphic Profiles, based on Total Quadrant Scale Scores; Rank Order of Quadrant Preferences, that indicate what percent of each group chose a particular Quadrant in a particular order; and, Overall Left/Right Quadrant Mean Scale Scores for all nursing students, depicting individual Quadrant scores and overall Left/Right Thinking Preferences.

Data will be presented as Figures (Graphic Profiles; graphs) with brief general and statistical analyses and discussions for each group. More detailed accounts and analyses by age-groups are found in the appendix (Figures 35-54).

Freshmen Males and Females

Freshmen Males

To discern whether there were any significant relationships between each of the individual Left/Right Quadrant Scale Scores for Freshmen Males or Females, Quadrant scores for Freshmen Males and Females were analyzed separately by Product Moment Correlation tests.

For Freshmen Males, there was a significantly strong positive relationship between Cerebral Left and Limbic Left Quadrants ($r=.89$; $p<.01$). In analyzing the relationship of overall Left/Right total scores to individual Quadrant scores, it was found that Freshmen Males had a very strong significant positive relationship between Left-combined Quadrant scores and the Cerebral Left ($r=.96$; $p<.001$) and Limbic Left ($r=.98$; $p<.001$) Quadrants, while having a very strong significant negative relationship between Right-combined Quadrant scores and the Cerebral Left ($r=-.91$; $p<.001$) and Limbic Left ($r=-.93$; $p<.001$) Quadrants.

Data from Figures 6 and 7 indicate that 37.5% of Freshmen Males chose Left, and 62.5% chose Right Thinking Preference factors. Freshmen Males chose both the Limbic Right and Cerebral Right Quadrants the most, and chose the Cerebral Left Quadrant the least. Overall, Left/Right

Figure 6

Rank Order of Left/Right Quadrant Preferences

All Freshmen Males (N=8): ___
All Freshmen Females (N=51): ---

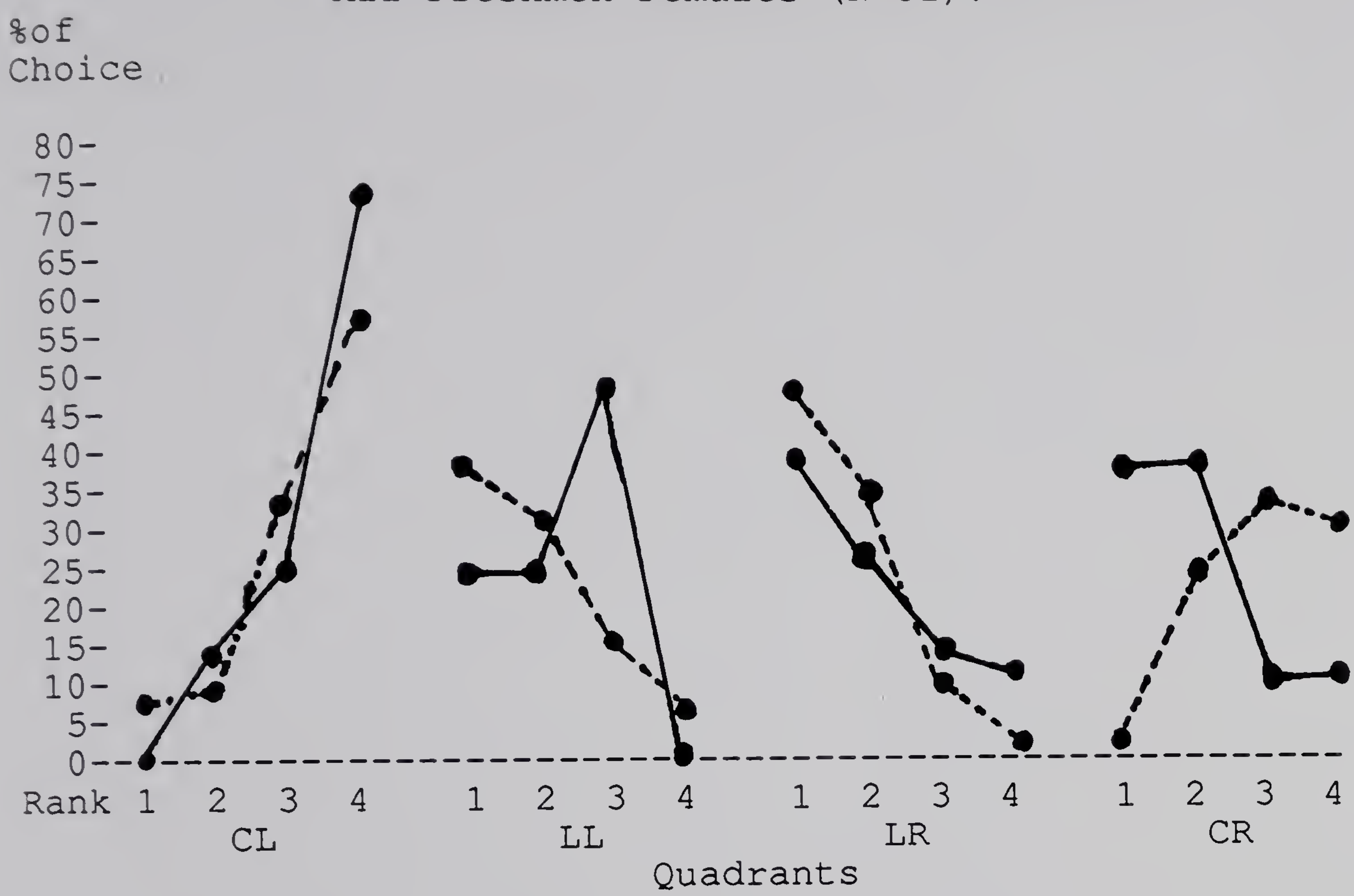
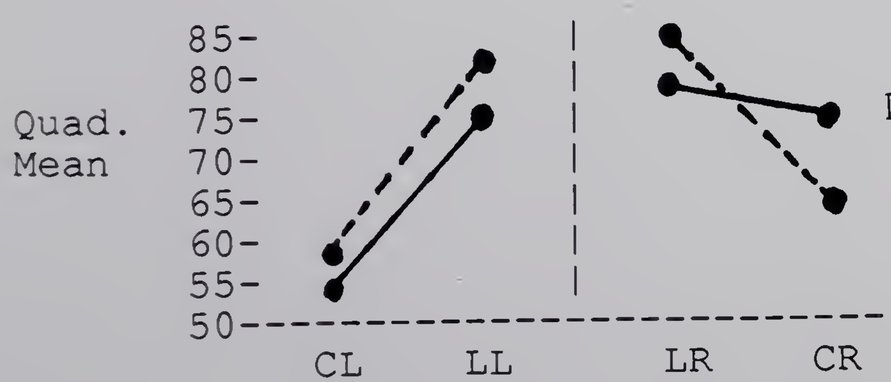


Figure 7

Overall Left/Right Quadrant Mean Scale Scores
All Freshman Males (N=8): ___
All Freshman Females (N=51): ---



L/R Totals:
Ms: L=128.7 Fs: L=138.4
R=256.3 R=151.7

L/R Frequency:
Ms: L=3(37.5%) Fs: L=21 (41.1%)
R=5(62.5%) R=30 (58.9%)

Overall TPREF=
Ms: Right
Fs: Right

Thinking Preference Totals indicated that Freshmen Males had an overall Right Thinking Preference bias.

Total Quadrant Scale Scores/Quadrant produced a composite Thinking Preference Profile of 2:1:1:1, as depicted in Figure 8, which indicates primary Thinking Preference strengths in the Limbic Left, Limbic Right and Cerebral Right Quadrants.

There was a strong significant positive relationship between overall Left-oriented Thinking Preferences and Limbic Left Key Descriptors ($r=.83$; $p<.01$), and Cerebral Left Work Elements ($r=.83$; $p<.01$), but a strong significant negative relationship between overall Right-oriented Thinking Preferences and Limbic Left Key Descriptors ($r=-.80$; $p<.01$).

For Freshmen Males, there were no significant relationships between Handwriting Position or Handedness Strength and overall Left- or Right-oriented Thinking Preferences, Learning Strategies, Key Descriptors or Work Elements.

<u>Freshmen Females</u>

For Freshmen Females, there was a strong significant negative relationship between the Cerebral Left and Limbic Right ($r=-.72$; $p<.001$) Quadrants, and a moderate negative relationship between the Cerebral Left and

Cerebral Right ($r=-.35$; $p<.01$) Quadrants, between the Limbic Left and Limbic Right ($r=-.36$; $p<.01$) Quadrants, and between the Limbic Left and Cerebral Right ($r=-.59$; $p<.001$) Quadrants.

Freshmen Females had fairly strong significant negative relationships between the overall Left-combined Quadrant scores and the Limbic Right ($r=-.78$; $p<.001$) and Cerebral Right ($r=-.65$; $p<.001$) Quadrants, and between the overall Right-combined Quadrant scores and the Cerebral Left ($r=-.70$; $p<.001$) and Limbic Left ($r=-.58$; $p<.001$) Quadrants.

Freshmen Females, on the other hand, had a fairly strong positive relationship between the overall Left-combined Quadrant scores and the Cerebral Left ($r=.76$; $p<.001$) and Limbic Left ($r=.65$; $p<.001$) Quadrants, and between the overall Right-combined Quadrant scores and the Limbic Right ($r=.84$; $p<.001$) and Cerebral Right ($r=.74$; $p<.001$) Quadrants.

Data from Figures 6 and 7 indicate that 41.1% chose Left and 58.9% chose Right Thinking Preference factors. Freshmen Females chose the Limbic Right quadrant the most, with the Limbic Left as second choice, and the Cerebral Left as the least chosen Quadrant. Overall, Left/Right Thinking Preference totals indicated that Freshmen Females had an overall Right Thinking Preference bias.

Total Quadrant Scale Scores/Quadrant produced a composite Thinking Preference profile of 2:1:1:2, as depicted in Figure 9, which indicates primary Thinking Preference strengths in the Limbic Left and Limbic Right Quadrants.

There were significant positive relationships between overall Left-oriented Thinking Preferences and Cerebral Left ($r=.64$; $p<.001$) and Limbic Left ($r=.36$; $p<.01$) Key Descriptors, and between Cerebral Left ($r=.47$; $p<.001$) and Limbic Left ($r=.48$; $p<.001$) Work Elements. There were also significant positive relationships between overall Right-oriented Thinking Preferences and Limbic Right ($r=.73$; $p<.001$) and Cerebral Right ($r=.68$; $p<.001$) Key Descriptors and between Limbic Right ($r=.38$; $p<.01$) Work Elements.

There were significant negative relationships between overall Left-oriented Thinking Preferences and Limbic Right ($-.68$; $p<.001$) and Cerebral Right ($r=-.58$; $p<.001$) Key Descriptors, and between Limbic Right ($r=-.35$; $p<.01$) Work Elements. There were also significant negative relationships between overall Right-oriented Thinking Preferences and Cerebral Left ($r=-.61$; $p<.001$) and Limbic Left ($r=-.37$; $p<.01$) Key Descriptors.

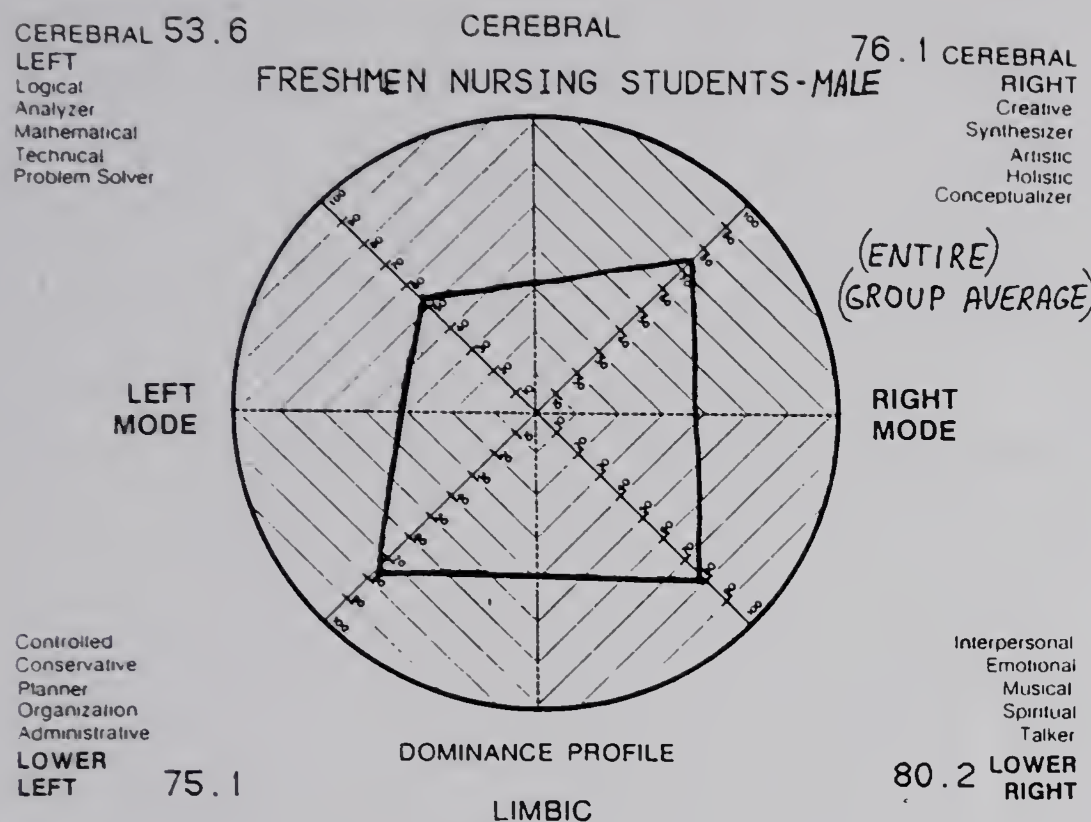


Figure 8
All Freshmen Males Profile

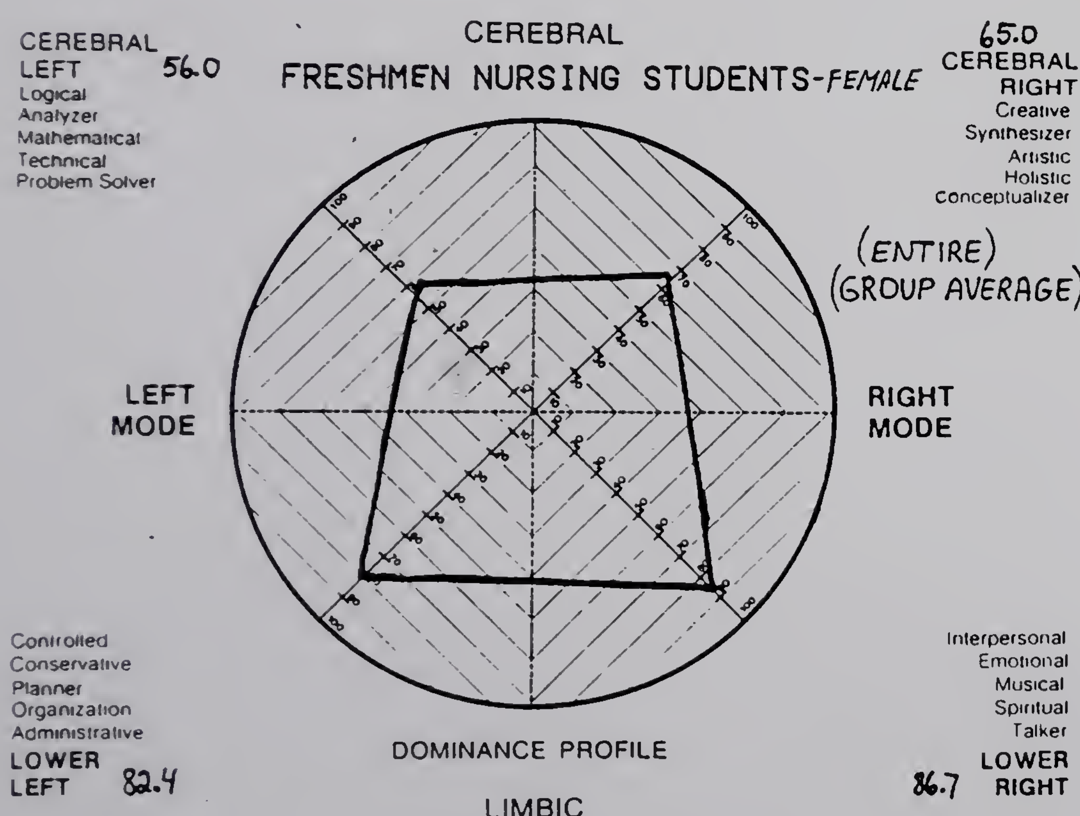


Figure 9
All Freshmen Females Profile

Figure 8

Thinking Preference Profile

All Freshmen Males-21-40
N=8

Group Average Profile 2-1-1-1

This is a multi-dominant group average profile with primaries in the Cerebral Right, Limbic Right and Limbic Left quadrants. This profile is characterized by strong preferences in the creative, synthesizing, artistic, holistic and conceptual modes of the Cerebral Right quadrant, as well as strong preferences in the interpersonal, emotional, musical and spiritual modes of the Limbic Right quadrant. The third primary in this profile is in the safe-keeping Limbic Left quadrant with contrasting preferences in the area of planning, organizing and administrative capabilities.

This profile is also characterized by a relatively low preference in the Cerebral Left quadrant dealing with logical, analytic and mathematical processing. People with this profile would exhibit strong interpersonal and emotional characteristics, but would also experience a duality between a more experimental Cerebral Right mode and a contrasting safe-keeping Limbic Left mode.

Figure 9

Thinking Preference Profile

All Freshmen Females
N=51

Group Average Profile 2-1-1-2

This profile yields a double primary in the limbic area. It is a mirror image reversal of profile 1-2-2-1, which has a double primary in the cerebral area. This profile, 2-1-1-2, is characterized by very strong (primary) preferences in the Limbic Left and Right Quadrants. Primary preferences in the Limbic Left quadrant focus on conservative thinking and controlled behavior with a desire for organization and structure and a preference for detail and accuracy. Persons with a preference in this quadrant tend to be perfectionists.

This profile would also feature an equal preference in the Limbic Right quadrant, which would be characterized by emotional and interpersonal processing coupled with an interest in music and a sense of sprituality. Persons with preferences in this quadrant would also tend to be intuitive with respect to their feelings. The combination of the two primaries in the Limbic quadrants would represent a duality for the person to resolve within themselves, and would involve the opposing qualities of control, structure and dominance compared with the emotional qualities associated with interpersonal interaction, musical, spiritual interests and intuitive feelings.

Another important characteristic of this limbic-oriented profile is the clear secondary preferences in the cerebral area, both in the left mode and the right mode. This indicates that logical, analytic processing is a secondary rather than a primary preference, and that holistic, conceptual, integrative thinking is similarly secondary rather than primary. The two primaries involved in this profile could be described as safe-keeping on one hand and emotional on the other.

There was a significant positive relationship between Handwriting Position and Cerebral Right Work Elements ($r=.35$; $p<.01$), but there were no other significant relationships between Handedness factors and Thinking Preferences, Learning Strategies and Key Descriptors.

A Multivariate Analysis of Variance test revealed that for the interaction of gender with class, there were no significant differences in Total Quadrant Mean Scale Scores between and within Freshmen Male and Female groups.

Senior Males and Females

Senior Males

To discern whether there were any significant relationships between each of the individual Left/Right Quadrant Scale Scores for Senior Males or Females, Quadrant scores for Senior Males and Females were analyzed separately by Product Moment Correlation tests.

For Senior Males, there was a very strong significant negative relationship between Cerebral Left and Cerebral Right Quadrants ($r=-.95$; $p<.01$). In analyzing the relationship of overall Left/Right total scores to individual Quadrant scores, it was found that there were no significant positive or negative relationships between Left- or Right-combined Quadrant scores and any of the Quadrants.

Data from Figures 10 and 11 indicate that 50.0% of Senior Males chose Left, and 50.0% chose Right Thinking Preference factors. Senior Males chose the Limbic Right Quadrant as first choice, the Limbic Right and Cerebral Right as second choices, the Cerebral Left Quadrant as third choice, and with both the Cerebral Left and Right Quadrants chosen last. Overall, Left/Right Thinking Preference Totals indicated that Senior Males had an overall Right Thinking Preference bias.

Figure 10

Rank Order of Left/Right Quadrant Preferences

All Senior Males (N=6): ____
All Senior Females (N=41): ----

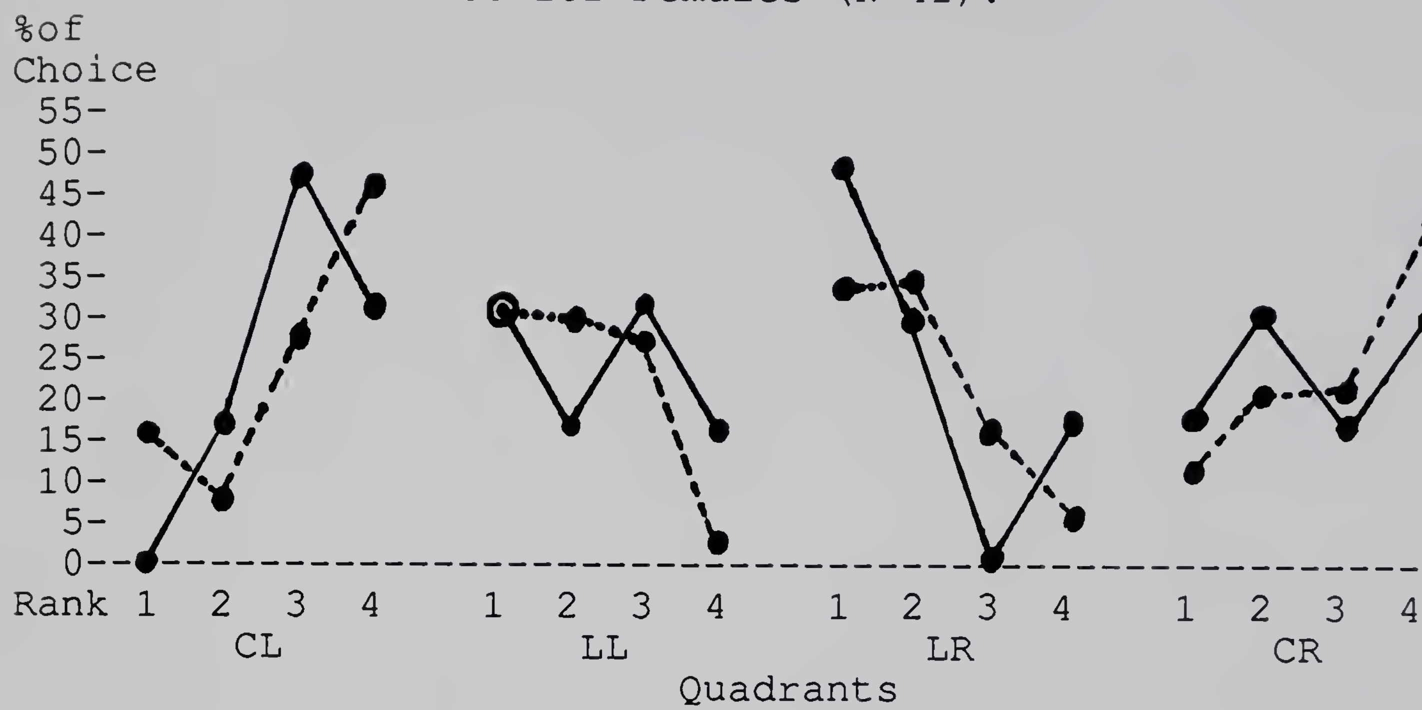
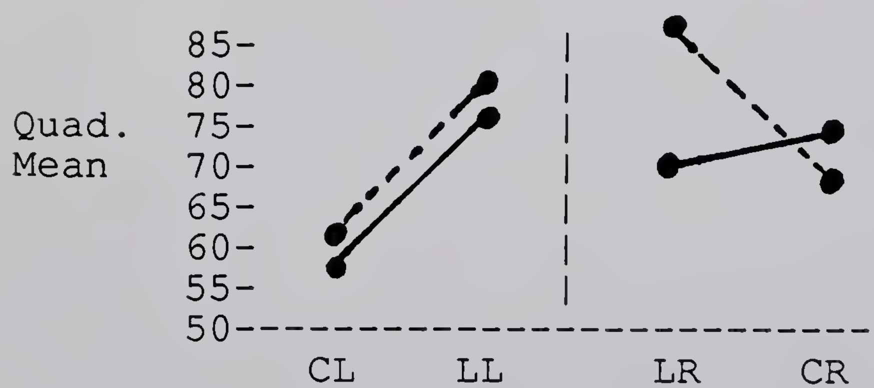


Figure 11

Overall Left/Right Quadrant Mean Scale Scores
All Senior Males (N=6): ____
All Senior Females (N=41): ---

L/R Totals:
Ms:L=137.1 Fs:L=150.7
R=146.1 R=154.9



L/R Frequency:
Ms:L=3(50.0%) Fs:L=20 (48.8%)
R=3(50.0%) R=21 (51.2%)

Overall TPREF=
Ms: Right
Fs: Right

There were no significant positive or negative relationships between overall Left- or Right-oriented Thinking Preferences and either Key Descriptors or Work Elements.

There was a significant strong positive relationship between Handwriting Position and Cerebral Right ($r=.91$; $p<.01$) Key Descriptors, but there were no other positive or negative relationships between Handedness factors and Thinking Preferences, Learning Strategies or Work Elements.

Total Quadrant Scale Scores/Quadrant produced a composite Thinking Preference Profile of 2:1:1:1, as depicted in Figure 12, which indicates primary Thinking Preference strengths in the Limbic Left, Limbic Right and Cerebral Right Quadrants.

<u>Senior Females</u>

For Senior Females, there was a strong significant negative relationship between the Cerebral Left and Limbic Right ($r=-.74$; $p<.001$) Quadrants, and a moderate significant negative relationship between the Cerebral Left and Cerebral Right ($r=-.59$; $p<.001$) Quadrants, and between the Limbic Left and Cerebral Right ($r=-.37$; $p<.01$) Quadrants.

Senior Females had fairly strong significant

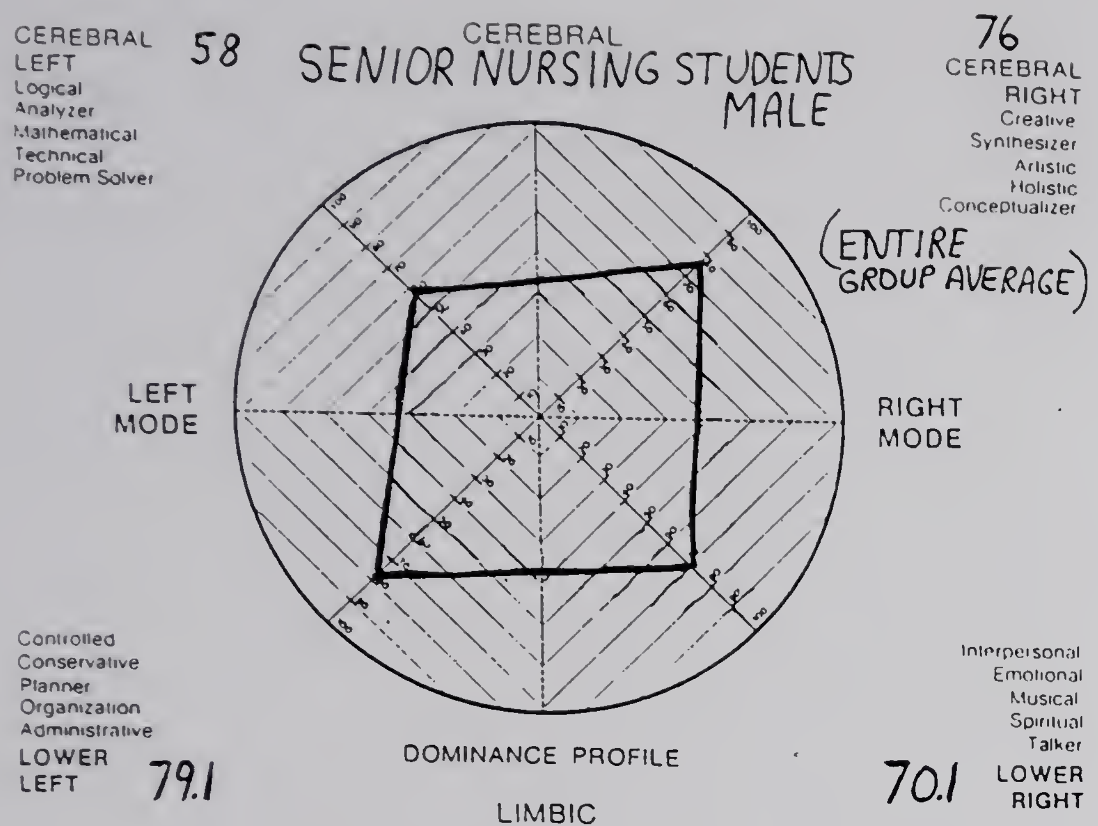


Figure 12
All Senior Males Profile

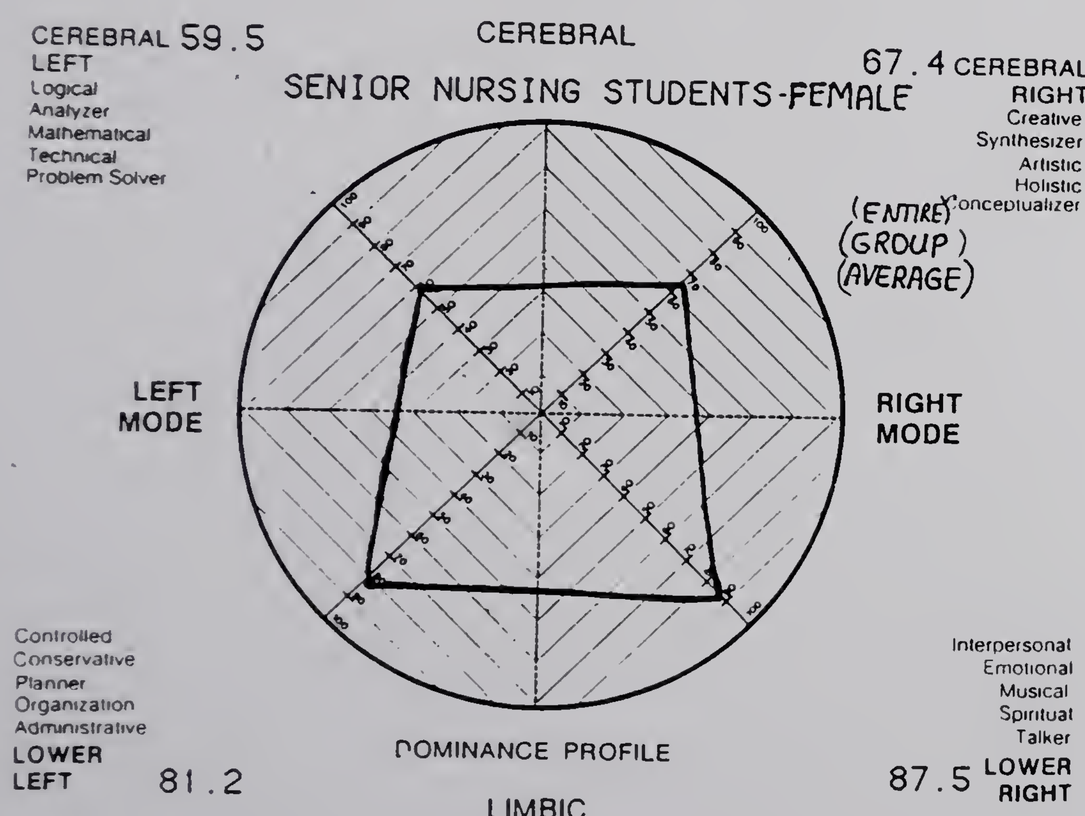


Figure 13
All Senior Females Profile

Figure 12

Thinking Preference Profile

All Senior Males-26-40
N=7

Group Average Profile 2-1-1-1

This multi-dominant group average profile yields primaries in the Cerebral Right, Limbic Right and Limbic Left quadrants. This profile is charaterized by strong preferences in the creative, synthesizing, artistic, holistic and conceptual modes of the Cerebral Right quadrant, as well as strong preferences in the interpersonal, emotional, musical and spiritual modes of the Limbic Right quadrant. The third primary in this profile is in the safe-keeping Limbic Left quadrant with contrasting preferences in the area of planning, organizing and administrative capabilities.

This profile is also characterized by a relatively low preference in the Cerebral Left quadrant dealing with logical, analytic and mathematical processing. People with this profile would exhibit strong interpersonal and emotional characteristics, but would also experience a duality between a more experimental Cerebral Right mode and a contrasting safe-keeping Limbic Left mode.

Figure 13

Thinking Preference Profile

All Senior Females-20-and-Under-51+
N=42

Group Average Profile 2-1-1-2

This group average profile yields a double primary in the limbic area. It is a mirror image reversal of profile 1-2-2-1, which has a double primary in the cerebral area. This profile, 2-1-1-2, is characterized by very strong (primary) preferences in the Limbic Left and Right Quadrants. Primary preferences in the Limbic Left quadrant focus on conservative thinking and controlled behavior with a desire for organization and structure and a preference for detail and accuracy. Persons with a preference in this quadrant tend to be perfectionists.

This profile would also feature an equal preference in the Limbic Right quadrant, which would be characterized by emotional and interpersonal processing coupled with an interest in music and a sense of sprituality. Persons with preferences in this quadrant would also tend to be intuitive with respect to their feelings. The combination of the two primaries in the Limbic quadrants would represent a duality for the person to resolve within themselves, and would involve the opposing qualities of control, structure and dominance compared with the emotional qualities associated with interpersonal interaction, musical, spiritual interests and intuitive feelings.

Another important characteristic of this limbic-oriented profile is the clear secondary preferences in the cerebral area, both in the left mode and the right mode. This indicates that logical, analytic processing is a secondary rather than a primary preference, and that holistic, conceptual, integrative thinking is similarly secondary rather than primary. The two primaries involved in this profile could be described as safe-keeping on one hand and emotional on the other.

negative relationships between the overall Left-combined Quadrant scores and the Limbic Right ($r=-.73$; $p<.001$) and Cerebral Right ($r=-.70$; $p<.001$) Quadrants, and between the overall Right-combined Quadrant scores and the Cerebral Left ($r=-.84$; $p<.001$) and Limbic Left ($r=-.36$; $p<.001$) Quadrants.

Senior Females, on the other hand, had a fairly strong significant positive relationship between the overall Left-combined Quadrant scores and the Cerebral Left ($r=.83$; $p<.001$) and Limbic Left ($r=.55$; $p<.001$) Quadrants, and between the overall Right-combined Quadrant scores and the Limbic Right ($r=.78$; $p<.001$) and Cerebral Right ($r=.81$; $p<.001$) Quadrants.

Data from Figures 10 and 11 indicate that 48.8% chose Left and 51.2% chose Right Thinking Preference factors. Senior Females chose the Limbic Right Quadrant the most, with the Limbic as also second choice, and the Cerebral Left (and almost the Cerebral Right) as the least chosen Quadrant. Overall, Left/Right Thinking Preference totals indicated that Senior Females had an overall Right Thinking Preference bias.

There were significant positive relationships between overall Left-oriented Thinking Preferences and Cerebral Left ($r=.63$; $p<.001$) Key Descriptors, and between Cerebral Left ($r=.53$; $p<.001$) and Limbic Left (r=.51; p<.001) Work Elements. There were also significant positive relationships between overall Right-oriented Thinking Preferences and Limbic Right (r=.68; p<.001) and Cerebral Right (r=.71; p<.001) Key Descriptors, and between Cerebral Right (r=.65; p<.001) Work Elements.

There were significant negative relationships between overall Left-oriented Thinking Preferences and Limbic Right (r=-.55; p<.001) and Cerebral Right (r=-.60; p<.001) Key Descriptors, and between Limbic Right (r=-.45; p<.01) and Cerebral Right (r=-.60; p<.001) Work Elements. There were also significant negative relationships between overall Right-oriented Thinking Preferences and Cerebral Left (r=-.73; p<.001) Key Descriptors, and between Cerebral Left (r=-.50; p<.001) and Limbic Left (r=-.38; p<.01) Work Elements.

There were no significant positive or negative relationships between Handedness factors and Thinking Preferences, Learning Strategies, Key Descriptors or Work Elements.

Total Quadrant Scale Scores/Quadrant produced a composite Thinking Preference profile of 2:1:1:2, as depicted in Figure 13, which indicates primary Thinking Preference strengths in the Limbic Left and Limbic Right Quadrants.

A Multivariate Analysis of Variance test revealed that for the interaction of gender with class, there were no significant differences in Total Quadrant Mean Scale Scores between and within Senior Male and Female groups.

All Males and All Females

Data from Figures 14 and 15 indicate that the overall Right-Thinking preference of All Males, collectively, was due to a high preference for Limbic Right and Cerebral Right Thinking Preference factor choices, with the Limbic Right being chosen most often, the Cerebral Right Quadrant as second choice, and the Cerebral Left as the least chosen Quadrant.

Quadrant Scale scores produced a 2:1:1:1 Thinking Preference profile, as depicted in Figure 16, with primaries in the Limbic Left, Limbic Right and Cerebral Right Quadrants. The simliarity of the two Male groups were analyzed by a Multivariate Analysis of Variance test which revealed that there were no significant differences in Total Quadrant Mean Scale Scores between and within Freshmen and Senior Male groups.

Data from Figures 14 and 15 indicate that the overall Right-Thinking Preference of All Females, collectively, was due to a slightly stronger preference for Limbic Right and Cerebral Right Thinking Preference factor choices than the Cerebral Left and Limbic Left factors, with the Limbic Right being chosen most often and as a second choice, and the Cerebral Left being the least chosen Quadrant.

Figure 14

Rank Order of Left/Right Quadrant Preferences

All Males (N=14): ___
All Females (N=92): ---

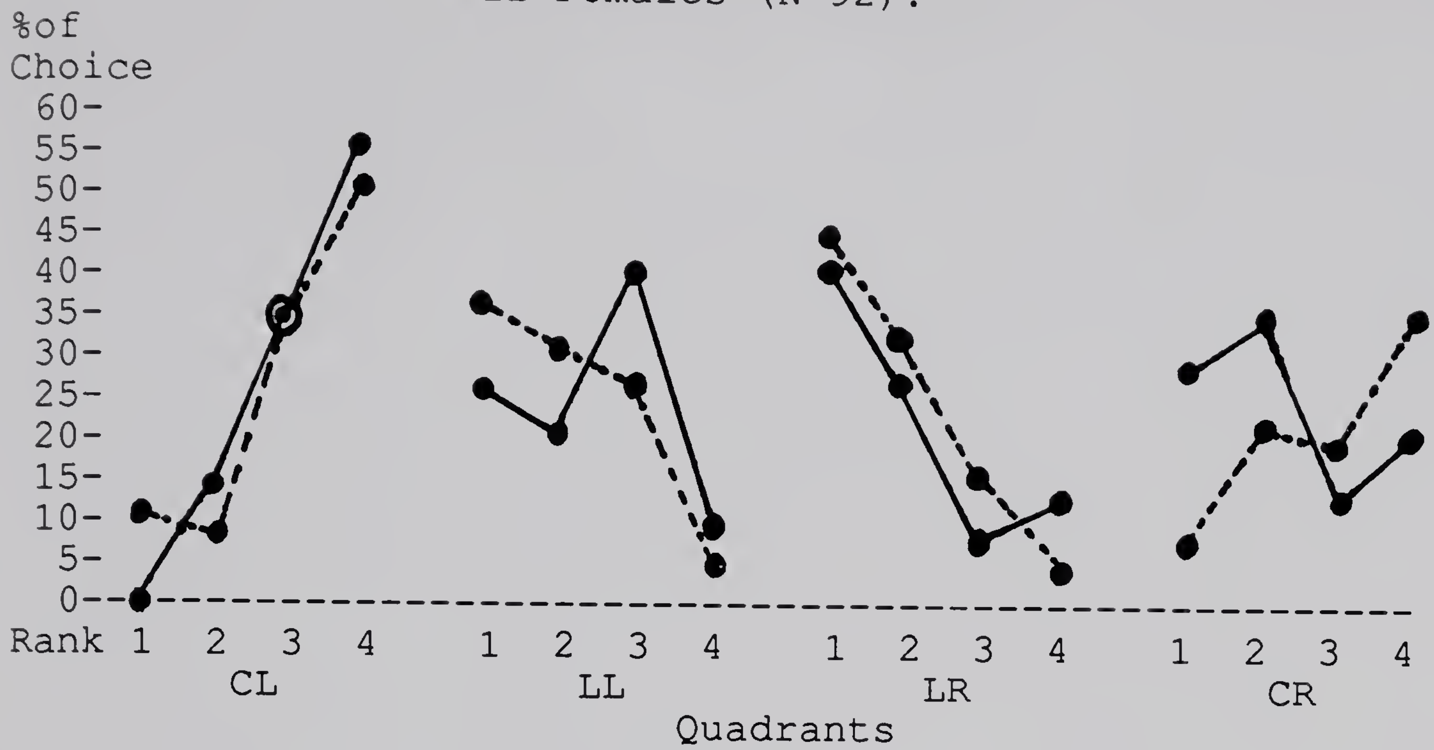
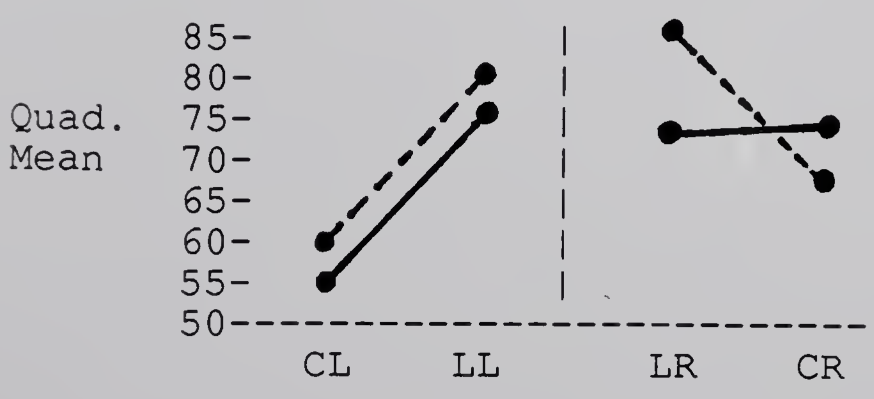


Figure 15

Overall Left/Right Quadrant Mean Scale Scores
All Males (N=14): ___
All Females (N=92): ---



L/R Totals:
Ms:L=132.9 Fs:L=139.6
R=151.3 R=153.3

L/R Frequency:
Ms:L=6(42.9%) Fs:L=41 (44.6%)
R=8(57.1%) R=51 (55.4%)

Overall TPREF=
All Ms: Right
All Fs: Right

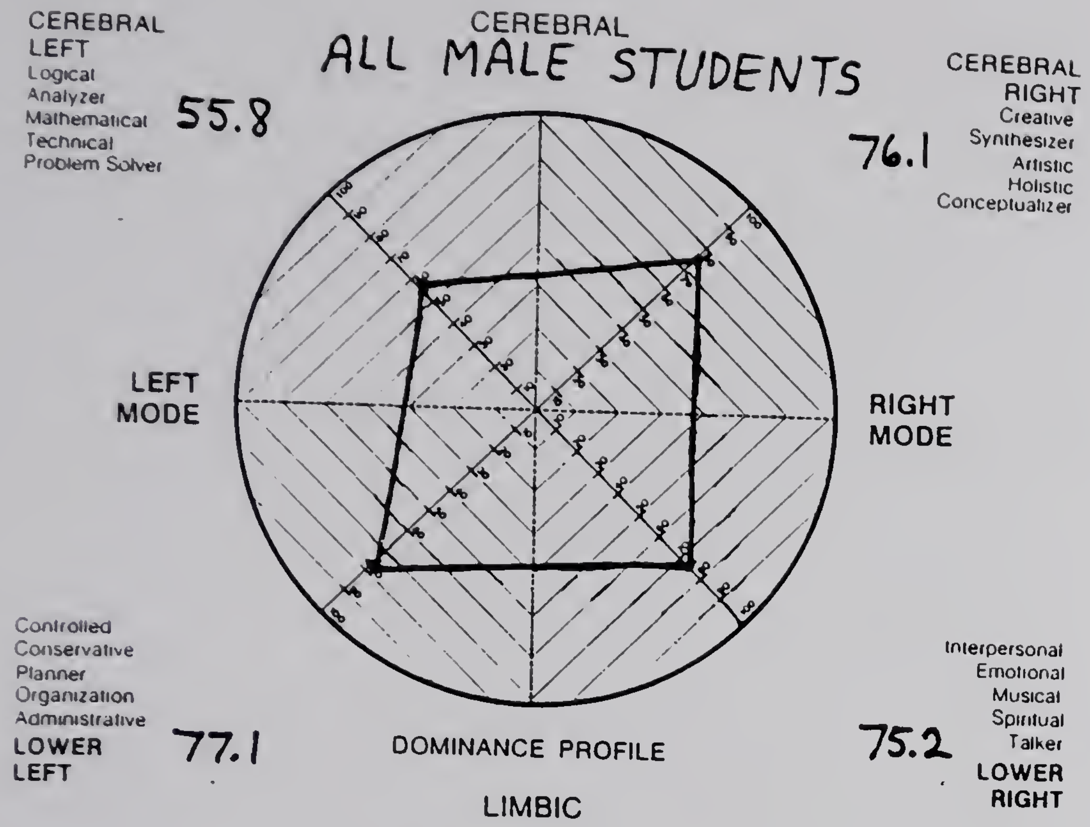


Figure 16
All Males Profile

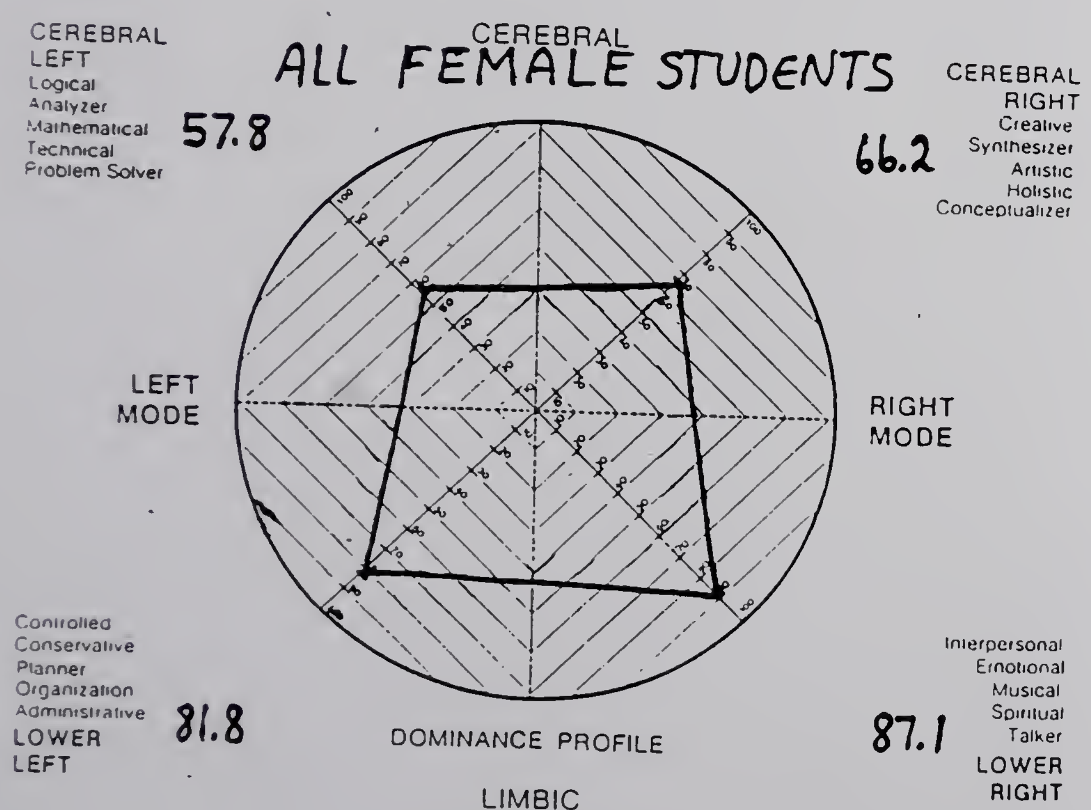


Figure 17
All Females Profile

Figure 16

Thinking Preference Profile

All Males-21-40
N=14

Group Average Profile 2-1-1-1

This is a multi-dominant group average profile with primaries in the Cerebral Right, Limbic Right and Limbic Left quadrants. This profile is characterized by strong preferences in the creative, synthesizing, artistic, holistic and conceptual modes of the Cerebral Right quadrant, as well as strong preferences in the interpersonal, emotional, musical and spiritual modes of the Limbic Right quadrant. The third primary in this profile is in the safe-keeping Limbic Left quadrant with contrasting preferences in the area of planning, organizing and administrative capabilities.

This profile is also characterized by a relatively low preference in the Cerebral Left quadrant dealing with logical, analytic and mathematical processing. People with this profile would exhibit strong interpersonal and emotional characteristics, but would also experience a duality between a more experimental Cerebral Right mode and a contrasting safe-keeping Limbic Left mode.

Figure 17

Thinking Preference Profile

All Females-20-and-Under-51+
N=92

Group Average Profile 2-1-1-2

This profile yields a double primary in the limbic area. It is a mirror image reversal of profile 1-2-2-1, which has a double primary in the cerebral area. This profile, 2-1-1-2, is characterized by very strong (primary) preferences in the Limbic Left and Right Quadrants. Primary preferences in the Limbic Left quadrant focus on conservative thinking and controlled behavior with a desire for organization and structure and a preference for detail and accuracy. Persons with a preference in this quadrant tend to be perfectionists.

This profile would also feature an equal preference in the Limbic Right quadrant, which would be characterized by emotional and interpersonal processing coupled with an interest in music and a sense of sprituality. Persons with preferences in this quadrant would also tend to be intuitive with respect to their feelings. The combination of the two primaries in the Limbic quadrants would represent a duality for the person to resolve within themselves, and would involve the opposing qualities of control, structure and dominance compared with the emotional qualities associated with interpersonal interaction, musical, spiritual interests and intuitive feelings.

Another important characteristic of this limbic-oriented profile is the clear secondary preferences in the cerebral area, both in the left mode and the right mode. This indicates that logical, analytic processing is a secondary rather than a primary preference, and that holistic, conceptual, integrative thinking is similarly secondary rather than primary. The two primaries involved in this profile could be described as safe-keeping on one hand and emotional on the other.

Quadrant Scale scores produced a 2:1:1:2 Thinking Preference profile, as depicted in Figure 17, with primaries in the Limbic Left and Limbic Right Quadrants. The simliarity of the two Female groups were analyzed by a Multivariate Analysis of Variance test which revealed that there were no significant differences in Total Quadrant Mean Scale Scores between and within Freshmen and Senior Female groups.

All Freshmen and All Seniors

Data from Figures 18 and 19 indicate that the overall Right-Thinking preference of All Freshmen, collectively, was due to a high preference for Limbic Right and Cerebral Right Thinking Preference factor choices, with the Limbic Right being chosen most often, virtually both the Limbic Left and Limbic Right Quadrants as second choice, and with the Cerebral Left as the least chosen Quadrant.

Quadrant Scale scores for All Freshmen produced a 2:1:1:1 Thinking Preference profile, as depicted in Figure 20, with primaries in the Limbic Left, Limbic Right and Cerebral Right Quadrants, with the primary strength in the Cerebral Right quadrant due to the strong Crebral right bias by Freshmen Males. The simliarity of the Male and Female Freshmen groups were analyzed by a Multivariate Analysis of Variance test which revealed that there were no significant differences in Total Quadrant Mean Scale Scores between and within Freshmen Male and Female groups.

Data from Figures 18 and 19 indicate that the overall Right-Thinking preference of All Senior Males and Females, collectively, was due to a slightly stronger preference for Cerebral Right Thinking Preference factor

Figure 18

Rank Order of Left/Right Quadrant Preferences

All Freshmen Students (N=59):___
All Senior Students (N=47): ---

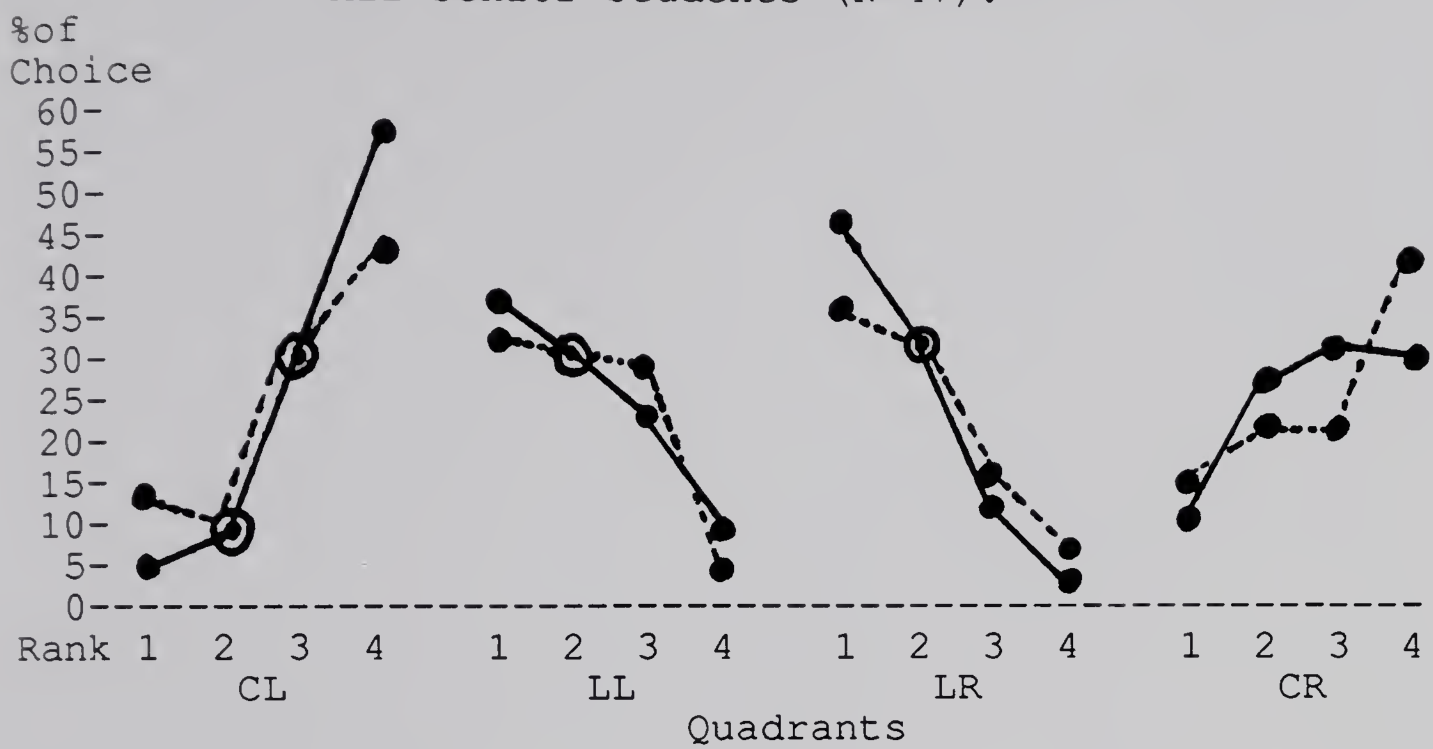
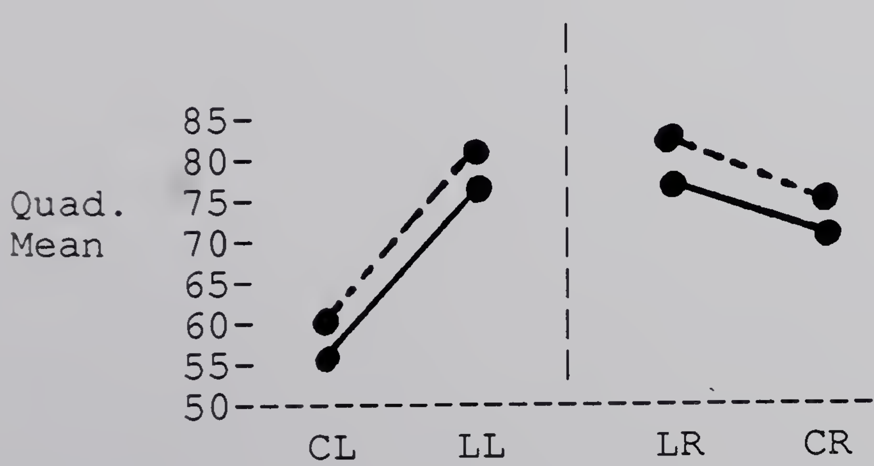


Figure 19

Overall Left/Right Quadrant Mean Scale Scores
All Freshmen Students (N=59):___
All Senior Students (N=47): ---



L/R Totals:

Fr:L=133.6 Sr:L=139.0
R=154.1 R=149.0

L/R Frequency:
Fr:L=24(40.7%) Sr:L=23 (48.9%)
R=35(59.3%) R=24 (57.1%)

Overall TPREF=
All Fr: Right
All Sr: Right

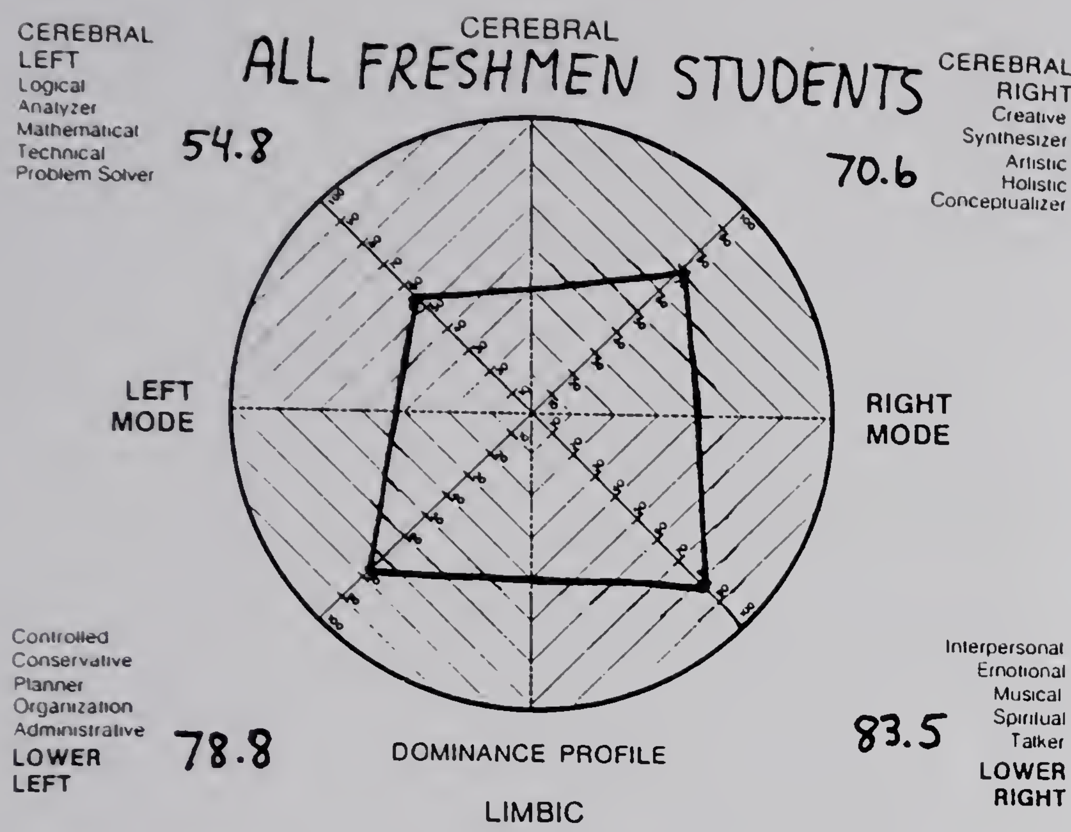


Figure 20
All Freshmen Profile

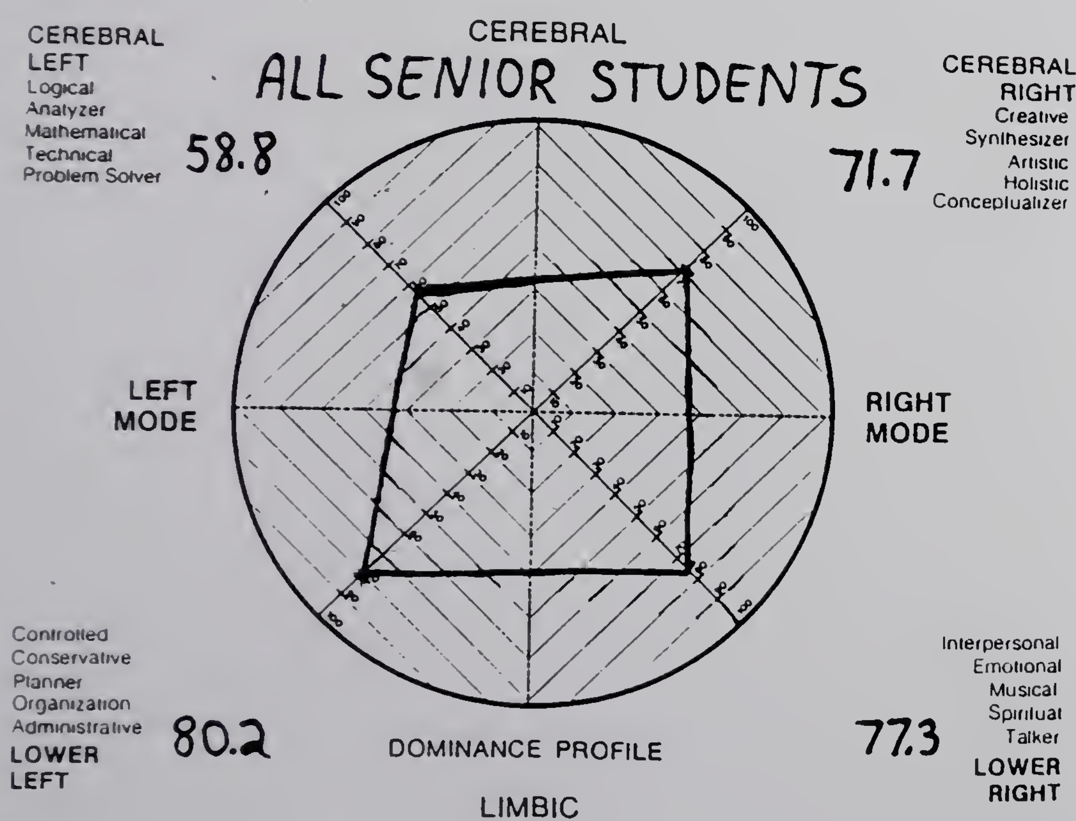


Figure 21
All Seniors Profile

Figures 20 and 21

Thinking Preference Profile

All Freshmen-20-and-Under-50
N=59

All Seniors-20-and-Under-51+
N=47

Group Average Profile 2-1-1-1

This is a multi-dominant group average profile with primaries in the Cerebral Right, Limbic Right and Limbic Left quadrants. This profile is characterized by strong preferences in the creative, synthesizing, artistic, holistic and conceptual modes of the Cerebral Right quadrant, as well as strong preferences in the interpersonal, emotional, musical and spiritual modes of the Limbic Right quadrant. The third primary in this profile is in the safe-keeping Limbic Left quadrant with contrasting preferences in the area of planning, organizing and administrative capabilities.

This profile is also characterized by a relatively low preference in the Cerebral Left quadrant dealing with logical, analytic and mathematical processing. People with this profile would exhibit strong interpersonal and emotional characteristics, but would also experience a duality between a more experimental Cerebral Right mode and a contrasting safe-keeping Limbic Left mode.

choices than the Cerebral Left, with Limbic Right factors being first and second choices, and the Cerebral Left and Cerebral Right Quadrants being the least chosen Quadrants.

Quadrant Scale scores for All Seniors produced a 2:1:1:1 Thinking Preference profile, as depicted in Figure 21, with primaries in the Limbic Left, Limbic Right and Cerebral Right Quadrants, and with the primary in the Cerebral Right due to the strong Cerebral Right bias of Senior Males. The simliarity of the Male and Female groups were analyzed by a Multivariate Analysis of Variance test which revealed that there were no significant differences in Total Quadrant Mean Scale Scores between and within Senior Male and Female groups.

All Students

To discern whether there were any significant relationships between each of the individual Left/Right Quadrant Scale Scores for All Freshmen and Senior, Males and Females, Quadrant scores for All Students were analyzed by Product Moment Correlation tests.

It was found that there was a strong significant negative relationship between Cerebral Left and Limbic Right ($r=-.69$; $p<.001$), Cerebral Left and Cerebral Right ($r=-.49$; $p<.001$), Limbic Left and Cerebral Right ($r=-.51$; $p<.001$) Quadrants, and a less significant negative relationship between the Limbic Left and Limbic Right ($r=-.31$; $p<.001$) Quadrants.

In analyzing the relationship of overall Left/Right Total Quadrant Scale Scores for All Students, collectively, it was found that there were strong significant positive relationships between Left-combined Quadrant scores and the Cerebral Left ($r=.79$; $p<.001$) and Limbic Left ($r=.67$; $p<.001$) Quadrants, and between the Right-combined Quadrant scores and the Limbic Right ($r=.80$; $p<.001$) and Cerebral Right ($r=.76$; $p<.001$) Quadrants. There were also strong significant negative relationships between the Left-combined Quadrant scores and the Limbic Right ($r=-.71$; $p<.001$) and Cerebral Right (r=-.68; p<.001) Quadrants, and between the Right-combined Quadrant scores and the Cerebral Left (r=-.76; p<.001) and Limbic Left (r=-.52; p<.001) Quadrants.

Data from Figures 22 and 23 indicate that 44.3% of All Students chose Left, and 55.7% chose Right Thinking Preference factors. Collectively, All Students chose the Limbic Right Quadrant as first and second choices, with the Cerebral Left as the third and also the least chosen Quadrant. Overall, Left/Right Thinking Preference Totals indicated that All Students, collectively, had an overall Right Thinking Preference bias.

For All Students considered collectively, there were significant positive relationships between overall Left-oriented Thinking Preferences and Cerebral Left (r=.61; p<.001) and Limbic Left (r=.35; p<.001) Key Descriptors, and between Cerebral Left (r=.48; p<.001) and Limbic Left (r=.51; p<.001) Work Elements. There were also significant positive relationships between overall Right-oriented Thinking Preferences and Limbic Right (r=.69; p<.001) and Cerebral Right (r=..68; p<.001) Key Descriptors, and between Limbic Right (r=.37; p<.001) and Cerebral Right (r=.37; p<.001) Work Elements.

For All Students considered collectively, there were significant negative relationships between overall

Figure 22

Rank Order of Left/Right Quadrant Preferences

All Students (N=106)

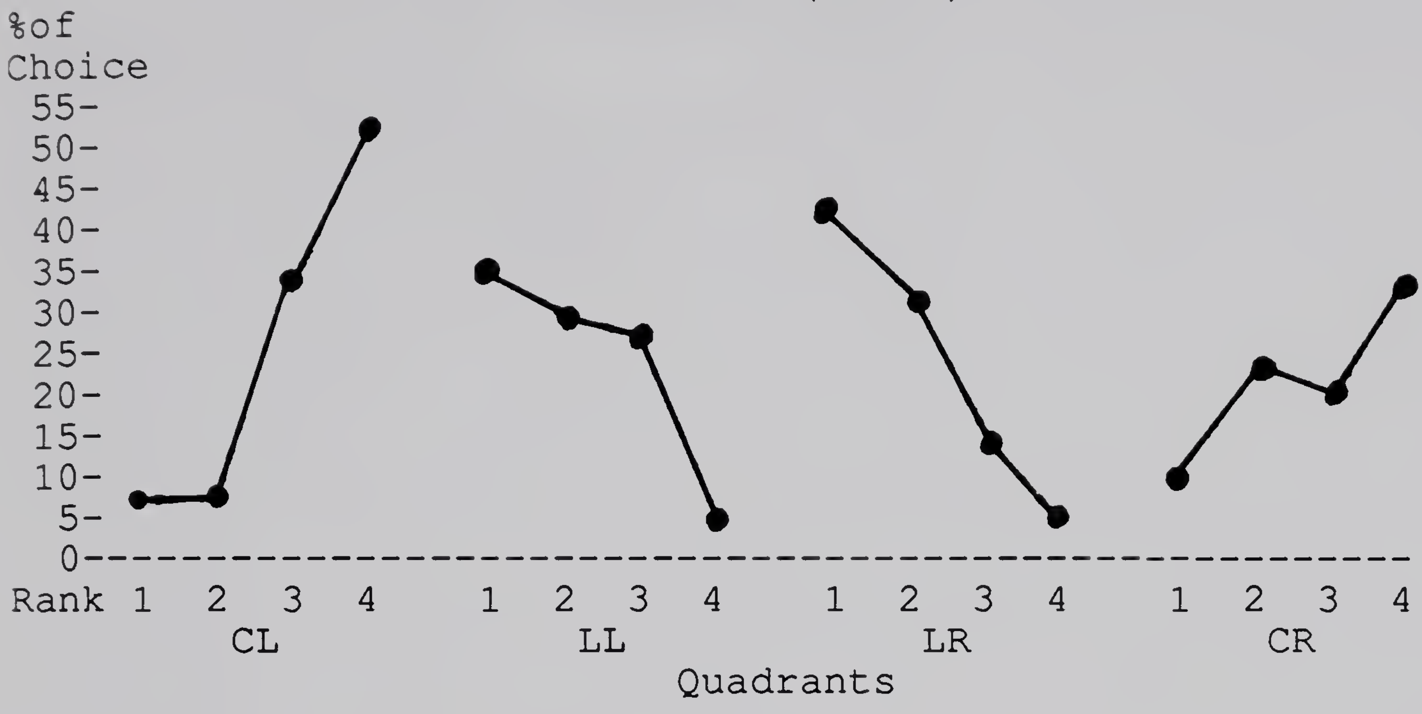
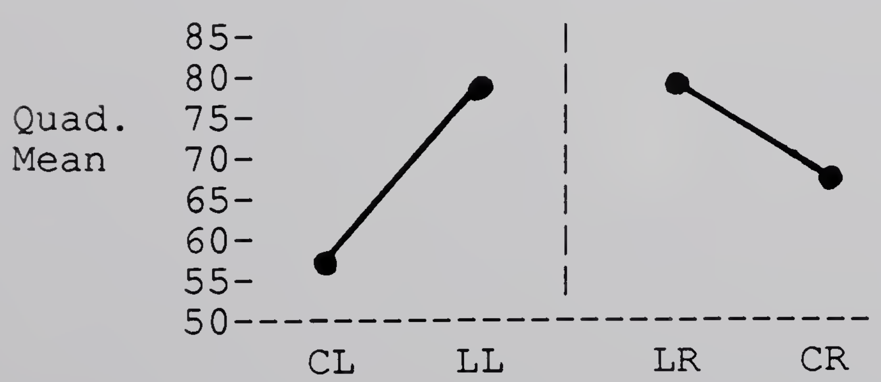


Figure 23

Overall Left/Right Quadrant Mean Scale Scores
All Students (N=106)



L/R Totals:
L=136.3
R=152.4

L/R Frequency:
L=47 (44.3%)
R=59 (55.7%)

Overall TPREF=
Right

Left-oriented Thinking Preferences and Limbic Right ($r=-.59$; $p<.001$) and Cerebral Right ($r=-.59$; $p<.001$) Key Descriptors, and between Limbic Right ($r=-.39$; $p<.001$) and Cerebral Right ($r=-.32$; $p<.001$) Work Elements. There were also significant negative relationships between overall Right-oriented Thinking Preferences and Cerebral Left ($r=-.64$; $p<.001$) and Limbic Left ($r=-.30$; $p<.001$) Key Descriptors, and between Cerebral Left ($r=-.39$; $p<.001$) and Limbic Left ($r=-.34$; $p<.001$) Work Elements.

For All Students considered collectively, there was a significant negative relationship between Handwriting Position and Limbic Left Key Descriptors ($r=-.24$; $p<.01$), and there were significant positive relationships between Handwriting Position and Cerebral Right Work Elements ($r=.27$; $p,.01$), and between Handedness Strength and Cerebral Right Work Elements ($r=.29$; $p<.01$). There were no other significant positive or negative relationships between Handedness factors and Thinking Preferences or Learning Strategies.

Total Quadrant Scale Scores/Quadrant produced a composite Thinking Preference Profile of 2:1:1:1, as depicted in Figure 24, which indicates primary Thinking Preference strengths in the Limbic Left, Limbic Right and Cerebral Right Quadrants, with the primary in the Cerebral Right quadrant due to the high Cerebral Right

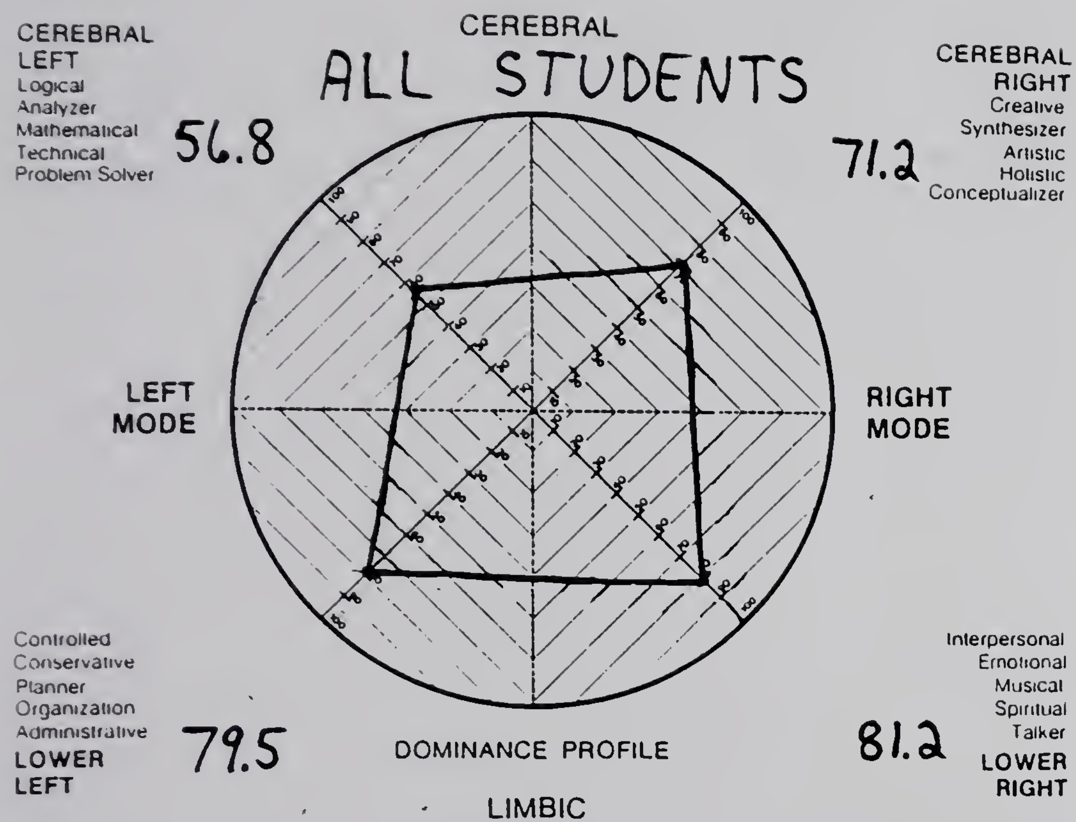


Figure 24
All Students Profile

Figure 24

Thinking Preference Profile

All Students-20-and-Under-51+
N=106

Group Average Profile 2-1-1-1

This is a multi-dominant group average profile with primaries in the Cerebral Right, Limbic Right and Limbic Left quadrants. This profile is characterized by strong preferences in the creative, synthesizing, artistic, holistic and conceptual modes of the Cerebral Right quadrant, as well as strong preferences in the interpersonal, emotional, musical and spiritual modes of the Limbic Right quadrant. The third primary in this profile is in the safe-keeping Limbic Left quadrant with contrasting preferences in the area of planning, organizing and administrative capabilities.

This profile is also characterized by a relatively low preference in the Cerebral Left quadrant dealing with logical, analytic and mathematical processing. People with this profile would exhibit strong interpersonal and emotional characteristics, but would also experience a duality between a more experimental Cerebral Right mode and a contrasting safe-keeping Limbic Left mode.

preference of both Freshmen and Senior Males.

A Multivariate Analysis of Variance test revealed that for the interaction of gender with class, there were no significant differences in Total Quadrant Mean Scale Scores between and within Freshmen and Senior, Male and Female groups.

Hemispheric Learning Strategies Data

The Hemispheric Learning Strategies (Methods) Questionnaire was designed to detect those Left-Right Hemispheric Strategies (Methods) that Freshmen Male and Female students actually had to use in order to successfully complete their course work prior to entering the Nursing program, and that Senior Males and Females had to use to successfully pass Nursing I and II. These strategies may or may not have been their 'best' hemispheric strategies that they had been used to using and preferred to use for their optimal learning, but were the ones they perceived needed to be used in order to understand and assimilate the information being presented and to succeed in their courses.

Thirty-two questions, half of which were Left- and half Right-hemispheric- oriented, were randomly listed on the questionnaire, but with opposing pairs of questions listed opposite each other on the following table for comparison purposes. Each group's average rating of each question is shown for each Learning Strategy question, with overall Left/Right averages for all questions displayed at the bottom. The closer the average responses were to 1.0, the weaker was the Left/Right hemispheric preference, whereas, the closer the average responses were to 7.0, the stronger was the Left/Right Hemispheric preference. Emphasis for discussion purposes was placed on those Left-Right strategies that were at least 1.1 rating units higher on one side than the other, as being the focus of concern for comparison purposes. A composite sample of the Learning Strategies (Methods) Questionnaire is found in the appendix.

Table 6 indicates that as an overall group, Nursing students had a moderately-strong Left-oriented Learning Strategy preference (5.0) versus only a slightly greater than moderate Right-oriented preference (4.3). Those Left-oriented strategies that the student group emphasized most over Right-strategies, were numbers 3 (dealing with things rationally-5.3), 18 (dealing with things in an orderly fashion-5.3), 19 (liking details of practical use-5.9=strongest preference), 26 (having definite study habits-4.6), 28 (planned to meet deadlines-4.9), and 29 (relying on definite facts-5.1). They only emphasized one Right-oriented strategy over Left for number 24 (memorized general/overall ideas of material-5.2).

This data also indicates that as a group, Nursing students used Learning Strategies (Methods) that were subsumed by mostly the Limbic Left, and somewhat by the Cerebral Left, Thinking Preference Quadrants to succeed

Table 6

Learning Strategy (Method) Question Averages for All Students*
N=104

L- Q's	All Fr.Ms L	All Fr.Ms R	All Fr.Fs L	All Fr.Fs R	All Sr.Ms L	All Sr.Ms R	All Sr.Fs L	All Sr.Fs R	All Ms L	All Ms R	All Fs L	All Fs R	All Stdts L	All Stdts R	R-Q's
1	6.3	5.7	5.5	5.6	4.8	5.3	5.4	5.5	5.4	5.6	5.5	5.6	5.5	5.6	17
2	4.6	5.8	5.1	5.3	2.8	4.9	5.1	5.7	3.8	5.2	5.1	5.5	4.5	5.4	21
3	5.5	3.4	5.5	2.6	4.8	2.5	5.2	2.4	5.1	3.2	5.4	2.5	5.3	2.9	32
6	4.8	3.8	4.5	5.2	4.5	5.8	5.0	4.9	4.5	5.1	4.8	5.1	4.7	5.1	20
8	4.1	4.0	4.2	5.2	3.8	5.7	3.2	5.3	4.1	5.0	3.7	5.3	3.9	5.2	24
10	5.3	2.9	5.6	5.1	6.1	5.7	6.0	5.4	5.8	4.6	5.8	5.3	5.8	5.0	23
12	6.0	3.8	5.0	5.2	4.7	5.3	4.5	5.3	5.1	4.7	4.8	5.3	5.0	5.0	4
14	5.0	6.2	4.6	4.2	3.1	2.5	4.4	3.2	3.9	4.3	4.5	3.7	4.2	4.0	31
16	4.8	5.5	4.3	3.9	4.0	2.8	4.7	2.5	4.2	4.1	4.5	3.2	4.4	3.7	30
18	6.3	4.8	5.5	2.6	4.5	2.8	5.0	2.7	5.2	4.0	5.3	2.7	5.3	3.4	27
19	5.8	5.0	5.5	4.3	5.8	4.3	6.1	3.4	5.9	4.6	5.8	3.9	5.9	4.3	9
22	5.6	4.8	5.0	4.6	5.5	4.2	5.4	4.5	5.5	4.7	5.2	4.6	5.4	4.7	5
25	5.7	3.5	5.0	4.7	4.3	4.6	4.3	5.1	5.1	4.0	4.7	4.9	4.9	4.5	11
26	4.7	3.0	5.1	3.3	3.9	4.3	5.1	2.7	4.1	3.9	5.1	3.0	4.6	3.5	7
28	4.8	3.3	5.4	2.8	3.8	4.1	5.7	2.7	4.1	3.8	5.6	2.8	4.9	3.3	13
29	5.0	2.1	4.9	4.0	5.4	4.0	5.0	4.5	5.2	3.2	5.0	4.3	5.1	3.8	15
Ave's:	5.3	4.2	5.0	4.3	4.5	4.3	5.0	4.1	4.8	4.4	5.0	4.2	5.0	4.3	
	L	R	L	R	L	R	L	R	L	R	L	R	L	R	

*Rating Significance:

1= very weak preference
2= weak preference
3= weak-moderate preference
4= moderate preference
5= moderate-strong preference
6= strong preference
7= very strong preference

in their coursework, with less help from the Right-oriented strategies. Results from an Analysis of Variance test for Left and Right Learning Strategy choices by gender and class revealed that there were no significant main effects for gender, or any significant interaction effects for gender and class for the usage of either Left- or Right-oriented Learning Strategies for Freshmen and Senior, Male and Female students (Table 7).

Detailed tables of the Learning Strategies (Methods) by age-groups are found in the appendix (Tables 47-50).

Table 7

Analysis of Variance for Left- and Right-Oriented Learning Strategies by Gender and Class for All Nursing Students ($p<.05$)

	Source of Variation	SS	DF	MS	F	Sig. of F
L-Learn. Strategy:	Main Effects:					
	Gender	65.724	1	65.724	1.285	.260
	Class	133.692	1	133.692	2.614	.109
	Two-Way Interactions:					
	GenderxClass	31.435	1	31.435	.615	.435
R-Learn. Strategy:	Main Effects:					
	Gender	42.400	1	42.400	1.109	.295
	Class	61.960	1	61.960	1.620	.206
	Two-Way Interactions:					
	GenderxClass	.064	1	.064	.002	.967

VI. Comparison of Thinking Preferences with Learning Strategies

Table 8 presents data on the congruency of overall Thinking Preference orientation with the Left/Right Hemispheric Learning Strategy orientation for All Male and Female, Freshmen and Senior Nursing students. Although 43% of All Males and All Females each used Left-oriented strategies and 57% used Right-strategies, 71% of all Males used Learning Strategies that were incongruent to their Thinking Preference orientation, versus 52% incongruency for All Females. Overall, even though 43% of All Students used Left-oriented Learning Strategies and 57% used Right, 55% had Learning Strategies incongruent to their Thinking Preference orientation.

Both Freshmen and Senior, Male and Female groups, had very similar degrees of preference for Left- and Right-oriented Learning Strategies used, but 62% of all Freshmen Females versus 40% of Senior Females had Learning Strategies incongruent to their Thinking Preference orientation, while 50% of Freshmen Males versus 100% of Senior Males had Learning Strategies incongruent to their Thinking Preference orientation.

Tables 9-12 indicate the results of a Chi-Square analysis for Freshmen and Senior, Male and Female Nursing

Table 8

Comparison of Thinking Preference/Learning Strategy Incongruency for Nursing Students

All Students
N=104

Group	Overall TPref Orient.	LStrat Orient. L	LStrat Orient. R	Total/% L	Total/% R	TPref/LStrat Orientation Incongruency+ Total/%
Fr Ms N=8	Left	3	0+	3/38		4/50
	Right	4+	1		5/62	
Fr Fs N=50	Left	16	4+	20/40		31/62
	Right	27+	3		30/60	
Sr Ms N=6	Left	0	3+	3/50		6/100
	Right	3+	0		3/50	
Sr Fs N=40	Left	17	2+	19/48		16/40
	Right	14+	7		21/52	
All Fr N=58	Left	19	4+	22/38		35/60
	Right	31+	4		35/42	
All Sr N=46	Left	17	5+	22/48		22/48
	Right	17+	7		24/52	
All Ms N=14	Left	3	3+	6/43		10/71
	Right	7+	1		8/57	
All Fs N=90	Left	33	6+	39/43		47/52
	Right	41+	10		51/57	
All Stdts N=104	Left	36	9+	45/43		57/55
	Right	48+	11		59/57	

student tests for congruency between the frequency of the number of students who used a Learning Strategy with the same hemispheric orientation as their Thinking Preference orientation, versus the number of students who used a Learning Strategy that differed from their Thinking Preference orientation.

When analyzed by class (Freshmen vs. Seniors) and controlling for gender, there was a significant difference between Freshmen and Senior Females ($X2=4.31$, $p<.05$, $df=1$) who used a Learning Strategy with a different hemispheric orientation than their Thinking Preference orientation (Table 9).

When analyzed by gender and controlled for class, there was a significant difference between Senior Males and Females ($X2=5.56$, $p<.05$, $df=1$) in their use of a Learning Strategy with a hemispheric orientation that was different from their Thinking Preference orientation (Table 10).

Table 9
Chi-Square Analysis of Thinking Preference/Learning Strategy Incongruity for Nursing Students by Class, Controlling for Gender

	Fisher's Exact Test	One-Tail	Two-Tail	
Fr/Sr Ms		.06993	.0849	ns

	X2	DF	Sig.	Sig. Level
Fr/Sr Fs	X2=4.30672	1	.0380	p<.05*

Table 10
Chi-Square Analysis of Thinking Preference/Learning Strategy Incongruity for Nursing Students by Gender, Controlling for Class

	X2	DF	Sig.	Sig. Level
Freshmen Ms & Fs	X2=.0619	1	.8491	ns
Senior Ms & Fs	X2=5.5880	1	.0184	p<.05+

Table 11

Chi-Square Analysis of Thinking Preference/Learning Strategy Incongruity for Nursing Students by Class

	X2	DF	Sig.	Sig. Level
Freshmen/ Seniors	X2=1.64795	1	.1982	ns

Table 12

Chi-Square Analysis of Thinking Preference/Learning Strategy Incongruity for Nursing Students by Gender

	X2	DF	Sig.	Sig. Level
Males/ Females	X2=1.28710	1	.2566	ns

*Before Yates Correction
+After Yates Correction

Research Question #2:

What are the Thinking Preferences of the Nursing Faculty, and to what degree are their Thinking Preferences congruent with the Thinking Preferences of the Freshmen and Senior Nursing students?

Thinking Preference Data-Faculty

Data gathered to answer this question was divided into three sections and included data on the Key Hemispheric Descriptors, Hemispheric Work Elements, and overall Thinking Preference profiles, including the Rank Order of Quadrant Preferences and Quadrant Scale Scores for all Nursing Faculty. Tables, Figures, general and statistical analyses from the first section, as well as from this section were used to answer this question.

I. Key Left and Right Hemispheric Descriptors- Nursing Faculty

Table 13 presents data on the Key Descriptors for all Nursing Faculty by class section.

Freshmen Faculty chose both a Cerebral Left Descriptor (Rational), and a Limbic Right Descriptor (Emotional), as their most commonly chosen Descriptor of

Table 13

Frequency of Key Descriptor Choices for All Nursing Faculty by Class Section
N=12

Key D./Quad.	Groups		
	Fr. Fac. Over/Best	Sr. Fac. Over/Best	All Fac Over*/Best+
Cerebral Left :			
Analytic	3/-	3/-	6/-
Logical	3/1	5/2	8/3
Mathematical	-/-	2/-	2/-
Rational	4/-	4/-	8/-
Critical	3/-	2/-	5/-
Quantitative	-/-	-/-	-/-
Factual	3/-	3/-	6/-
Totals:	16/1	19/2	35/3
Limbic Left :			
Conservative	1/-	3/-	4/-
Controlled	3/-	-/-	3/-
Sequential	2/1	1/-	3/1
Detailed	1/-	2/-	3/-
Dominant	1/-	1/1	2/1
Verbal(Art.)	1/-	1/-	2/-
Reader(Tech.)	3/-	2/1	5/1
Totals:	12/1	10/2	22/3
Limbic Right :			
Reader(Pers.)	3/-	2/1	5/1
Verb.(Talker)	1/-	1/-	2/-
Intuit.(Feel.)	2/-	4/-	6/-
Symbolic	1/-	-/-	1/-
Spiritual	1/-	4/1	5/1
Musical	1/-	2/-	3/-
Emotional	4/2	2/1	6/3
Totals:	13/2	15/3	28/5
Cerebral Right :			
Spatial	1/-	-/-	1/-
Simultaneous	1/-	1/-	2/-
Synthesizer	1/-	1/-	2/-
Holistic	3/1	3/1	6/2
Intuit.(Sol).	2/-	4/-	6/-
Artistic	2/-	-/-	2/-
Creative	3/1	2/-	5/1
Totals:	13/2	11/1	24/3

*Key Descriptors most commonly chosen fo all Descriptors.
+Key Descriptors chosen that 'Best' describes the group.

the group, with 'Emotional' being chosen as the 'very best' Descriptor of the group, with Left-oriented Descriptors and Quadrants generally chosen slightly more overall than Right Descriptors (52%-L vs 48%-R).

Senior Faculty chose more Left-oriented Descriptors altogether (53%) and chose the Cerebral Left Quadrant most often, although the Limbic Right Quadrant was chosen most often for their 'best' descriptor. They also chose the Cerebral Left Descriptor 'Logical' as the most commonly chosen and 'very best' Descriptor of the group.

Overall, all Nursing Faculty chose the Cerebral Left Quadrant most often (32%) and chose the Cerebral Left Descriptors 'Logical' and 'Rational' most often, while also choosing Left-oriented Descriptors more often (52%) than Right-oriented Descriptors (48%). They were equally split on choosing the Cerebral Left Descriptor 'Logical' and Limbic Right Descriptor 'Emotional' as their 'very best' Descriptors, but favored the Limbic Right Quadrant overall for 'best' Descriptors of their group.

II. <u>Left and Right Hemispheric Work Elements- Faculty</u>

Table 14 presents data on the Work Elements of all Nursing Faculty and indicates that, overall, all Faculty slightly preferred Limbic Left (Planning) and Limbic Right (Teaching; Interpersonal Aspects) Work Elements, while least preferring Cerebral Left (Finacial Aspects) and Cerebral Right (Innovative; Creative Aspects) Work Elements. Generally, all Faculty slightly favored Limbic Quadrant Work Elements over Cerebral Elements, while finding the Cerebral Right Work Elements the least favorable for their type of work.

The Freshmen Faculty most preferred Limbic Right Work Elements (Teaching and Training; Interpersonal Aspects), and least preferred Cerebral Left (Technical and Financial Aspects) and Limbic Left (Administrative) Work Elements.

The Senior Faculty most preferred the Limbic Left Work Elements (Organization; Planning; Administrative Aspects), while least preferring the Cerebral Left (Financial Aspects) and Cerebral Right (Integration; Creativity; Innovating) Work Elements.

Table 14

Left and Right Hemispheric Work Elements *
All Freshmen and Senior Nursing Instructors (N=12)

Quadrants/ Work Elements	Groups		
	Freshmen Instructors	Senior Instructors	All Instructors
Cerebral Left:			
Analytical	3.7+	3.8	3.8+
Technical Aspects	2.8-	3.2	3.0
Problem Solving	3.2	4.0	3.6
Financial Aspects	2.8-	2.7-	2.8-
Limbic Left:			
Organization	3.0	4.3+	3.7
Planning	3.5	4.2+	3.8+
Administrative	2.8-	4.2+	3.5
Implementation	3.2	3.7	3.4
Limbic Right:			
Teaching/ Training	4.7+	4.3+	4.5+
Writing	3.0	4.0	3.5
Expressing Ideas	2.7	2.8-	2.8-
Interpersonal Aspects	4.2+	4.0	4.1+
Cerebral Right:			
Integration	3.8+	2.7-	3.3
Conceptualizing	3.5	3.0	3.3
Creative Aspects	3.2	1.8-	2.5-
Innovating	2.8-	2.3-	2.6-

* A rating of one (1) represented work done worst of all and a five (5) represented work done best of all. The values shown are averages of the individual ratings. The pluses (+) signify the four highest ratings; the minuses (-) the four lowest.

Thinking Preference Data-Faculty

This section includes the Thinking Preference Profiles, Rank Order of Quadrant Preferences, and Overall Left/Right Quadrant Mean Scale Scores for Freshmen and Senior Nursing Faculty. Data will be presented as Figures (Graphic Profiles; graphs) with brief descriptive analyses for each group.

Freshmen vs. Senior Faculty

Data from Figures 25 and 26 indicate that 50.0% of both Freshmen and Senior Faculty chose Left, and 50.0% of both groups chose Right Thinking Preference factors. Freshmen Faculty chose both the Limbic Right and Cerebral Right Quadrants the most, and the Cerebral Right Quadrant the least. Senior Faculty chose the Cerebral Left and Limbic Right Quadrants the most, the Cerebral Right Quadrant as third choice, and the Cerebral Left Quadrant the least often. Overall, Left/Right Thinking Preference Totals indicated that Freshmen Faculty had an overall Right Thinking Preference bias, while the Senior Faculty had an overall Left Thinking Preference bias.

Total Quadrant Scale Scores/Quadrant for Freshmen Faculty produced a composite Thinking Preference Profile of 2:2:1:2, as depicted in Figure 27, which indicates a primary Thinking Preference strength in the Limbic Right Quadrant, with secondary strengths in the other three Quadrants. For Senior Faculty, Total Quadrant Scale Scores produced a composite Thinking Preference Profile of 2:1:1:2, which, unlike the Freshmen Faculty, indicates a primary strength in the Limbic Left as well as the Limbic Right Quadrants (Figure 28).

A Multivariate Analysis of Variance test revealed

Figure 25

Rank Order of Left/Right Quadrant Preferences

All Freshmen Faculty (N=6): ___
All Senior Faculty (N=6): ---

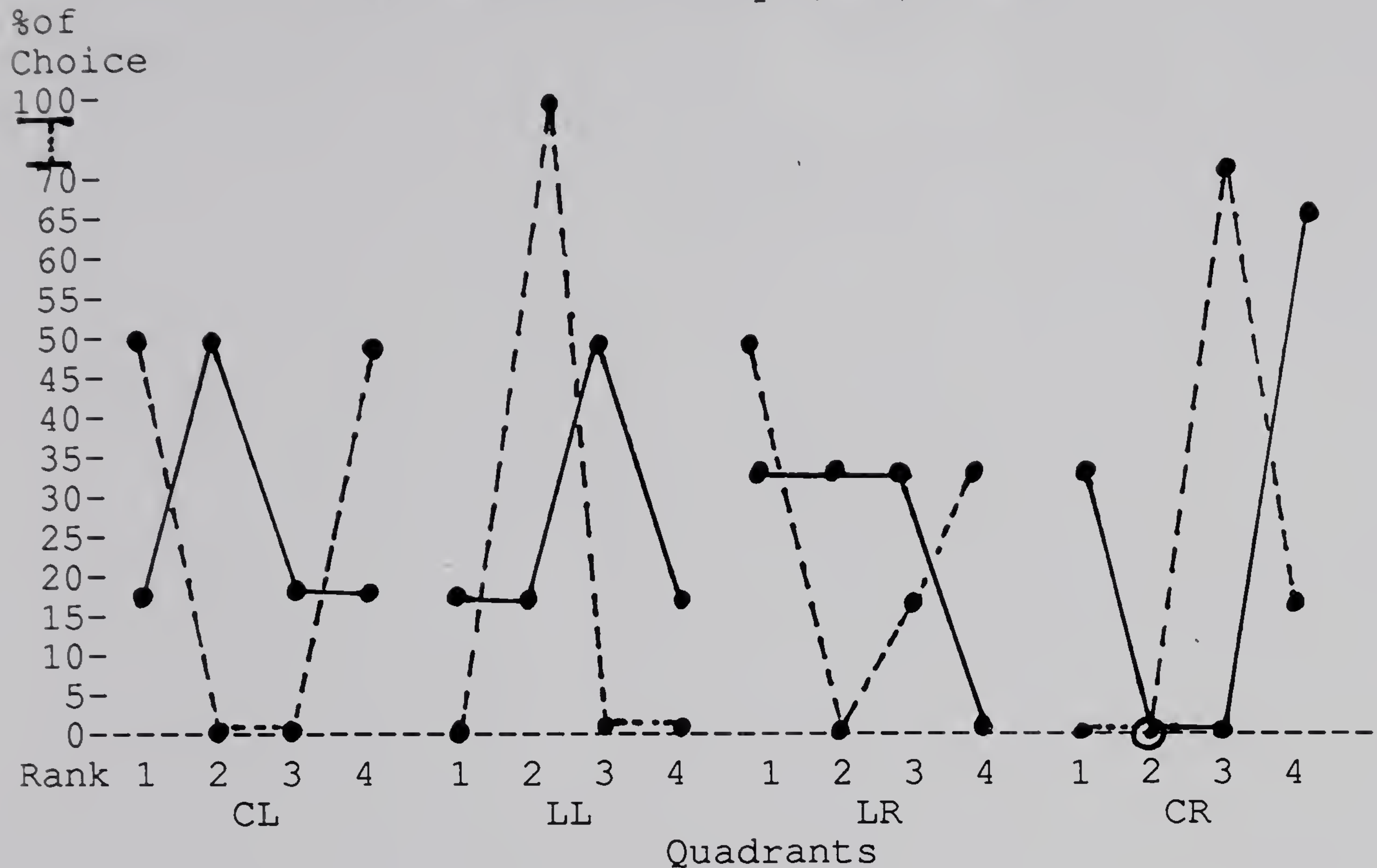
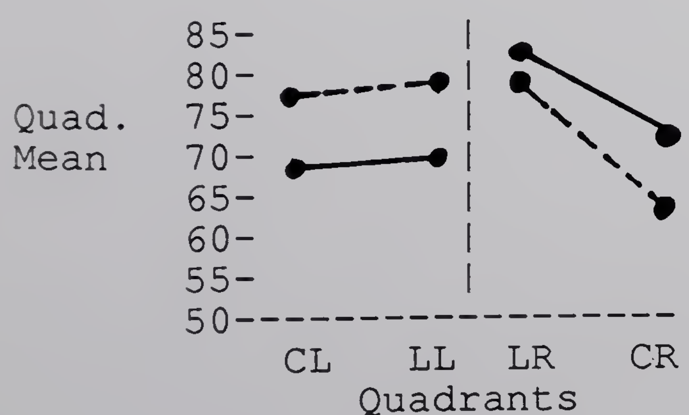


Figure 26

Overall Left/Right Quadrant Mean Scale Scores

All Freshmen Faculty (N=6): ___
All Senior Faculty (N=6): ---

L/R Totals:
Fr: L=134.4 Sr: L=156.1
R=155.1 R=142.6



L/R Frequency:
Fr: L=3 (50.0%) Sr: L=3(50%)
R=3 (50.0%) R=3(50%)

Overall TPREF=
Fr: Right
Sr: Left

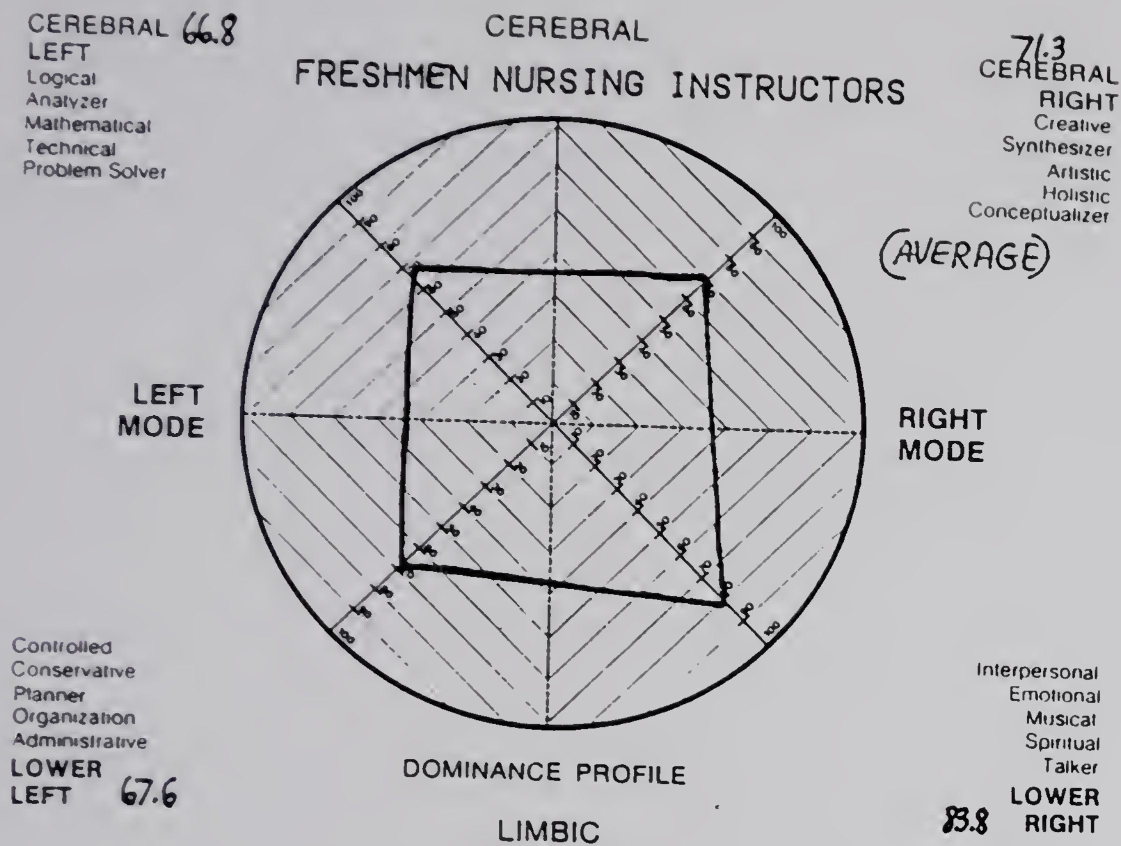


Figure 27
Freshmen Faculty Profile

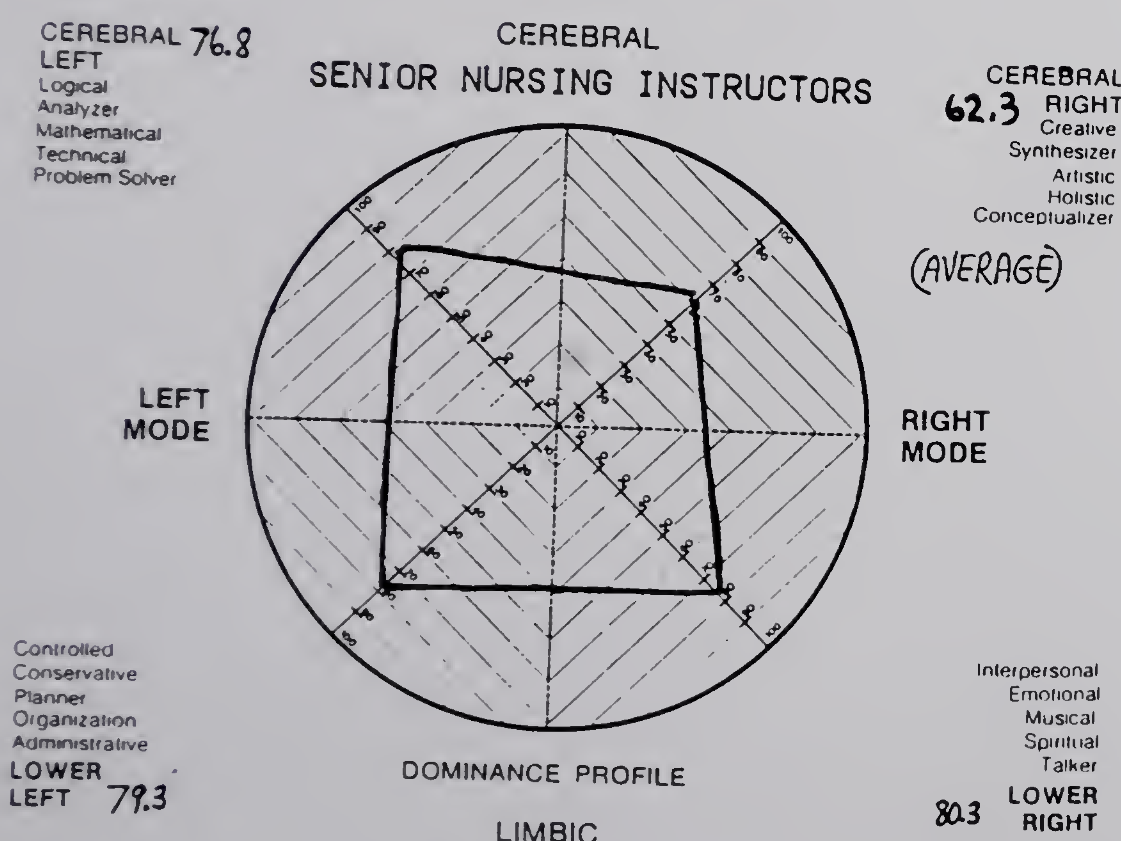


Figure 28
Senior Faculty Profile

Figure 27

Thinking Preference Profile

Freshmen Faculty
N=6

Group Average Profile 2-2-1-2

This profile yields a primary in the Limbic Right mode quadrant and secondaries in the Cerebral Left, Limbic Left and Cerebral Right quadrants. The Limbic Right primary shows strong preferences in the interpersonal, intuitive, emotional, spiritual and musical modes.

The Cerebral Right secondary mode indicates some preference for activities dealing with integration, synthesizing, conceptualizing and holistic thinking. The Cerebral Left secondary mode features some logical, analytic, rational and factual processing, and the Limbic Left mode shows some preferences for planning, organizing activities, and a more structured and controlled thinking.

Figure 28

Thinking Preference Profile

Senior Faculty
N=6

Group Average Profile 2-1-1-2

This profile yields a double primary in the limbic area. It is a mirror image reversal of profile 1-2-2-1, which has a double primary in the cerebral area. This profile, 2-1-1-2, is characterized by very strong (primary) preferences in the Limbic Left and Right Quadrants. Primary preferences in the Limbic Left quadrant focus on conservative thinking and controlled behavior with a desire for organization and structure and a preference for detail and accuracy. Persons with a preference in this quadrant tend to be perfectionists.

This profile would also feature an equal preference in the Limbic Right quadrant, which would be characterized by emotional and interpersonal processing coupled with an interest in music and a sense of sprituality. Persons with preferences in this quadrant would also tend to be intuitive with respect to their feelings. The combination of the two primaries in the Limbic quadrants would represent a duality for the person to resolve within themselves, and would involve the opposing qualities of control, structure and dominance compared with the emotional qualities associated with interpersonal interaction, musical, spiritual interests and intuitive feelings.

Another important characteristic of this limbic-oriented profile is the clear secondary preferences in the cerebral area, both in the left mode and the right mode. This indicates that logical, analytic processing is a secondary rather than a primary preference, and that holistic, conceptual, integrative thinking is similarly secondary rather than primary. The two primaries involved in this profile could be described as safe-keeping on one hand and emotional on the other.

that there were no significant differences in Total Quadrant Mean Scale Scores between and within Freshmen and Senior Faculty groups.

<u>All Faculty</u>

Data from Figures 29 and 30 indicate that 50.0% of All Faculty chose Left, and 50.0% chose Right Thinking Preference factors. Collectively, All Faculty chose the Limbic Right Quadrant the most, the Limbic Left Quadrant as second, the Cerebral Right third, and the Cerebral Right as the least chosen Quadrant. Overall, Left/Right Thinking Preference Totals indicated that All Faculty, collectively, had an overall Right Thinking Preference bias, although both total scores were very similar.

Total Quadrant Scale Scores/Quadrant produced a composite Thinking Preference Profile of 2:1:1:2, as depicted in Figure 31, which indicates primary Thinking Preference strengths in the Limbic Left and Limbic Right Quadrants, and secondaries in the Cerebral Left and Cerebral Right Quadrants.

A Multivariate Analysis of Variance test revealed that there were no significant differences in Total Quadrant Mean Scale Scores between and within Freshmen and Senior Faculty groups.

Figure 29

Rank Order of Left/Right Quadrant Preferences

All Faculty (N=12)

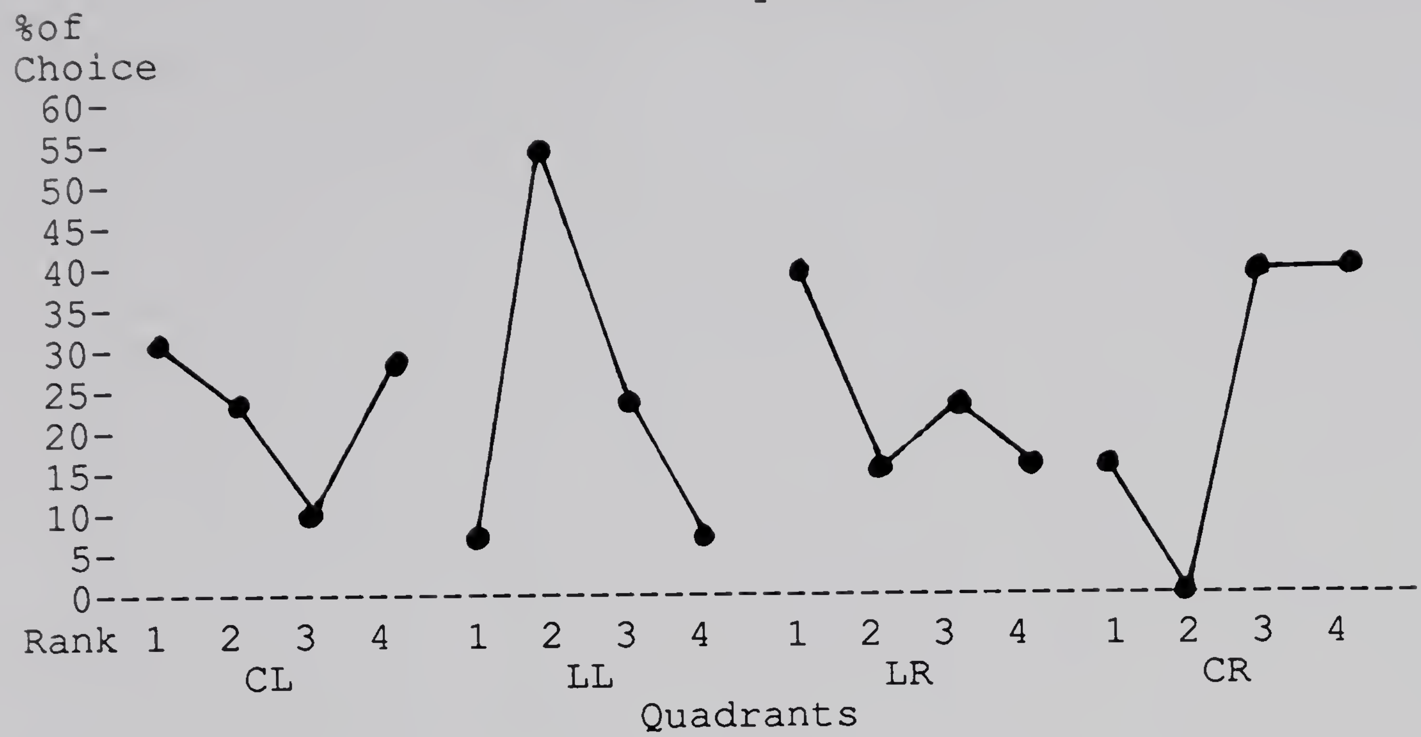
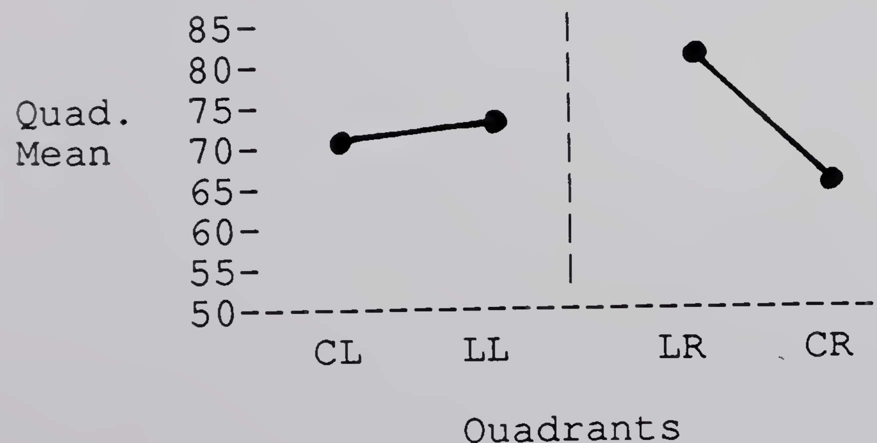


Figure 30

Overall Left/Right Quadrant Mean Scale Scores
All Faculty (N=12)



L/R Totals:
L=145.3
R=148.9

L/R Frequency:
L=6 (50.0%)
R=6 (50.0%)

Overall TPREF=
All Fac: Right

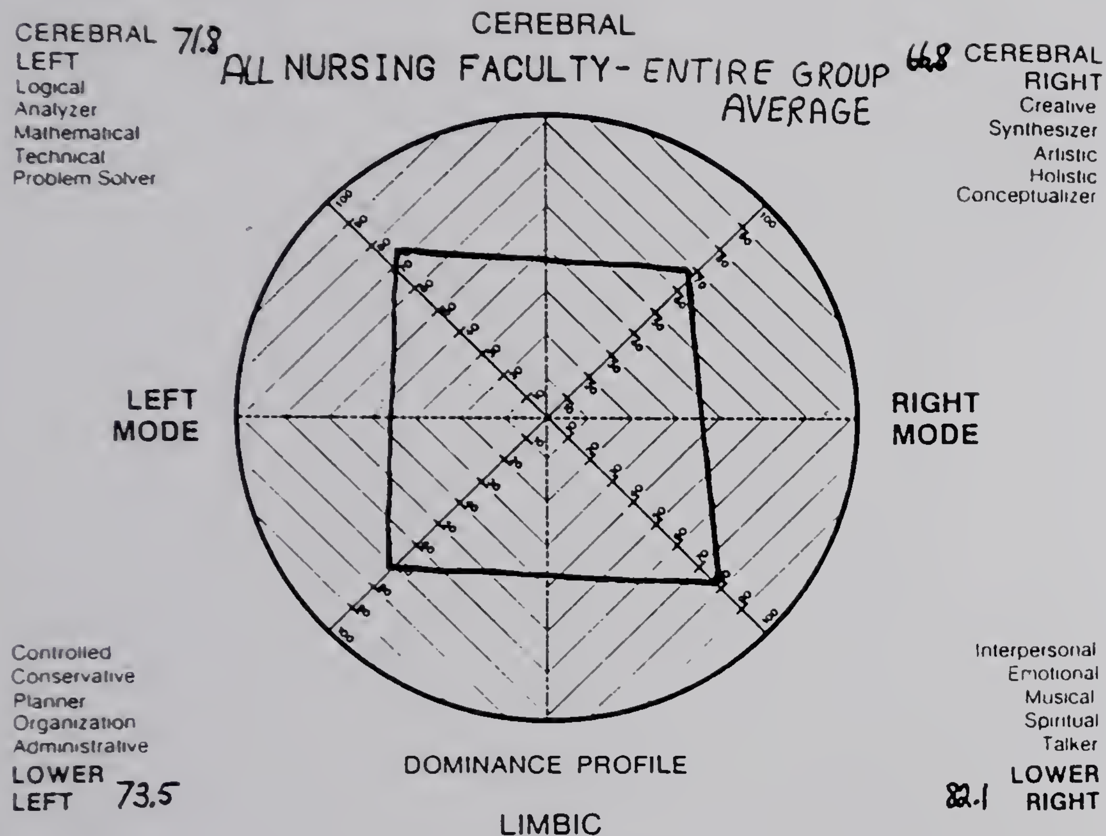


Figure 31
All Faculty Profile

Figure 31

Thinking Preference Profile

All Nursing Faculty
N=12

Group Average Profile 2-1-1-2

This overall group average profile yields a double primary in the limbic area. It is a mirror image reversal of profile 1-2-2-1, which has a double primary in the cerebral area. This profile, 2-1-1-2, is characterized by very strong (primary) preferences in the Limbic Left and Right Quadrants. Primary preferences in the Limbic Left quadrant focus on conservative thinking and controlled behavior with a desire for organization and structure and a preference for detail and accuracy. Persons with a preference in this quadrant tend to be perfectionists.

This profile would also feature an equal preference in the Limbic Right quadrant, which would be characterized by emotional and interpersonal processing coupled with an interest in music and a sense of sprituality. Persons with preferences in this quadrant would also tend to be intuitive with respect to their feelings. The combination of the two primaries in the Limbic quadrants would represent a duality for the person to resolve within themselves, and would involve the opposing qualities of control, structure and dominance compared with the emotional qualities associated with interpersonal interaction, musical, spiritual interests and intuitive feelings.

Another important characteristic of this limbic-oriented profile is the clear secondary preferences in the cerebral area, both in the left mode and the right mode. This indicates that logical, analytic processing is a secondary rather than a primary preference, and that holistic, conceptual, integrative thinking is similarly secondary rather than primary. The two primaries involved in this profile could be described as safe-keeping on one hand and emotional on the other.

Nurses in the General Population

Data from Figures 32 and 33 represents Grand Quadrant Scale Mean Scores of all Nurses surveyed in the field at this writing by Ned Herrmann. Overall, these General Population of Nurses chose Right Thinking Preference factors more than Left, choosing the Limbic Right Quadrant the most, the Limbic Left Quadrant as second, the Cerebral Left third, and Cerebral Right Quadrant as being chosen the least. Overall, Left/Right Thinking Preference Totals indicated that they collectively had an overall Right Thinking Preference bias.

Total Quadrant Scale Scores/Quadrant produced a composite Thinking Preference Profile of 2:1:1:2, as depicted in Figure 34, which indicates primary Thinking Preference strengths in the Limbic Left and Limbic Right Quadrants, with secondary strengths in the Cerebral Left and Cerebral Right Quadrants.

Since there was insufficient data to run statistical analyses on the Thinking Preference scores, a general analysis indicates that the Thinking Preference Quadrant Scores and profiles were very similar to those of the Freshmen and Senior Faculty groups, and to Freshmen and Senior Females.

Figure 32

Rank Order of Left/Right Quadrant Preferences

Nurses in the General Population
N=Quadrant Preference Rank Order for 1000 Nurses
Four Grand Mean Quadrant Scores

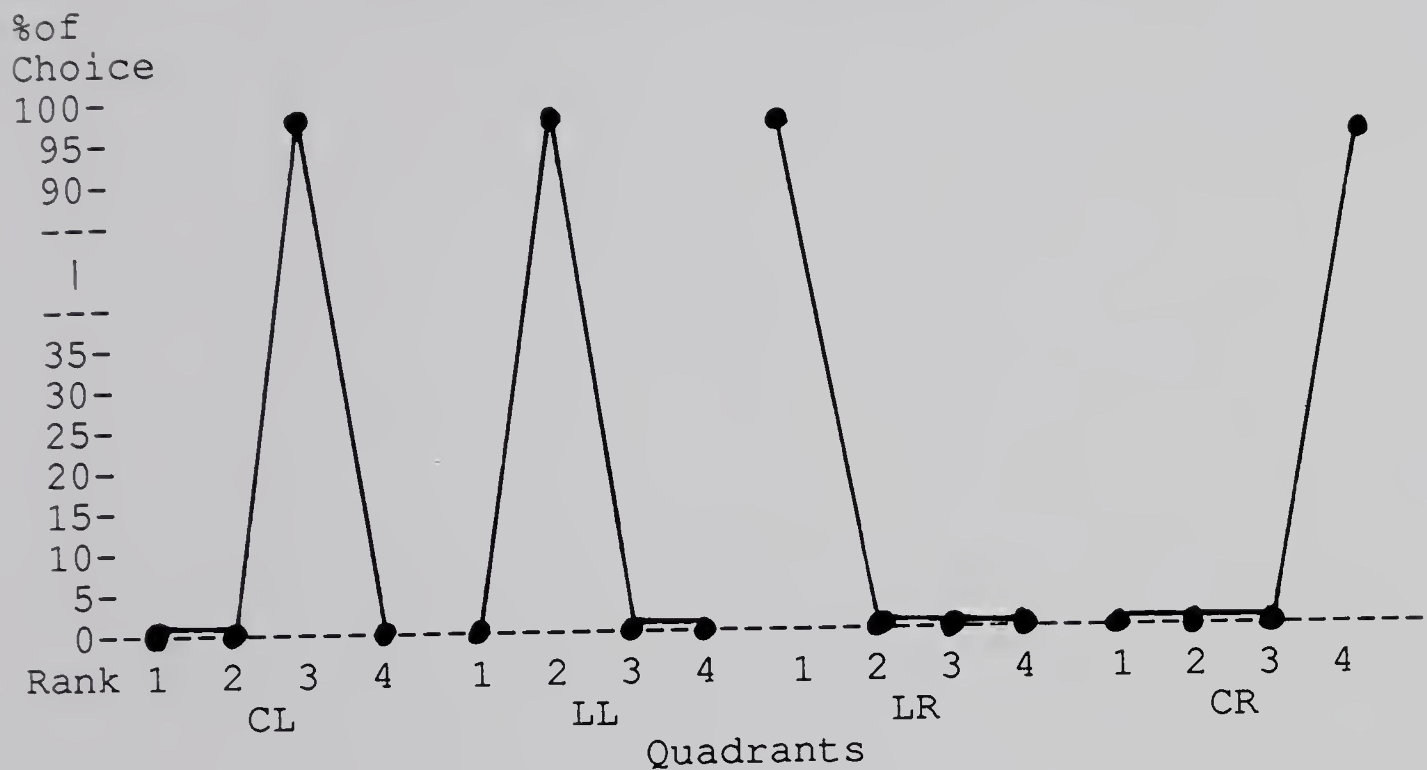
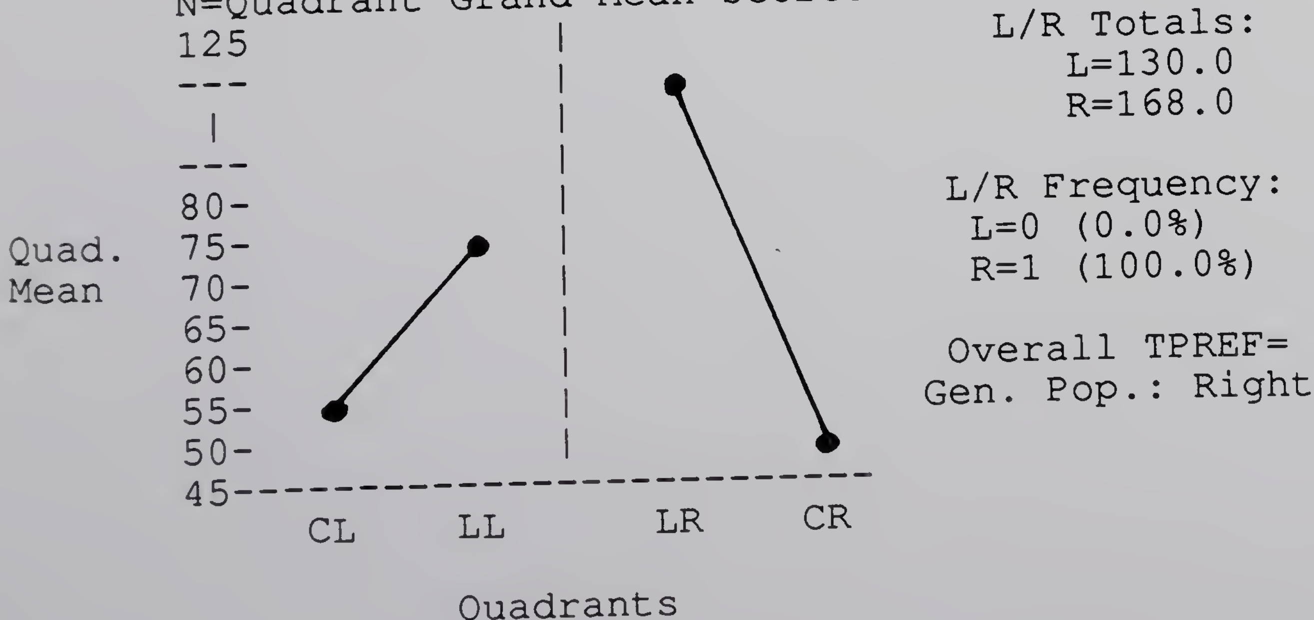


Figure 33

Overall Left/Right Quadrant-Grand Mean Scale Scores
Nurses in the General Population
N=Quadrant Grand Mean Scores for 1000 Nurses



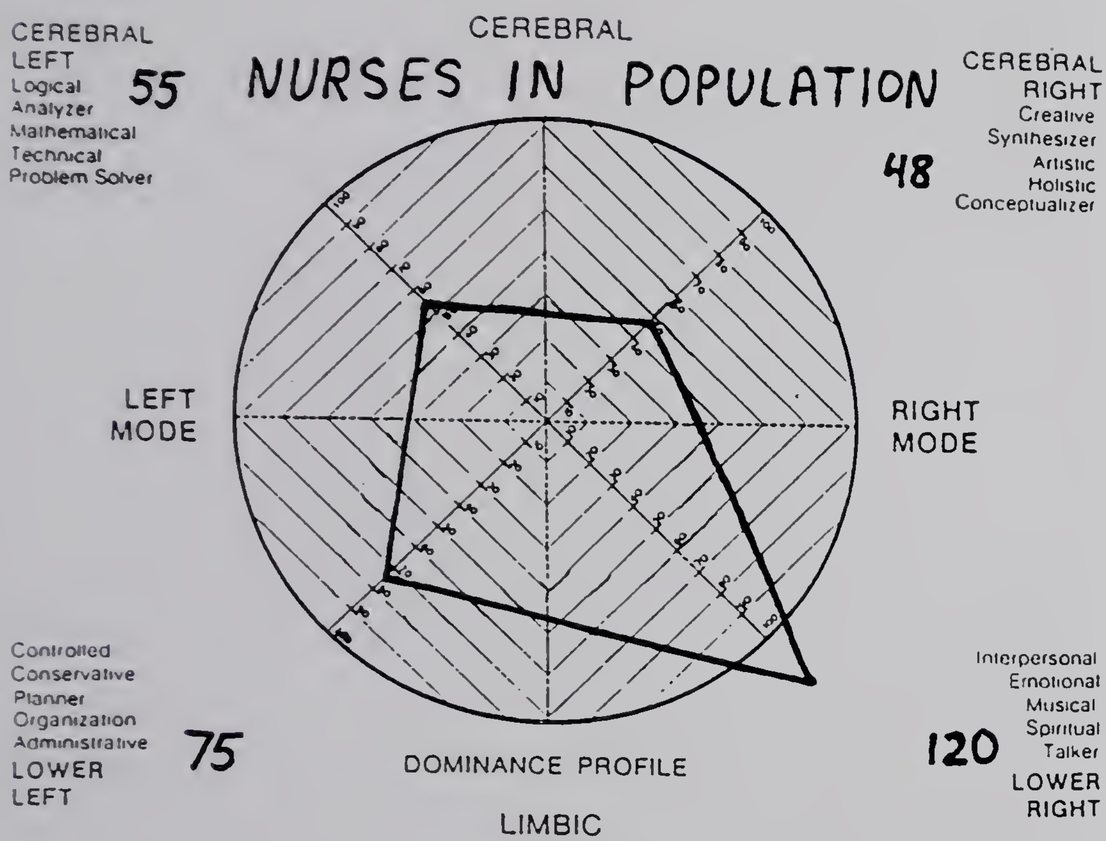


Figure 34
General Nursing Population Profile

Figure 34

Thinking Preference Profile

Nurses in the General Population
Represents Quadrant Grand Mean Scores for 1000 Nurses

Group Average Profile 2-1-1-2

This profile represents a double primary in the limbic area. It is a mirror image reversal of profile 1-2-2-1, which has a double primary in the cerebral area. This profile, 2-1-1-2, is characterized by very strong (primary) preferences in the Limbic Left and Right Quadrants. Primary preferences in the Limbic Left quadrant focus on conservative thinking and controlled behavior with a desire for organization and structure and a preference for detail and accuracy. Persons with a preference in this quadrant tend to be perfectionists.

This profile would also feature an equal preference in the Limbic Right quadrant, which would be characterized by emotional and interpersonal processing coupled with an interest in music and a sense of sprituality. Persons with preferences in this quadrant would also tend to be intuitive with respect to their feelings. The combination of the two primaries in the Limbic quadrants would represent a duality for the person to resolve within themselves, and would involve the opposing qualities of control, structure and dominance compared with the emotional qualities associated with interpersonal interaction, musical, spiritual interests and intuitive feelings.

Another important characteristic of this limbic-oriented profile is the clear secondary preferences in the cerebral area, both in the left mode and the right mode. This indicates that logical, analytic processing is a secondary rather than a primary preference, and that holistic, conceptual, integrative thinking is similarly secondary rather than primary. The two primaries involved in this profile could be described as safe-keeping on one hand and emotional on the other.

Summary

Freshmen Males vs. Freshmen Faculty

From the data on the Total Quadrant Scale Scores, it was found that both Freshmen Males and Freshmen Faculty favored Right-oriented Thinking Preferences overall, and both groups had no significant differences in Total Scale Scores as verified from the results of the Multivariate Analysis of Variance test. For both groups, the Limbic Right Quadrant mode preferences were the most preferred Thinking Preference factors, while the Cerebral Left mode factors were the least preferred preferences.

Both Freshmen Males and Freshmen Faculty preferred Limbic Right Quadrant preferences, but Freshmen Males preferred the Limbic Left and Cerebral Right Quadrant factors more than Freshmen Faculty, which was shown by the 2:1:1:1 Thinking Preference profile for Freshmen Males versus the 2:2:1:2 profile for Freshmen Faculty.

Freshmen Females vs. Freshmen Faculty

From the data on the Total Quadrant Scale Scores, it was found that both Freshmen Females and Freshmen Faculty favored Right-oriented Thinking Preferences overall, and both groups had almost identical Total Scale Scores, yielding no significant differences as verified from the results of the Multivariate Analysis of Variance test. For both groups, the Limbic Right Quadrant mode preferences were the most preferred Thinking Preference factors, while the Cerebral Left mode factors were the least preferred preferences.

Both Freshmen Males and Freshmen Faculty preferred Limbic Right Quadrant preferences, but Freshmen Females preferred the Limbic Left factors more than Freshmen Faculty, which was shown by the 2:1:1:2 Thinking Preference profile for Freshmen Females versus the 2:2:1:2 profile for Freshmen Faculty.

Senior Males vs. Senior Faculty

From the data on the Total Quadrant Scale Scores, it was found that Senior Males favored Right-oriented Thinking Preferences overall, while Senior Faculty favored Left-oriented Thinking Preferences overall, with both groups having very similar Total Right Scale scores. Even though there was a difference in the Left Total Scale Scores between the two groups, there were no overall significant differences between the two groups as verified from the results of the Multivariate Analysis of Variance test.

Senior Males preferred Limbic Left Quadrant mode factors the most and the Cerebral Left Quadrant modes the least, whereas, Senior Faculty, in complete reversal of Senior Males, favored the Limbic Right Quadrant mode factors the most and the Cerebral Right mode factors the least.

Both Senior Males and Senior Faculty preferred Limbic Left and Limbic Right Quadrant preferences, but Senior Males preferred the Cerebral Right Quadrant factors more than Senior Faculty, which was shown by the 2:1:1:1 Thinking Preference profile for Senior Males versus the 2:1:1:2 profile for Senior Faculty.

Senior Females vs. Senior Faculty

From the data on the Total Quadrant Scale Scores, it was found that Senior Females favored Right-oriented Thinking Preferences overall, while Senior Faculty favored Left-oriented Thinking Preferences overall. Both groups had very similar Left-oriented Total Scale Scores, but Senior Females had higher Right-oriented Scale Scores, although the differences were not significant, as verified from the results of the Multivariate analysis of Variance test. For both groups, the Limbic Right Quadrant mode preferences were the most preferred Thinking Preference factors, while the Cerebral Left mode factors were the least preferred preferences for Senior Females, and Cerebral Right mode factors were the least preferred preferences for Senior Faculty.

Both Senior Females and Senior Faculty preferred Limbic Left and Limbic Right Quadrant preferences the most, which was shown by the 2:1:1:2 Thinking Preference profile for Senior Females and the 2:1:1:2 profile for Senior Faculty.

C H A P T E R V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Introduction

The main purposes of this study were:

1. To discover the Thinking Preference (brain dominance) characteristics of Associate degree Nursing students and the relationships of these characteristics to the actual Hemispheric Learning Strategies used by these students in their course work;

2. To discover the relationship of the Thinking Preferences of students to the Thinking Preferences of Nursing Faculty; and,

3. To discuss the educational implications of these findings as they relate to Associate degree Nursing education.

A secondary purpose was to note the general trends of the findings on the Thinking Preferences of the students as they relate to factors such as gender, handedness and handwriting position, and age, which have been suggested in the literature to have some relationship to one's cognitive styles.

This study was undertaken because of the interest the researcher had in discovering the implications that a body of information from the literature and through actual workshop experience had, which suggested that educators should be aware of the importance of knowing the cognitive styles of learners. Data also implied that learning could be enhanced if the cognitive style of the learner more closely approximated the cognitive style of the instructor.

The author chose Nursing students because of the similarity of their overall common goals and because the comparatively equal numbers of students in each academic class would lend itself to comparison studies. In addition, and specific to the Nursing profession, the author was interested in discerning to what extent the Nursing curriculum was addressing some of the recent findings as put forth in the literature which suggested that Nursing education should be promoting more analytical, creative and intuitive thinking and problem-solving skills in the Nursing curriculum. Therefore, discovering the Thinking Preferences of all subjects in the Nursing program would enable Nursing educators to use data gathered as a 'needs analysis' to improve the overall curriculum and to help the students to go from where they are cognitively to where they might want to be, as more whole-brained, confident thinkers and doers. Because of the importance of this development to the Nursing students, and because the Thinking Preferences and Hemispheric Learning Strategies (Methods) of Nursing students and Faculty have not been previously investigated at Springfield Technical Community College, this study seemed appropriate to investigate.

In discussing the findings, the author will follow an order based upon the initially stated research questions. The findings will first be reviewed in summary, and then respectively be followed by conclusions and recommendations for further research.

Summary-Students

Part I

Research Question Number One:

What are the Thinking Preferences and Hemispheric Learning Strategies (Methods) of Freshmen and Senior Associate degree Nursing students, and to what degree are their Thinking Preferences congruent with the Hemispheric Learning Strategies (Methods)?

In order to answer research question number one, data were divided into five categories that included Key

Hemispheric Descriptors; Hemispheric Work Elements; Thinking Preference Factors (Rank Order of Quadrant Preferences; Quadrant Scale Scores; Thinking Preference Profiles); Handedness Profiles and Hemispheric Learning Strategies (Methods). Students were divided into Freshmen and Senior, Male and Female class categories, and then each of these in turn subdivided into 20-and-Under, 21-25, 26-30, 31-35, 36-40, 41-50 and 51-or-over age-group categories for comparison purposes. General and statistical analyses as delineated in Chapter 3 followed data presentation for overall groups and groups by age.

Freshmen Females

Freshmen Females chose more Right-oriented Key Desriptors, favoring a Limbic Left descriptor as the one very best, and the Limbic Right Quadrant most commonly chosen generally and for 'best' descriptors, while least preferring Cerebral Left and Cerebral Right descriptors. This concurs with their preferences for using Limbic Left and Limbic Right Work Elements most often, least preferring to use Cerebral Left and Cerebral Right Work Elements, and in their overall choosing of Limbic Left and Limbic Right Quadrants of all Thinking Preference factors most frequently. This also concurs with the significant positive relationships in this group between overall Left-oriented Thinking Preferences and Cerebral Left ($r=.76$; $p<.001$) and Limbic Left ($r=.65$; $p<.001$) Quadrant scores, and between overall Right-oriented Thinking Preferences and Limbic Right ($r=.84$; $p<.001$) and Cerebral Right ($r=.74$; $p<.001$) Quadrant scores.

The group average Thinking Preference profile, 2-1-1-2, reveals double primary preference strengths in the Limbic Left and Limbic Right Quadrants, with 41% preferring Left- and 59% preferring Right-oriented Thinking Preferences overall, and with the Limbic Right Quadrant the most preferred, and the Cerebral Left Quadrant the least preferred quadrants of all. Results from the Mutivariate Analysis of Variance tests revealed that Freshmen Females were not significantly different from one another or with other students in their class for overall Quadrant Scale Scores.

Freshmen Females had a 'moderate-strong' preference for Left-oriented, and slightly moderate preference for Right-oriented, Hemispheric Learning Strategies they indicated they used for their coursework prior to entering the Nursing program. Simple Analysis of Varaince tests indicated that there were no significant differences between Left or Right Learning Strategy usage by Freshmen Females compared with other groups.

Although they preferred Right-oriented Thinking

Preferences overall, 61% (31) of all Freshmen Females used Learning Strategies that were incongruent to their Right-oriented Thinking Preferences. Of these 31 students, 27 (53%) had Right-oriented Thinking Preferences yet used Left-oriented Learning Strategies, while 4 (8%) students had Left-oriented Thinking Preferences and yet used Right-oriented Learning Strategies. Chi-Square Analysis indicated that there was a significant difference (X2=4.31, p<.05, df=1) between Freshmen Females and Senior Females in their use of Learning Strategies that differed in hemispheric orientation from their Thinking Preference orientation.

Data also indicate that as a group, 88% of Freshmen Females were Right-handed and 88% of them used a Right-Straight and 2% used a Right-Inverted Handwriting Position. Twelve percent of them were Left-handed with 4% using a Left-Inverted and 6% a Left-Straight position. There were, however, no significant relationships between Handedness factors and their Thinking Preferences, Learning Strategies and Key descriptors, but there was a significant positive relationship between Hand Position and Cerebral Right Work Elements (r=.35; p<.01).

Freshmen Males

Freshmen Males chose more Right-oriented Key

Descriptors than Left, with the Limbic Right quadrant the most commonly chosen Quadrant. The Limbic Left was the most commonly chosen quadrant of 'best' descriptors, and the Cerebral Right Quadrant was chosen as having the descriptor that 'best' describes the group. They preferred Limbic Right and Cerebral Right Work Elements the most and Cerebral Left and Limbic Left Elements the least, which concurs with their choosing Limbic Right and Cerebral Right Quadrant factors most frequently.

The group average profile, 2-1-1-1, reveals that 63% preferred Left- and 37% Right-oriented Thinking Preferences, and that they had triple primary strengths for Limbic Left, Limbic Right and Cerebral Right Quadrant modes, with Cerebral Right modes preferred most overall and Cerebral Left preferred the least overall, with Correlation Analyses confirming these findings.

Freshmen Males had slightly greater than 'moderately strong' Left-oriented, and 'slightly moderate' Right-oriented Learning Strategy preferences for their prior coursework. Although they preferred Right-oriented Thinking Preferences, 50% of them used Learning Strategies that were incongruent to their Right-oriented Thinking Preference orientation. Chi-Square Analysis, however, revealed that there were no significant differences between the frequency of this incongruity of

Freshmen Males and other students in their class.

Data also indicate that as a group, 88% of Freshmen Males were Right-handed and 88% used a Right-Straight Handwriting Position, while 12% were Left-handed and 12% using the Left-Inverted handwriting position. There were, however, no significant relationships between Handedness factors and Thinking Preferences, Learning Strategies, Key Descriptors or Work Elements.

Senior Females

Senior Females favored more Right-oriented Key Descriptors than Left, choosing more Limbic Right Descriptors than others and as very 'best' Descriptors of the group. They preferred Limbic Left and Limbic Right Work Elements the most and Cerebral Left and Cerebral Right Elements the least.

The group average profile, 2-1-1-2, reveals that 50% preferred Left- and 50% preferred Right-oriented Thinking Preferences, with double primary strengths in the Limbic Left and Limbic Right quadrant mode preferences, leaning toward more Right-oriented Thinking Preferences overall and the Limbic Right quadrant most of all, the findings of which concur with the results of the Correlation Analysis. Within the Senior Female group, most students were within the 21-35 age-groups and were essentially the same in their Thinking Preference choices, which was verified by the results of the Multivariate Analysis of Variance tests.

Senior Females had a 'moderate-strong' Left-oriented, and a 'moderate' Right-oriented preference for using Learning Strategies in their Nursing I and II courses. Although they preferred Right-oriented Thinking Preferences overall, 38% (16) of all Senior Females used Learning Strategies that were incongruent to their Thinking Preference orientation. Of these 16 students, 14 (35%) had Right-oriented Thinking Preferences yet used Left-oriented Learning Strategies, while 2 (5%) had Left-oriented Thinking Preferences yet used Right-oriented Learning Strategies. Comparing the frequency of these incongruities with those of Freshmen Females by Chi-Square Analysis revealed a siginificant difference ($X2=4.31$, $p<.05$, $df=1$) between these two groups.

Data also indicate that 91% of all Senior Females were Right-handed, with 88% using the Right-Straight Handwriting Position, while 7% were Left-handed, with 10% using a Left-Straight Handwriting Position. There were, however, no significant relationships between Handedness factors and Thinking Preferences, Learning Strategies, Key Descriptors or Work Elements.

Senior Males

Senior Males evenly chose Limbic Left and Limbic Right Key Descriptors most often and for very 'best' descriptors. Though they leaned toward choosing more Left-oriented descriptors and the Cerebral Left Quadrant most often, Limbic Left Quadrant descriptors were chose most for 'best' descriptors. They preferred Limbic Left Work Elements the most and Cerebral Left Elements the least.

The group average profile for Senior Males, 2-1-1-1, along with Quadrant scores, reveals that 43% preferred Left- and 57% preferred Right-oriented Thinking Preferences, with triple primary strengths in the Limbic Left, Limbic Right and Cerebral Right Quadrants, with Limbic Left modes preferred most overall. There were, however, no significant positive or negative relationships between overall Left- or right oriented Thinking Preferences and individual Quadrant scores.

Fifty percent of Senior Males used Left- and 50% used Right-oriented Learning Strategies in their Nursing I and II courses, with a slightly 'moderate' to 'moderate-strong' preference for Left-oriented Strategies, and a slightly 'moderate' preference for Right-oriented Strategies. Although they preferred

Right-oriented Thinking Preferences overall, all six Senior Males used Learning Strategies that were incongruent to their Thinking Preference orientation. Chi-Square analysis indicated that there was a significant difference ($X2=5.58$, $p<.05$, $df=1$) between these incongruities of Senior Males and Senior Females.

Data also indicate that 90% of all Senior Males were Right-handed, with 88% using a Right-Straight and 12% a Right-Inverted Handwriting Position, while no Senior Males were found to be Left-handed. There was a significant positive relationship between Hand Posture and Cerebral Right Key Descriptors ($r=.91$; $p<.01$), but there were no other significant relationships between Handedness factors and Thinking Preferences, Learning Strategies or Work Elements.

All Females

Analysis of the Key Descriptors, Work Elements, Rank Order Preferences, Quadrant Scale Scores and Group Average Profiles of All Freshmen and Senior Females revealed that as a group, their primary Thinking Preference strengths were in both Limbic Left and Limbic Right Quadrant modes (Profiles 2-1-1-2), with Limbic Right Quadrant modes most preferred overall and the Cerebral Left Quadrant modes the least preferred modes overall. In addition, not only did both groups favor Right-oriented preferences overall, they both were very similar in overall Total Scale Score Averages for Left- and Right-oriented preferences (138.4/L-Fr. vs. 140.7/L-Sr.; 151.7/R-Fr. vs. 154.9/R-Sr.).

As a group, they favored Right-oriented Key Descriptors, with 'Emotional', a Limbic Right Descriptor, as the 'very best' overall group Descriptor, while also preferring Limbic Left and Limbic Right Work Elements most and Cerebral Left and Cerebral Right Work Elements least.

Overall, 80% of Freshmen and Senior Female students favored Left-oriented Learning Strategies over Right-Strategies, exhibiting a 'moderate-strong' (5.0) preference average for Left-oriented Strategies versus a slightly 'moderate' (4.2) Right-oriented Strategy-preference average.

The Learning Strategies All Female students collectively indicated they needed to use, involved dealing with things in an 'orderly, detailed fashion, planning, and definite study habits'. This indicates a strong preference for Limbic Left mode Strategies, while dealing 'rationally' related to Cerebral Left modes and 'memorizing general concepts' related to Cerebral Right mode Strategies. As a group, therefore, they perceived the need to rely on Left-oriented Strategies in their coursework, primarily using Limbic Left Strategies and avoiding Cerebral Right modes, even though both groups favored Right-oriented Thinking Preferences.

Nearly twice as many Freshmen as Senior Females saw a need to shift their learning approach and emphasis from their normally preferred Right-oriented Thinking modes to Left-oriented Thinking modes and to adapt Left-oriented Strategies to their coursework prior to the nursing program. Fewer Senior Females than Freshmen Females, on the other hand, preferred to use Left-oriented Learning Strategies, and preferred to use more Right-oriented Learning Strategies which better matched their Thinking Preference orientation.

It could be inferred, then, that based on these findings, that Right-oriented Thinking Preferences and Right-oriented Learning Strategies can be successfully implemented to pass Nursing I and II courses, as shown to be done by most Senior Females. That being the case, then it might be predicted that if all other factors (eg. gender; age; handedness) are kept constant, then Freshmen Females, having the ability to use Left-oriented Learning Strategies in a Left-oriented Nursing program, even though they have an overall Right-oriented Thinking Preference, have the cognitive strengths and potential with their Limbic Left Quadrant strength, to 'reach in and grasp' those Thinking Preferences and use those Learning Strategies that will be needed to successfuly pass Nursing I and II. However, whether or not these or other Freshmen Females will, in fact pass Nursing I and II, and whether or not other factors will play an equal or more important influence on the future success of Freshmen Females can not be discerned from this study.

All Males

The small numbers of Male Nursing students in each group preclude drawing any significant conclusions about what their Thinking Preference and Learning Strategy data may indicate other than overall trends in their cognitive preferences in learning environments.

Analysis of the Key Descriptors, Work Elements, Rank Order of Quadrant Preferences, Quadrant Scale Scores and Group Average Profiles of All Freshmen and Senior Males revealed that as a group their primary Thinking Preference strengths were in the Limbic Left, Limbic Right and Cerebral Right Quadrant modes (Profiles 2-1-1-1). The Limbic Right Quadrant modes were most preferred overall by Freshmen Males, the Limbic Left Quadrant modes most preferred by Senior Males, with the Cerebral Left Quadrant modes the least preferred modes by both groups overall. In addition, although both groups favored Right-oriented Quadrant mode preferences overall, Freshmen had a stronger preference for Right mode preferences than Seniors (156.3/R-Fr. vs. 146.1/R-Sr.), while Seniors had stronger Left mode preferences than Freshmen (128.7/L-Fr. vs. 137.1/L-Sr.).

As a group, although they favored Left-oriented Key Descriptors over Right, they were almost equally in favor of Limbic Left and Limbic Right Descriptors overall and for 'best' descriptors. Both groups favored both Limbic Left and Limbic Right Work Elements the most and Cerebral Left Work Elements the least.

Sixty-four percent of all Males favored Left-oriented Learning Strategies over Right, with Freshmen Males more adamant in choosing Left- than Right-oriented Strategies than Senior Males (5.1/Fr. vs. 4.5/Sr.), although both groups essentially indicated similar preferences for Right-oriented Strategies (4.4/Fr. vs. 4.3/Sr.).

The Learning Strategies they indicated they needed to use, such as 'dealing with things rationally, in a detailed fashion and logically', are related to Cerebral Left-mode Strategies, with 'order and practical use of details' related to Limbic Left and 'generating visual images' Cerebral Right mode Strategies. As a group, therefore, they perceived the need to rely primarily on Cerebral Left and Limbic Left Learning Strategies, while using Cerebral Right mode Strategies to some extent.

Both Freshmen and Senior Male groups were very similar in their perception of what Learning Strategies they needed to use and actually did use for their coursework. As seen by Chi-Square Analysis, there were no significant differences between the frequency of either group for choosing a Learning Strategy with a different Hemispheric orientation than their Thinking Preference.

Based on these findings, keeping all other factors the same, then it can be inferred that since Freshmen Males were essentially similar to Senior Males in cognitive and Learning Strategy preferences, then it might be predicted that Freshmen Males have the potential to successfully pass Nursing I and II. However, as was true for Females, whether or not Freshmen and Senior Males are, in fact, successful in their Nursing program, and whether or not other factors influence the future success of the present Freshmen Male group or future groups, more or less than the cognitive factors described in this study, can not be discerned from this investigation.

Overall Summary

Neither Male nor Female groups indicated a preference for using Limbic Right-oriented Learning Strategies to actually learn the course material or other skills in either prior-to-Nursing coursework for Freshmen or Nursing I and II courses for Seniors. Limbic Right Preferences and Strategies were perhaps more useful in thinking 'as a Nurse', but of little value in actually learning how to learn the information and skills 'to be a Nurse'. The 'bread-and-butter' Limbic Left preferences seemed to carry them through their coursework, with occasional 'flashes' of need and use of Cerebral Left and Cerebral Right Preferences and Strategies.

For a more accurate analysis and comparison of Thinking Preferences with Learning Strategies, upon considering the entire Female group, the question arises as to why 62% of Freshmen Females used Learning Strategies with a Hemispheric orientation that was incongruent to their normally preferred Thinking Preferences orientation? Assuming that both groups were fairly similar in background (entrance requirements, general goals), the difference seemed to be the perception that the Freshmen Female students had of what they thought they actually needed to do (what Strategies were needed to be used) to learn the information for the courses they were taking before entering the Nursing program. These strategies would have varied according to the teaching methodology used in Science and/or Humanities courses, most of which were probably designed according to the traditional lecture format, which by its rigid guidelines and objectives are Left-Brain oriented courses. When exposed to Left-Brain-oriented organization and presentation of material, Freshmen more than Senior Females adjusted their Thinking Preferences in such a way that they could accomodate their cognitive strategies by using Left-oriented Learning Strategies. To them, by matching their efforts with the teaching methodologies, they seemed comfortable in this approach since this was 'the usual' way they were expected to learn the information.

Perhaps, not knowing any other successful way, and not having had enough experience in, or feeling confident with and competent in using their main Right-oriented Thinking Preferences to guide them to use Right-oriented Learning Strategies, Freshmen Females succumbed to the teaching method of the instructor and searched for and found Learning Strategies of opposite preference to match or reflect that which was being presented in their classes. This does not imply that Freshmen students could not have used Right-oriented Learning Strategies, but only indicates that they in fact did not use them. Having many different Instructors in different subject areas did not lend itself to becoming confident with both Left and Right modes of thinking and in using Learning Strategies to match these cognitive preferences situationally where the teaching methods varied and called for a change of strategy for optimum learning.

During the first year of the Nursing Program, Senior Females may have found the Nursing curricula, philosophy, goals and teaching methodologies of Nursing Faculty a little more consistently compatible with the goals and teaching methods that they were used to experiencing, and in such a more stable environment, felt that they would be more supported for their efforts. In this environment, they were better able to be aware of and consistently try-out what Learning Strategies did or did not work for them, or what Strategies they did not need to use. Perhaps, they felt that they were already in the program and could predict more readily what would be expected of them in their Nursing I and II courses. They might have felt more comfortable than Freshmen (or they themselves) had prior to entering the program, in using Learning Strategies that they were more comfortable with because they matched their Thinking Preferences much better, and they didn't need to struggle to use Learning Strategies that didn't match their strongest Thinking Preferences.

The fact that both groups of students surveyed succeeded in their courses indicates their potential to access other neurocognitive modes when needed other than their strongest preferences. However, data do not indicate the degree to which they did this, nor the degree to which they could/could not have done better/worse had they used their preferred Right-oriented Thinking Preferences and matched them with Right-oriented Learning Strategies. Data from other related research (Douglass,1979; Cafferty, 1980) indicate that matching the cognitive style of the student with that of the Instructor is conducive to more optimal learning. However, the degree that this would be true for Nursing students could not be discerned from this study and awaits further research.

Handedness, Gender and Thinking Preferences

Though not a primary focus of this study, a brief review of the findings on Handedness, Handwriting Position and Gender, as they relate to the data on the Thinking Preferences and Learning Strategies surveyed in this study, will follow.

Handedness and Thinking Preferences

Much controversy still exists concerning the value in using handedness and handwriting positions for predicting cognitive functions, and for drawing conclusions for educational purposes, which in the past has generated conflicts of which can be confirmed by the findings of Levy and Reid (1976), Heron, et al., (1979), Moskovitch and Smith (1979), McKeever and Van Deventer (1980), and Tapley and Bryden (1983).

LeMay and Culebras (1970) and Hochberg and LeMay (1975) found increased sizes of the left parietal lobes already present in fetal life, perhaps indicating the development of predetermined language centers first in most individuals already at birth, before a strong hand preference occurs. Considering that there is a lifetime of experiences yet ahead to influence the development of one's cognitive potentials and preferences, it would seem doubtful that one's handedness strengths and position preferences that develop after language centers have developed, can be used for anything much more than inferring the locus of motor control for that hand. To use handedness as a predictor of success in a course or in career counseling, based on such conflicting evidence, would be illfounded and irresponsible.

Instead of viewing handedness in a self-serving way to predict language-related success, why not be concerned with developing everyone's cognitive potentials irregardless of one's handedness preferences? In fact, Way (1981) failed to find significant differences in handedness in occupational choice among college students, and for 'traditional', white, middle class college students, he found no difference in handedness laterality distributions.

Interestingly, Way's (1981) results concur with the findings of this study, whereby, even though Males were slightly more Right-handed, collectively, 92% of Male and Female student groups were both Right-handed. Eighty-eight percent used the Right-Straight Handwriting Position, with Females having slightly more Left-handers of those using a Left-Straight position. For All students considered collectively, there was a significant negative relationship between Hand Position and Limbic Left Key Descriptors ($r=-.24$; $p<.01$), and significant positive relationships between Hand Position and Cerebral Right Work Elements ($r=.27$; $p<.01$), and between Handedness Strength and Cerebral Right Work Elements ($r=.29$; $P<.01$). There were, however, no other significant relationships between Handedness factors and Thinking Preferences or Learning Strategies.

Since other Allied Health students were not surveyed, it is not known whether the incidence of handedness discerned from this study is peculiar only to Nursing students, nor does it portend to imply something significant as regard to the predictive value for success in the Nursing program. The incidences of Left- and Right-handedness of Freshmen and Senior students in this study is in line with the generally acceptable values in western society of 90% frequency for Right-handedness, and 8-16% frequency for Left-handers, as was suggested by Geschwind and Levitsky (1968) and Spiegler and Yeni-Komshian (1983). Given that both Freshmen and Seniors were able to use Left- and Right-oriented Thinking Preferences to successfully pass their coursework, then knowing the handedness preference of a student Nurse does not inform us as to the ways or neurocognitive mechanisms that are at work that result in learning in college courses, nor can it be of value to predict which Learning Strategies are the most successful ones to use.

Gender and Thinking Preferences

It has been found from various tests of brain lateralization that women show a smaller degree of cerebral asymmetry (ie., are less lateralized) than men.

Hypotheses that have attempted to explain the significance of these claims with implications for education and the development of cognitive skills have not really explained whether there are in fact real differences in cognitive abilities due to ones gender, nor whether gender by itself can be used to predict success or failure in educational endeavors. In other words, is it better to teach toward the purported sex differences in brain functioning, or should all people be taught all subjects without regard to the findings of brain lateralization test differences for gender? Assuming that a student can not learn and should not be taught a particular subject or concept because of gender, goes a long way in acting in a self-serving way to convince others that a particular gender is not suited for a particular career, but is very short on having hard facts to prove that you have a valid reason for doing so.

Ray (1976), Witelson (1976) and McGlone (1977) have shown that males have their cerebral hemispheres more lateralized with regard to increased activity on either side for a particular cognitive function. When performing visual tasks, males have increased right-sided activity more than left, and for verbal tasks, there results in increased left hemisphere activity more than right, while females show a more balanced activity for either task.

However, even though females may be better able to access each hemisphere through an enlarged corpus callosum (Herrmann, 1984), Bunch (1983) has found that not all females have been able to take advantage of this potential.

Therefore, of what value is it to insist that there are sex differences in cognitive and career potential and to suggest that each gender be treated differently in education? Though data in this study are limited to Associate degree student Nurses, and there are a little more than six times as many Females as Males in the study, some overall comparisons can be made to what has been put forth in the literature.

Data from this study indicated that both Males and Females overall had higher Right-oriented Total Scale Scores than Left Total Scale Scores (279.1/L--306.6/R for Females vs. 265.8/L--302.4/R for Males). Females had both higher Left-oriented overall Total Scale Scores (279.1/Fs. vs. 265.8/Ms.), and higher Right-oriented Scale Scores than Males (306.6/Fs. vs. 302.4/Ms.). Analysis of the difference between the Left and Right Total Scale Scores reveals that Females had a smaller Left/Right difference than Males (27.5/Right bias -Females vs. 36.6/Right bias-Males), which in general, concurs with the previously sited studies that suggest that males are more latralized than females. This only confirms for males the claim by Hines (1981) that androgens affect the Right side of the male brain more than the left, assuming that males used their right hemispheres for cognitive tasks more than their left.

In addition, when comparing Total Scale Scores for each quadrant of Herrmann's Instrument for Males versus Females, it was seen that Females had higher Total Scores than Males in the Cerebral Left (115.5/Fs. vs. 107.1/Ms.), Limbic Left (163.6/Fs. vs. 160.1/Ms.), and Limbic Right (174.2/Fs. vs. 166.7/Ms.) Quadrants, but Males had higher Scale Scores in the Cerebral Right Quadrant than Females (154.6/Ms. vs. 132.4/Fs.), suggesting that Females had a stronger Left-orientation than did Males in their thinking. When the Scale Scores for each quadrant are analyzed, it can be seen that both groups chose, from highest preference to lowest, the order of Limbic Right, Limbic Left, Cerebral Right, and Cerebral Left Quadrants, indicating overall similarity of Thinking Preferences by both Male and Female groups. This was confirmed by the results of the Multivariate Analysis of Variance tests that did not find any significant difference between Quadrant Scale Scores for either Males or Females.

From the data, it seems that Females are a little more balanced in their Thinking Preference choices than Males, as the difference between Left- and Right-oriented Total Quadrant Scores were closer together for Females than for Males. However, since Females are not significantly different from Males for Quadrant choices, and Females have higher Left/Right Scores than Males, it seems that Females are not quite as balanced in their actual usage of both hemispheres for their preferred Thinking Preferences, as might be expected from the literature, even though they may anatomically have both hemispheres developed more evenly than Males. Although low numbers of Male subjects preclude any definite conclusions on this matter, it could be said that even though Males had a higher Cerebral Right Quadrant Scale Score than Females, and generated a primary preference for that Quadrant, Males were not as assymetrical as might have been expected by findings in the literature.

Given the direction of the statistically verified similarities of both groups, there seems to be reason to infer, all factors held constant, that either group is on fairly equal ground to either be successful or not in the Nursing program.

Summary-Students vs. Faculty

Part II

Research Question Number Two:

What are the Thinking Preferences of the Nursing Faculty, and to what degree are their Thinking Preferences congruent with the Thinking Preferences of the Freshmen and Senior Nursing students?

Data to answer research question number two were divided into three categories that included Key Hemispheric Descriptors, Hemispheric Work Elements and Thinking Preference Factors (Rank Order of Quadrant Preferences; Quadrant Scale Scores; Thinking Preference Profiles) for Freshmen and Senior Nursing Faculty. Faculty were divided into two groups according to the student level they taught, which resulted in six faculty members for each student group. The following is a composite summary of all of the factors incorporated into the Thinking Preference findings, along with comparisons to students.

Freshmen Females vs. Freshmen Faculty

Both Freshmen Females and Freshmen Faculty favored Right-oriented Thinking Preferences, and both preferred

Limbic Right Quadrant mode preferences the most and Cerebral Left modes the least. Freshmen Females also favored more Limbic Left preferences than did Freshmen Faculty, as indicated by Freshmen Females having a 2-1-1-2 profile versus a 2-2-1-2 profile for Freshmen faculty.

Freshmen Females have a stronger Limbic Left mode preference than Freshmen Faculty, and have shown that for those students with a Right-oriented Thinking Preference bias they could actually use Left-oriented Learning Strategies succesfully. Considering that the Nursing program is organized and generally taught in a Left-brain-oriented fashion, then it would seem that Freshmen Females would have the potential to successfully pass the Nursing courses and succeed in the program, assuming all other factors influencing their achievement are held constant. Furthermore, the fact that Senior Females did not have any significant differences in their Thinking Preference scores, and have on the whole been successful with a similar 2-1-1-2 profile, lends more weight to implying that Freshmen Females theoretically have the Thinking Preference strengths to get through the Nursing program. This does not imply, however, that a 2-1-1-2 profile is the only one, the best one, or the least preferred one for student Nurses to have, and does not definitely predict success or failure in the program.

Freshmen Males vs. Freshmen Faculty

Both Freshmen Males and Freshmen Faculty favored Right-oriented Thinking Preferences, and both preferred Limbic Right mode preferences the most and Cerebral Left modes the least, the findings of which concur with there not having any significant differences between themselves for Quadrant Scale Scores. In addition, Freshmen Males preferred Cerebral Right mode preferences as primary strengths, to go along with their primaries in the Limbic Left and Limbic Right Quadrants (2-1-1-1 profile), while Freshmen Faculty only had primaries in the Limbic Left and Limbic Right Quadrants (2-1-1-2 profile). Data indicate then, if all other factors are held constant, Freshmen Males have the cognitive potential to get through the Nursing program, and have the Thinking Preference potential for what is needed to do so. Data does not discern whether Freshmen Males will, however, actually get through the program, but only infers the potential to do so.

Senior Females vs. Senior Faculty

Senior Females preferred Right-oriented Thinking Preferences, while Senior Faculty favored Left-oriented

Preferences. Both groups chose Limbic Right modes as the most preferred, while Senior Females found the Cerebral Left and Senior Faculty the Cerebral Right, modes the least preferred. Though both groups differed on specific Quadrant preferences that they liked least, which might have accounted for the secondary preferences in the Cerebral Left and Cerebral Right Quadrants, they both had the same profile of 2-1-1-2, and there were no significant differences between Quadrant Scale Scores of either group.

Most of the Senior Females indicated that they used Right-oriented Learning Strategies in their Nursing I and II courses, which, even though the program and presentation is Left-Brain oriented, did not seem to interfere with them successfully passing the courses. Since Senior Females found Cerebral Left modes the least preferred, it can be assumed that their success was partly based on their use of their Limbic Left Thinking Preferences to help them organize themselves in the courses, and partly based for most students in having the ability to feel confident enough to use Right-oriented Learning Strategies for these same courses. Though the potential to complete the Nursing program is present, data from this study can not predict the actual outcome of that endeavor.

Senior Males vs. Senior Faculty

Senior Males preferred Right-oriented Thinking Preferences while Senior Faculty favored Left-oriented Thinking Preferences. Whereas, Senior Males preferred the Limbic Left quadrant most and Cerebral Left modes the least (2-1-1-1 profile), Senior Faculty preferred Limbic Right modes the most and Cerebral Right modes the least (2-1-1-2 profile). Even though they had somewhat opposite Quadrant preferences, there were no significant differences between Quadrant scores for either group.

Data indicate that that Senior Males were able to adapt to the overall Left-oriented Nursing program with their Right-oriented Thinking Preferences by using their Limbic Left Thinking modes and being able to either use Left- or Right-oriented Learning Strategies. Though the potential to complete the Nursing program is present, data from this study can not predict the actual outcome of that endeavor.

Overall Conclusions

Ornstein (1978) suggests that schools offer educational experiences for half our brains, mostly the left-half, with a need to reinstate a balance in emphasis with more Right-brained activities. Nursing program are generally organized and taught according to the guidelines as set forth by the National League for Nursing, which means they lean heavily toward Left-oriented practices. However, since the majority of both faculty and student groups had Right-oriented Thinking Preferences and they were not significantly different in these Preferences, indicates that the Nursing Faculty and program does not exclude Right-oriented Thinking and practices to the degree that Ornstein infers might be the case. It does not seem apparent that there is a need to rush to promote Right-oriented activities to overcompensate for a Left-oriented program, since the Nursing program subsumes Right-oriented interpersonal skills, and since Nursing students in general seem to be cognitively flexible enough to use and adjust their Thinking Preferences and Learning Strategies to succeed in the Nursing program, irregardless of the teaching strategies used.

However, this does not imply that no more effort or emphasis is needed in expanding the use of the presently-indicated Limbic-oriented Thinking Preferences and practices, which, even though they are strong enough to create a balanced Thinking Preference usage, do not assist in the expanded development of the students' cognitive potential.

Since there are many inter-individual differences among learners, educators have long sought to attempt to relate the cognitive functionings of the learner to a more appropriate method of instruction, which would lead to greater achievement gains in subject matter acquisition and retention. Coop and Brown (1970) suggests that learners with certain cognitive styles are either facilitated or hampered by the particular teaching methods to which they are exposed. Cognitive style not only operates to influence how well a student learns, but also what kind of content the learner chooses to attend to and what content he/she would rather ignore or get out of the way as fast as possible.

Community college students have been found to enjoy being involved in planning, conducting and evaluating their own learning and in setting performance standards for them to achieve as part of their evaluation (Kerwin, 1981-82; Tracy and Schuttenberg, 1986). Using this involvement-approach is an effective way of introducing andragogical concepts and practices involved with helping adults learn, into a community college curriculum. Davenport and Davenport (1986) suggest that instructors consider a blend of pedagogical and andragogical techniques for many groups of learners since few, if any, groups are primarily andragogical or pedagogical. They also found that female college students were more andragogically-oriented than males and, therefore, instructors should consider somewhat more andragogical approaches for female students. Furthermore, Van Allen (1982) found there was a general absence of an andragogical attitude within the student and faculty populations of community colleges they studied, with student and faculty educational attitudes described as neutral though slightly leaning toward pedagogy, which is associated with educational traditionalism, versus a more progressive attitude related to andragogy.

Since the Limbic Left and Limbic Right-mode Quadrant preferences and Limbic Left Learning Strategies are already strongly ingrained and implmented in the Nursing program, there seems a definite need to develop more of the Cerebral Left and Cerebral Right-mode cognitive skills, encompassing more andragogical methods, for all groups of students and faculty concerned in the Nursing field. It is not that Nursing students aren't whole-brained, but rather they are not taking advantage of the potential of half of each side of their brain encompassed by the Cerebral Left and Cerebral Right Quadrants of Herrmann's Instrument. Nursing students and Faculty are too ingrained with only using their Limbic cognitive skills, those safe-keeping cognitive styles that are useful and practical at the time, but do not promote extended creative and analytical thinking skills, which have been recently touted as so very necssary in the fast-paced, ever-changing technologically-based medical profession (Cowan and Wiens, 1986; Johnson, 1986; Malek, 1986; Hammes and Duryea, 1986-87; Pinkerton, Primm, Smeltzer, and Walker, 1987).

Malek (1986) stresses that in a profession where situations change rapidly, Nurses cannot depend upon routinized behavior, procedure manuals, or traditions to guide clinical judgement and decision making. They must develop the ability to make guided decisions drawn from sound, rational bases in order to respond appropriately under the stress of fast-paced clinical environments, all of which makes the development of critical thinking an indispensible component of education for clinical Nursing practice. Developing the students' ability to think critically is best supported through efforts of clinical faculty who are comfortable with teaching strategies that foster this skill (Malek, 1986).

In view of the trend to make the BSN degree the educational requirement for entry into professional Nursing, with the Associate degree the educational requirement for entry into Associate (Technical) Nursing, strengthening the cognitive skills by emphasizing more Cerebral Left and Right-modes of thinking of associate Nurses will help them handle the rigors of advanced educational training. For, as Styles (1987) suggests, the Nursing profession needs adventurers in Nursing to use their imaginations to push into unknown and untried facets of their profession, as well as the practical supporters that help make dreams realities.

If a goal of Nursing education is to develop and foster independent, critical and creative thinkers, problem seers and problem solvers, as well as facilitators and leaders in the Nursing profession, then more emphasis must be placed on enhancing the abilities to access and make situational-use of the Cerebral Left and Cerebral Right Quadrant mode Thinking Preferences, and to strive to develop more of a whole-brained, 1-1-1-1-type profile. This would enable the students to be more well-balanced cognitively, but still have sufficiently strong preferences to be able to process information effectively in each of the specialized

Quadrants in a situational-need basis.

If Cerebral Left and Cerebral Right Quadrant modes are not strengthened and developed, where are the new solutions, insights and critical, analytical decisions coming from? Is it possible that the same techniques, philosophy, strategies, solutions and goals are being applied, reapplied and stressed to problems and situations that are both old and new? Since there is potential in all of us to develop these unstressed and unused thinking modes, could it be possible that if given the chance, these students may provide Nursing and health care with innovative and more progressive solutions to old and new problems? Can health care individuals look the other way and dare not promote more critical and creative thinking skills in their profession?

The challenge, then, lies with the Nursing Faculty, to reassess and readjust their Nursing curriculum and teaching methodology in light of these and other research findings, in order to not only assist their students in passing the State Nursing Boards, but also in preparing for all of the demanding and unexpected neurocognitive demands that lie ahead for them after graduation. This emphasis will go a long way toward developing a more experienced, confident, competent and whole-brained Nurse that will in turn provide a good foundation and stimulus for the students to remain intellectually-curious throughout their lives and become life-long learners and leaders in the Nursing profession.

Recommendations

Based on the findings of this study and the future trends in the Nursing and Health professions, it is recommended that:

1. Nursing Faculty be made aware of their students' and their own Thinking Preferences in order to better understand each other and to work in a synergistic manner for the benefit of both parties in developing whole-brain neurocognitive competencies within the Nursing program.

2. Nursing Faculty perceive the value of discovering that the knowledge of the Thinking Preferences and Hemispheric Learning Strategies of their students affords them with a glimpse of the actual neurocognitive mechanisms that the students actually used and relied on in their coursework. This new information can then be used as a 'needs analysis' by Faculty in readjusting and improving curricula guidelines and objectives that are more in line with assisting in strengthening weaker modes and enhancing those cognitve and psychomotor skills that need

to be improved in their students.

3. Nursing Faculty evaluate their curricula with an eye toward developing class and clinical strategies, simulations and problem-solving situations that promote the use and development of Cerebral Left and Cerebral Right mode Thinking and Learning Strategies, to simulate actual real-life situations that students will face that may require the use of these modes more than the other modes. This may entail redesigning the time-frame (calendar) needed for the Associate degree in Nursing as well as readjusting the emphasis of the curricula. Perhaps, including as mandatory, special clinical-type simulations/mock hospital problem-solving, trouble-shooting, small group hands-on workshops or mini-courses during the summer sessions, which would be geared toward strengthening the Cerebral Left and Right Thinking modes of which there is less emphasis during the regular Fall-Spring semester sequence.

Recommendations for Further Research

Further research is needed to:

1. Try to more fully understand the role that Thinking Preferences have in affecting learning and teaching.

2. Try to understand how one's Thinking Preferences can affect one's overall neurocognitive potential.

3. Try to elucidate the relationship and interactions that gender, age, handedness, and handwriting position has to one's Thinking Preferences.

4. Try to more fully investigate the relationship between Thinking Preferences and Learning Strategies used.

5. Try to investigate the relationship between the Thinking Preferences, Learning Strategies and other related data of students who did not pass Nursing I and/or II, and are either repeating the first year Nursing courses, or have dropped out of the program altogether.

6. Try to investigate the interaction of Thinking Preference and Learning Strategy data with Achievement Scores (SAT; Nelson-Denny) and Quality Point Averages on a long term basis in order to generate a more complete data base for practical use by Nursing educators.

These efforts should promote an increased awareness of the special needs and potentials of each individual learner, and go a long way in stimulating people to want to learn and to feel free and confident to try out new and/or old-but-inhibited ideas and strategies to promote lifelong learning.

APPENDIX

Table 15

<u>Consent Form</u>

S.T.C.C.
Springfield, Mass.

To: Nursing Faculty, STCC
From: George J. Leslie, Biology Dept., STCC

Dear Nursing Instructor:

This semester, as part of my Doctoral Dissertation, I will be conducting a small exploratory study with the Nursing Faculty in order to determine the thinking preferences of Nursing Instructors. One (1) paper-and-pencil survey questionnaire will be used and will take approximately 25-35 minutes in one sitting to complete.

The information from this questionnaire and the data generated will be used <u>only</u> by me in my dissertation, and at <u>no</u> time will any data be known to other students, instructors, or administrators, <u>nor</u> will the data be reflected in anyone's personnel file. Your name will <u>not</u> appear in the final study, and will <u>only</u> be used to assist in collecting, collating and scoring the questionnaires.

Your participation in the completion of this questionnaire and allowing me to use the data generated in my dissertation is completely voluntary on your part.

Would you please check and sign one of appropriate spaces below.

Thank you very much.

_________ I am willing to complete the questionnaire indicated above, and have the data that is generated be used for the research purposes stated above. I understand that I have the right to withdraw the data generated from my completing the questionnaire at any time during the course of this research.

_________ I am unwilling to complete the questionnaire indicated above, and have the data that is generated be used for the research purposes stated above.

Date:__________________ Signed:________________________

Table 16

<u>Consent Form</u>

S.T.C.C.
Springfield, Mass.

To: Freshmen/Senior Nursing Students, STCC
From: George J. Leslie, Biology Dept, STCC

Dear Student:

This semester, as part of my doctoral dissertation at the University of Massachusetts, I will be conducting a small exploratory study with the nursing classes in order to determine the Thinking and Preferences and Learning Strategies of nursing students. Two (2) paper-and-pencil survey questionnaires will be used and that will take approximately 45-50 minutes in one sitting to complete.

The information from these questionnaires and the data generated will be used <u>only</u> by me in my dissertation, and at <u>no</u> time will any data be known to other students or instructors, <u>nor</u> will the data be reflected in anyone's grade or personal file. Your name will <u>not</u> appear in the final study, and will only be used to assist in collecting, collating and scoring the questionnaires.

Your participation in the completion of these questionnaires and allowing me to use the data generated in my dissertation is completely voluntary on your part.

Would you please check and sign one of appropriate spaces below.
Thank you very much.

_________I am willing to complete the two (2) questionnaires indicated above, and have the research data that is generated be used for the research purposes stated above. I understand that I have the right to withdraw the data generated from my completing both questionnaires at any time during the course of this research.

_________I am unwilling to complete the two (2) questionnaires indicated above, and have the data that is generated be used for the research purposes stated above.

Date:______________ Signed:______________________

Table 17

8-1-81 (Revised 4-1-83) HERRMANN PARTICIPANT SURVEY FORM

DIRECTIONS Answer each question by writing the appropriate words or marking in the box or space provided. Since this is not a test, there are no right or wrong answers. You are only indicating your preferences. For definition of terms used, refer to the glossary on the back of the 20 Questions Form

I. BIOGRAPHICAL INFORMATION

1 Name ______________________ 2. Sex: Male ______ Female ______

3 Educational Focus or Major ______________________

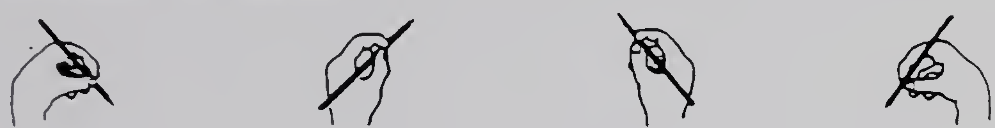
4 Occupation or Job Title ______________________

Describe the nature of your work ______________________

____

II. HANDEDNESS

5 Which picture most closely resembles the way you hold a pencil? Mark A, B, C, or D.



A ☐ B ☐ C ☐ D ☐

6 Strength and direction of your handedness: Mark A, B, C, D, or E.

A ☐	B ☐	C ☐	D ☐	E ☐
Primary Left	Primary Left Some Right	Both Hands Equal	Primary Right Some Left	Primary Right

III. BEST/WORST SUBJECTS

Thinking back to your best/worst subjects in elementary or secondary school please rank the following subjects with a 1, 2, or 3 on the basis of how well you did. Rank all three subjects: 1 is best, 2 is second, 3 is third best. Record your ranks in the boxes.

☐ 7. Math ☐ 8. Foreign Language ☐ 9. Native Language or Mother Tongue

IV. WORK ELEMENTS

Indicate your response to <u>each</u> of the work elements below using the following key:

5 = Work I do best
4 = Work I do well
3 = Neutral
2 = Work I do less well
1 = Work I do least well

Do not exceed more than 4-5's, 4-4's, 4-3's, 4-2's or 4-1's. Leave <u>no</u> Blanks

10 ____ Analytical
11 ____ Administrative
12 ____ Conceptualizing
13. ____ Expressing Ideas
14 ____ Integration
15. ____ Writing
16. ____ Technical Aspects
17 ____ Implementation
18. ____ Planning
19. ____ Interpersonal Aspects
20. ____ Problem Solving
21. ____ Innovating
22. ____ Teaching/Training
23. ____ Organization
24. ____ Creative Aspects
25. ____ Financial Aspects

V. KEY DESCRIPTORS

Select the eight adjectives which best describe the way you see yourself and mark a "2" by each. Then change a single "2" to a "3" for the adjective which best describes you.

26 ____ Logical
27 ____ Creative
28. ____ Musical
29 ____ Sequential
30 ____ Synthesizer
31 ____ Verbal
32 ____ Conservative
33 ____ Analytical
34 ____ Detailed
35. ____ Emotional
36. ____ Spatial
37 ____ Critical
38. ____ Artistic
39. ____ Spiritual
40. ____ Rational
41 ____ Controlled
42. ____ Mathematical
43. ____ Symbolic
44 ____ Dominant
45. ____ Holistic*
46. ____ Intuitive
47. ____ Quantitative
48. ____ Reader
49. ____ Simultaneous
50. ____ Factual

*(Can see the forest as contrasted with the trees.)

VI. HOBBIES

Indicate a maximum of 6 hobbies you are actively engaged in by marking a "3" for your major hobby, "2" for primary hobbies and "1" for your secondary hobbies.

51. ____ Arts/Crafts
52. ____ Boating
53. ____ Camping/Hiking
54. ____ Cards
55. ____ Collecting
56. ____ Cooking
57. ____ Creative Writing
58. ____ Fishing
59. ____ Gardening/Plants
60. ____ Golf
61. ____ Home Improvements
62. ____ Music/Listening
63. ____ Music/Playing
64. ____ Photography
65. ____ Reading
66. ____ Sailing
67. ____ Sewing
68. ____ Spectator Sports
69. ____ Swimming/Diving
70. ____ Tennis
71. ____ Travel
72. ____ Wood Working

(Other) ____________________

____

VII. ENERGY LEVEL

73. Thinking about your energy level or "drive", SELECT the ONE which best represents you. Mark A, B, or C.

A ☐ "Day Person" B ☐ "Day/Night" Equally C ☐ "Night Person"

VIII. MOTION SICKNESS

74. Have you ever experienced motion sickness (nausea, vomiting) in response to any kind of vehicular motion (such as car, boat, plane, bus train, amusement ride)? Number of times: Mark A, B, C, or D.

A ☐ None B ☐ 1-2 C ☐ 3-10 D ☐ More than 10

75. Can you read while traveling in a car without stomach awareness, headache, nausea or vomiting? Mark A or B.

A ☐ Yes B ☐ No

IX. ADJECTIVE PAIRS

Which word or phrase in each pair is more descriptive of yourself? Answer each of the questions (#'s 76-99 inclusive) Leave no blanks. Choose only "A" or "B" for each.

	Column A	Column B
76.	☐ Conservative	☐ Empathetic
77.	☐ Analyst	☐ Synthesizer
78.	☐ Quantitative	☐ Musical
79.	☐ Problem Solver	☐ Planner
80.	☐ Controlled	☐ Creative
81.	☐ Original	☐ Emotional
82.	☐ Feeling	☐ Thinking
83.	☐ Interpersonal	☐ Organizer
84	☐ Spiritual	☐ Creative
85.	☐ Detailed	☐ Holistic
86.	☐ Originate Ideas	☐ Test & Prove Ideas
87.	☐ Warm, Friendly	☐ Analytical

	Column A	Column B
88.	☐ Imaginative	☐ Sequential
89.	☐ Original	☐ Reliable
90.	☐ Creative	☐ Logical
91.	☐ Controlled	☐ Emotional
92.	☐ Musical	☐ Detailed
93.	☐ Simultaneous	☐ Empathetic
94.	☐ Communicator	☐ Conceptualizer
95.	☐ Technical Things	☐ People Oriented
96.	☐ Well Organized	☐ Logical
97.	☐ Rigorous Thinking	☐ Metaphorical Thinking
98.	☐ Like Things Planned	☐ Like Things Mathematical
99.	☐ Technical	☐ Dominant

X. INTROVERSION/EXTROVERSION

100. Where would you place yourself on this scale? Mark an "X" in one of the boxes on the scale between introvert and extrovert.

INTROVERT ☐——☐——☐——☐——☐——☐——☐——☐——☐ EXTROVERT

8-1-81(Revised 5-1-83)

HERRMANN 20 QUESTIONS

Name ______________________________

DIRECTIONS: Answer each question by marking an "X" in the appropriate column.

	Strongly Agree	Agree	In Between	Disagree	Strongly Disagree
1. I feel that a step by step method is best for solving problems.					
2. Daydreaming has provided the impetus for the solution of many of my more important problems.					
3. I like people who are most sure of their conclusions.					
4. I would rather be known as a reliable than an imaginative person.					
5. I often get my best ideas when doing nothing in particular.					
6. I rely on hunches and the feeling of "rightness" or "wrongness" when moving toward the solution to a problem.					
7. I sometimes get a kick out of breaking the rules and doing things I'm not supposed to do.					
8. Much of what is most important in life cannot be expressed in words.					
9. I'm basically more competitive with others than self-competitive.					
10. I would enjoy spending an entire day "alone with my thoughts.					
11. I dislike things being uncertain and unpredictable.					
12. I perfer to work with others in a team effort rather than solo.					
13. It is important for me to have a place for everything and everything in its place.					
14. Unusual ideas and daring concepts interest and intrigue me.					
15. I prefer specific instructions to those which leave many details optional.					
16. Know-why is more important than know-how.					
17. Thorough planning and organization of time are mandatory for solving difficult problems.					
18. I can frequently anticipate the solutions to my problems.					
19. I tend to rely more on my first impressions and feelings when making judgements than on a careful analysis of the situation.					
20. I feel that laws should be strictly enforced.					
	Column A	Column B	Column C	Column D	Column E

Table 18

STUDENT CODE: NAME:

STUDENT LEARNING STRATEGIES QUESTIONNAIRE

This is not a test and there are no right or wrong answers. Do not answer the way you think your Instructor or someone else would want you to answer. It is essential that each question be answered candidly. Your answers in NO way jeopardizes your status in your program, since responses are kept completely confidential with the researcher.

Thank you very much for your assistance with this survey.

PART I: Background Information

1. Circle your age bracket:

a. 20 or under
b. 21-25
c. 26-30
d. 31-35
e. 36-40
f. 41-50
g. 51 +

2. What are (were)your reason(s) for choosing:
a)the STCC Nursing Program; and, b)Nursing as a career? Indicate here.

Listed below are courses required of Freshman nursing students at STCC.

Please check which of those courses you took successfully BEFORE you enrolled in the the Fall, 1985 or 1986 semester at STCC, or at a time (eg., Summer) OTHER THAN the Fall, 1985, or Spring, 1986, daytime semesters at STCC.

COURSES: COURSES TAKEN OUTSIDE DAYTIME FALL/SPRING SEMESTERS:

General Psychology----------------------
Anatomy and Physiology I+ Lab-----------
Normal/Abnormal Psychology--------------
Anatomy and Physiology II+ Lab----------
Microbiology+ Lab-----------------------

Introduction to Sociology I------------
Social Science Elective (Specify)------
English Composition I------------------
English Elective (Specify)-------------

PART II: Learning Strategies (Methods) Questionnaire

Please indicate your response to EACH of the following statements listed below by choosing the appropriate number on the SCALE listed below. Circle your choices in the column to the RIGHT of the statements. Choose only ONE number per statement, and respond to ALL statements candidly and honestly. You are being asked to indicate those Learning Strategies (Methods) that you resorted to using in order to successfully pass the Nursing I and II courses (for Seniors), or for course work prior to entering the Nursing program (Freshmen). Thank you very much.

SCALE:

1=Never Did
2=Did Rarely
3=Did Sometimes, but Less Than 50% of the Time
4=Did 50% of the Time
5=Did Frequently; More Than 50 % of the Time
6=Did Very Frequently, but Not Always
7=Always Did

STATEMENTS:

1. Read text: for details	1 2 3 4 5 6 7
2. Tried to generate word thoughts or word associations of material	1 2 3 4 5 6 7
3. Dealt with things: rationally	1 2 3 4 5 6 7
4. Summarized material studied	1 2 3 4 5 6 7
5. Learned: by doing/experimentally	1 2 3 4 5 6 7
6. Verified what was said/heard/seen	1 2 3 4 5 6 7
7. Had no definite study habits/times	1 2 3 4 5 6 7
8. Memorized instructions/formulas word for word	1 2 3 4 5 6 7
9. Avoided too much detail/got the 'big' picture	1 2 3 4 5 6 7
10. Tried to think: logically	1 2 3 4 5 6 7
11. Dealt with: several things simultaneously	1 2 3 4 5 6 7

12. Outlined things studied	1 2 3 4 5 6 7
13. Did things at the last minute/ not planned	1 2 3 4 5 6 7
14. Measured/evaluatd with precision	1 2 3 4 5 6 7
15. Played your hunches/'gut' feelings	1 2 3 4 5 6 7
16. Rewrote notes/took as much detail down as possible	1 2 3 4 5 6 7
17. Read text: for overall main ideas	1 2 3 4 5 6 7
18. Dealt with things: in an orderly fashion	1 2 3 4 5 6 7
19. Liked details that could be used immediately/of practical use	1 2 3 4 5 6 7
20. Assumed facts were correct/accurate as given	1 2 3 4 5 6 7
21. Tried to generate: visual images, pictures of material	1 2 3 4 5 6 7
22. Learned: by verbal means/word descriptions of material	1 2 3 4 5 6 7
23. Tried to think: intuitively/ instinctly	1 2 3 4 5 6 7
24. Memorized general concepts/overall ideas of material	1 2 3 4 5 6 7
25. Dealt with: one thing at a time	1 2 3 4 5 6 7
26. Had definite study habits/times	1 2 3 4 5 6 7
27. Dealt with things: with no set pattern or order	1 2 3 4 5 6 7
28. Planned ahead-aware of time and deadlines	1 2 3 4 5 6 7
29. Relied on a sure thing, definite fact	1 2 3 4 5 6 7
30. Took few detailed notes/noted general ideas	1 2 3 4 5 6 7
31. Estimated accuracy of facts	1 2 3 4 5 6 7
32. Dealt with things: with no definite reason or logic	1 2 3 4 5 6 7

Thank you very much

Table 19

Most Commonly Selected Key Left and Right Hemispheric
Dominant Descriptors for
Freshmen Male Students, Ages 21-25, (N=1)

Key Descriptors/ Quadrant	Overall Choice/Frequency +	'Best' Descriptor/Frequency ++
Cerebral Left:****		
Analytic	-	-
Logical	-	-
Mathematical *	1	-
Rational	-	-
Critical *,**	1	1
Quantitative	-	-
Factual	-	-
	/2 (29%)	/1 (100%)
Limbic Left:***		
Conservative *	1	-
Controlled *	1	-
Sequential *	1	-
Detailed	-	-
Dominant	-	-
Verbal(Art.)	-	-
Reader(Tech.)	-	-
	/3 (42%)	/0 (0%)
Limbic Right:		
Reader(Pers.)	-	-
Verbal(Talker)	-	-
Intuitive(Feel.)	-	-
Symbolic	-	-
Spiritual	-	-
Musical *	1	-
Emotional *	1	-
	/2 (29%)	/0 (0%)
Cerebral Right:		
Spatial	-	-
Simultaneous	-	-
Synthesizer	-	-
Holistic	-	-
Intuitive(Sol.)	-	-
Artistic	-	-
Creative	-	-
	/0 (0%)	/0 (0%)

* Most common key descriptor of the group
** Key descriptor that 'Best' describes the group
*** Most commonly chosen quadrant 'Overall'
**** Most commonly chosen quadrant of 'Best' descriptors
+ For 'Overall' descriptors, Left-mode quadrant preferences were chosen 5 times (71%); Right-mode chosen 2 times (29%).
++ For 'Best' descriptors, Left-mode quadrant preferences were chosen 1 time (100%); Right-mode chosen 0 times (0%).

Table 20

Most Commonly Selected Key Left and Right Hemispheric Dominant Descriptors for Freshmen Male Students, Ages 26-30, (N=4)

Key Descriptors/ Quadrant	Overall Choice/Frequency +	'Best' Descriptor/Frequency ++
Cerebral Left:		
Analytic	-	-
Logical	3	-
Mathematical	-	-
Rational	3	-
Critical	1	-
Quantitative	-	-
Factual	-	-
	/7 (18%)	/0 (0%)
Limbic Left:****		
Conservative	1	1
Controlled	-	-
Sequential	-	-
Detailed	1	-
Dominant	-	-
Verbal(Art.)	3	-
Reader(Tech.)	2	1
	/7 (18%)	/2 (40%)
Limbic Right: ***		
Reader(Pers.)	2	1
Verbal(Talker)	3	-
Intuitive(Feel.)	2	-
Symbolic	-	-
Spiritual	1	-
Musical	1	-
Emotional *	4	-
	/13 (33%)	/1 (20%)
Cerebral Right:****		
Spatial	1	-
Simultaneous	-	-
Synthesizer	2	-
Holistic **	3	2
Intuitive(Sol.)	2	-
Artistic	2	-
Creative	2	-
	/12 (31%)	/2 (40%)

* Most common key descriptor of the group
** Key descriptor that 'Best' describes the group
*** Most commonly chosen quadrant 'Overall'
**** Most commonly chosen quadrant of 'Best' descriptors
\+ For 'Overall' descriptors, Left-mode quadrant preferences were chosen 14 times (36%); Right-mode chosen 25 times (64%).
++ For 'Best' descriptors, Left-mode quadrant preferences were chosen 2 times (40%); Right-mode chosen 3 times (60%).

Table 21

Most Commonly Selected Key Left and Right Hemispheric Dominant Descriptors for Freshmen Male Students, Ages 31-35, (N=1)

Key Descriptors/ Quadrant	Overall Choice/Frequency +	'Best' Descriptor/Frequency ++
Cerebral Left:****		
Analytic	-	-
Logical *	1	-
Mathematical	-	-
Rational *,**	1	1
Critical	-	-
Quantitative	-	-
Factual *	1	-
	/3 (33%)	/1 (100%)
Limbic Left: ***		
Conservative *	1	-
Controlled	-	-
Sequential *	1	-
Detailed *	1	-
Dominant	-	-
Verbal(Art.)	-	-
Reader(Tech.) *	1	-
	/4 (45%)	/0 (0%)
Limbic Right:		
Reader(Pers.) *	1	-
Verbal(Talker)	-	-
Intuitive(Feel.)	-	-
Symbolic	-	-
Spiritual	-	-
Musical	-	-
Emotional	-	-
	/1 (11%)	/0 (0%)
Cerebral Right:		
Spatial	-	-
Simultaneous	-	-
Synthesizer	-	-
Holistic	-	-
Intuitive(Sol.)	-	-
Artistic *	1	-
Creative	-	-
	/1 (11%)	/0 (0%)

* Most common key descriptor of the group
** Key descriptor that 'Best' describes the group
*** Most commonly chosen quadrant 'Overall'
**** Most commonly chosen quadrant of 'Best' descriptors
+ For 'Overall' descriptors, Left-mode quadrant preferences were chosen 7 times (78%); Right-mode chosen 2 times (22%).
++ For 'Best' descriptors, Left-mode quadrant preferences were chosen 1 time (100%); Right-mode chosen 0 times (0%).

Table 22

Most Commonly Selected Key Left and Right Hemispheric Dominant Descriptors for Freshmen Male Students, Ages 36-40, (N=2)

Key Descriptors/ Quadrant	Overall Choice/Frequency +	'Best' Descriptor/Frequency ++
Cerebral Left:		
Analytic	-	-
Logical	1	-
Mathematical	-	-
Rational	-	-
Critical *	2	-
Quantitative	-	-
Factual	1	-
	/3 (18%)	/0 (0%)
Limbic Left: ***,****		
Conservative	1	-
Controlled *,**	2	1
Sequential	1	-
Detailed	-	-
Dominant	-	-
Verbal(Art.)	-	-
Reader(Tech.) *	2	-
	/6 (35%)	/1 (50%)
Limbic Right:****		
Reader(Pers.) *	2	-
Verbal(Talker)	-	-
Intuitive(Feel.)	1	-
Symbolic	1	-
Spiritual **	1	1
Musical	-	-
Emotional	-	-
	/5 (29%)	/1 (50%)
Cerebral Right:		
Spatial	-	-
Simultaneous	1	-
Synthesizer	-	-
Holistic *	2	-
Intuitive(Sol.)	-	-
Artistic	-	-
Creative	-	-
	/3 (18%)	/0 (0%)

* Most common key descriptor of the group
** Key descriptor that 'Best' describes the group
*** Most commonly chosen quadrant 'Overall'
**** Most commonly chosen quadrant of 'Best' descriptors
\+ For 'Overall' descriptors, Left-mode quadrant preferences were chosen 9 times (53%); Right-mode chosen 8 times (47%).
++ For 'Best' descriptors, Left-mode quadrant preferences were chosen 1 time (50%); Right-mode chosen 1 time (50%).

Table 23

Most Commonly Selected Key Left and Right Hemispheric Dominant Descriptors for Freshmen Female Students, Ages 20-and-Under, (N=6)

Key Descriptors/ Quadrant	Overall Choice/Frequency +	'Best' Descriptor/Frequency ++
Cerebral Left:		
Analytic	1	-
Logical **	4	1
Mathematical	2	-
Rational	4	-
Critical	1	-
Quantitative	1	-
Factual	1	-
	/14 (27%)	/1 (14%)
Limbic Left: ***,****		
Conservative	4	-
Controlled **	4	1
Sequential	3	-
Detailed	2	-
Dominant **	2	1
Verbal(Art.)	1	-
Reader(Tech.) **	2	1
	/18 (35%)	/3 (43%)
Limbic Right:		
Reader(Pers.) **	2	1
Verbal(Talker)	1	-
Intuitive(Feel.)	-	-
Symbolic	3	-
Spiritual **	3	1
Musical	1	-
Emotional *	5	-
	/15 (29%)	/2 (29%)
Cerebral Right:		
Spatial	-	-
Simultaneous	-	-
Synthesizer	1	-
Holistic **	1	1
Intuitive(Sol.)	-	-
Artistic	-	-
Creative	2	-
	/4 (8%)	/1 (14%)

* Most common key descriptor of the group
** Key descriptor that 'Best' describes the group
*** Most commonly chosen quadrant 'Overall'
**** Most commonly chosen quadrant of 'Best' descriptors
\+ For 'Overall' descriptors, Left-mode quadrant preferences were chosen 32 times (62%); Right-mode chosen 19 times (37%).
\++ For 'Best' descriptors, Left-mode quadrant preferences were chosen 4 times (57%); Right-mode chosen 3 times (43%).

Table 24

Most Commonly Selected Key Left and Right Hemispheric Dominant Descriptors for Freshmen Female Students, Ages 21-25, (N=16)

Key Descriptors/ Quadrant	Overall Choice/Frequency +	'Best' Descriptor/Frequency ++
Cerebral Left:****		
Analytic	3	1
Logical **	9	3
Mathematical	3	-
Rational	7	1
Critical	3	-
Quantitative	-	-
Factual	2	-
	/27 (18%)	/5 (28%)
Limbic Left:		
Conservative	7	1
Controlled	7	1
Sequential	3	-
Detailed	3	-
Dominant	3	-
Verbal(Art.)	11	1
Reader(Tech.)	8	1
	/45 (30%)	/4 (22%)
Limbic Right: ***,****		
Reader(Pers.)	8	1
Verbal(Talker)	11	1
Intuitive(Feel.)	10	1
Symbolic	2	-
Spiritual	3	-
Musical	4	1
Emotional *	13	1
	/51 (34%)	/5 (28%)
Cerebral Right:		
Spatial	-	-
Simultaneous	1	-
Synthesizer	1	-
Holistic	4	2
Intuitive(Sol.)	10	1
Artistic	3	-
Creative	9	1
	/28 (18%)	/4 (22%)

* Most common key descriptor of the group
** Key descriptor that 'Best' describes the group
*** Most commonly chosen quadrant 'Overall'
**** Most commonly chosen quadrant of 'Best' descriptors
\+ For 'Overall' descriptors, Left-mode quadrant preferences were chosen 72 times (48%); Right-mode chosen 79 times (52%).
++ For 'Best' descriptors, Left-mode quadrant preferences were chosen 9 times (50%); Right-mode chosen 9 times (50%).

Table 25

Most Commonly Selected Key Left and Right Hemispheric Dominant Descriptors for Freshmen Female Students, Ages 26-30, (N=12)

Key Descriptors/ Quadrant	Overall Choice/Frequency +	'Best' Descriptor/Frequency ++
Cerebral Left:		
Analytic	1	1
Logical	6	1
Mathematical	-	-
Rational	4	-
Critical	3	-
Quantitative	-	-
Factual	2	-
	/16 (14%)	/2 (12.5%)
Limbic Left:		
Conservative	3	2
Controlled	3	-
Sequential	2	-
Detailed	4	-
Dominant	2	-
Verbal(Art.)	6	-
Reader(Tech.)	8	-
	/28 (24%)	/2 (12.5%)
Limbic Right: ***,****		
Reader(Pers.)	8	-
Verbal(Talker)	6	-
Intuitive(Feel.) **	8	3
Symbolic	4	-
Spiritual	6	-
Musical	3	1
Emotional **	8	3
	/43 (37%)	/7 (44%)
Cerebral Right:		
Spatial	-	-
Simultaneous	1	-
Synthesizer	1	-
Holistic *	9	2
Intuitive(Sol.) **	8	3
Artistic	3	-
Creative	7	-
	/29 (25%)	/5 (31%)

* Most common key descriptor of the group
** Key descriptor that 'Best' describes the group
*** Most commonly chosen quadrant 'Overall'
**** Most commonly chosen quadrant of 'Best' descriptors
+ For 'Overall' descriptors, Left-mode quadrant preferences were chosen 44 times (38%); Right-mode chosen 72 times (62%).
++ For 'Best' descriptors, Left-mode quadrant preferences were chosen 4 times (25%); Right-mode chosen 12 times (75%).

Table 26

Most Commonly Selected Key Left and Right Hemispheric Dominant Descriptors for Freshmen Female Students, Ages 31-35, (N=11)

Key Descriptors/ Quadrant	Overall Choice/Frequency +	'Best' Descriptor/Frequency ++
Cerebral Left:		
Analytic	2	-
Logical *	8	-
Mathematical	2	-
Rational	6	1
Critical	3	-
Quantitative	-	-
Factual	1	-
	/22 (21.8%)	/1 (6%)
Limbic Left:		
Conservative **	6	2
Controlled	4	-
Sequential	-	-
Detailed	5	-
Dominant	3	-
Verbal(Art.) **	5	2
Reader(Tech.) **	5	2
	/28 (27.7%)	/6 (35%)
Limbic Right: ***,****		
Reader(Pers.)**	5	2
Verbal(Talker)**	5	2
Intuitive(Feel.)	2	1
Symbolic	2	-
Spiritual	5	-
Musical	4	-
Emotional **	7	1
	/30 (29.7%)	/8 (47%)
Cerebral Right:		
Spatial	-	-
Simultaneous	6	-
Synthesizer	1	1
Holistic	6	-
Intuitive(Sol.)	2	1
Artistic	3	-
Creative	3	-
	/21 (20.8%)	/2 (12%)

* Most common key descriptor of the group
** Key descriptor that 'Best' describes the group
*** Most commonly chosen quadrant 'Overall'
**** Most commonly chosen quadrant of 'Best' descriptors
+ For 'Overall' descriptors, Left-mode quadrant preferences were chosen 50 times (49.5%); Right-mode chosen 51 times (50.5%).
++ For 'Best' descriptors, Left-mode quadrant preferences were chosen 7 times (41%); Right-mode chosen 10 times (59%).

Table 27

Most Commonly Selected Key Left and Right Hemispheric Dominant Descriptors for Freshmen Female Students, Ages 36-40, (N=4)

Key Descriptors/ Quadrant	Overall Choice/Frequency +	'Best' Descriptor/Frequency ++
Cerebral Left:****		
Analytic **	2	2
Logical	1	-
Mathematical	1	-
Rational *	4	1
Critical	1	-
Quantitative	-	-
Factual	2	-
	/11 (28%)	/3 (60%)
Limbic Left:		
Conservative	2	1
Controlled	1	-
Sequential	1	-
Detailed	-	-
Dominant	-	-
Verbal(Art.)	2	-
Reader(Tech.)	1	-
	/7 (18%)	/1 (20%)
Limbic Right: ***		
Reader(Pers.)	1	-
Verbal(Talker)	2	-
Intuitive(Feel.)	3	-
Symbolic	2	-
Spiritual	2	1
Musical	1	-
Emotional	2	-
	/13 (33%)	/1 (20%)
Cerebral Right:		
Spatial	-	-
Simultaneous	-	-
Synthesizer	-	-
Holistic	3	-
Intuitive(Sol.)	3	-
Artistic	1	-
Creative	1	-
	/8 (21%)	/0 (0%)

* Most common Key descriptor of the group
** Key descriptor that 'Best' describes the group
*** Most commonly chosen quadrant 'Overall'
**** Most commonly chosen quadrant of 'Best' descriptors
+ For 'Overall' descriptors, Left-mode quadrant preferences were chosen 18 times (46%); Right-mode chosen 21 times (54%).
++ For 'Best' descriptors, Left-mode quadrant preferences were chosen 5 times (80%); Right-mode chosen 1 time (20%).

Table 28

Most Commonly Selected Key Left and Right Hemispheric Dominant Descriptors for Freshmen Female Students, Ages 41-50, (N=2)

Key Descriptors/ Quadrant	Overall Choice/Frequency +	'Best' Descriptor/Frequency ++
Cerebral Left:****		
Analytic	-	-
Logical	1	-
Mathematical	-	-
Rational *,**	2	1
Critical	1	-
Quantitative	-	-
Factual	-	-
	/4 (21%)	/1 (50%)
Limbic Left:****		
Conservative	1	-
Controlled **	1	1
Sequential	-	-
Detailed	-	-
Dominant	1	-
Verbal(Art.)	-	-
Reader(Tech.) *	2	-
	/5 (26%)	/1 (50%)
Limbic Right: ***		
Reader(Pers.) *	2	-
Verbal(Talker)	-	-
Intuitive(Feel.)	1	-
Symbolic	-	-
Spiritual	-	-
Musical *	2	-
Emotional *	2	-
	/7 (37%)	/0 (0%)
Cerebral Right:		
Spatial	1	-
Simultaneous	-	-
Synthesizer	1	-
Holistic	-	-
Intuitive(Sol.)	1	-
Artistic	-	-
Creative	-	-
	/3 (16%)	/0 (0%)

* Most common Key descriptor of the group
** Key descriptor that 'Best' describes the group
*** Most commonly chosen quadrant 'Overall'
**** Most commonly chosen quadrant of 'Best' descriptors
+ For 'Overall' descriptors, Left-mode quadrant preferences were chosen 9 times (47%); Right-mode chosen 10 times (53%).
++ For 'Best' descriptors, Left-mode quadrant preferences were chosen 1 time (50%); Right-mode chosen 1 time (50%).

Table 29

Most Commonly Selected Key Left and Right Hemispheric Dominant Descriptors for Senior Male Students, Ages 26-30, (N=3)

Key Descriptors/ Quadrant	Overall Choice/Frequency +	'Best' Descriptor/Frequency ++
Cerebral Left:		
Analytic	-	-
Logical	2	-
Mathematical	-	-
Rational *	3	-
Critical	-	-
Quantitative	-	-
Factual	2	-
	/7 (24%)	/0 (0%)
Limbic Left: ***,****		
Conservative	-	-
Controlled	2	-
Sequential	-	-
Detailed	2	-
Dominant	-	-
Verbal(Art.) *,**	3	1
Reader(Tech.) **	1	1
	/8 (28%)	/2 (40%)
Limbic Right:****		
Reader(Pers.) **	1	1
Verbal(Talker) *,**	3	1
Intuitive(Feel.)	-	-
Symbolic	-	-
Spiritual	1	-
Musical	-	-
Emotional	2	-
	/7 (24%)	/2 (40%)
Cerebral Right:		
Spatial	-	-
Simultaneous	1	-
Synthesizer	1	-
Holistic	1	-
Intuitive(Sol.)	-	-
Artistic **	2	1
Creative	2	-
	/7 (24%)	/1 (20%)

* Most common key descriptor of the group
** Key descriptor that 'Best' describes the group
*** Most commonly chosen quadrant 'Overall'
**** Most commonly chosen quadrant of 'Best' descriptors
\+ For 'Overall' descriptors, Left-mode quadrant preferences were chosen 15 times (52%); Right-mode chosen 14 times (48%).
\++ For 'Best' descriptors, Left-mode quadrant preferences were chosen 2 times (40%); Right-mode chosen 3 times (60%).

Table 30

Most Commonly Selected Key Left and Right Hemispheric Dominant Descriptors for Senior Male Students, Ages 31-35, (N=4)

Key Descriptors/ Quadrant	Overall Choice/Frequency +	'Best' Descriptor/Frequency ++
Cerebral Left:		
Analytic	-	-
Logical	3	-
Mathematical	-	-
Rational	1	-
Critical	2	-
Quantitative	1	-
Factual	3	-
	/10 (26%)	/0 (0%)
Limbic Left:****		
Conservative	1	-
Controlled **	3	1
Sequential	-	-
Detailed	1	-
Dominant	-	-
Verbal(Art.) **	3	1
Reader(Tech.)	2	-
	/10 (26%)	/2 (40%)
Limbic Right: ***,****		
Reader(Pers.)	2	-
Verbal(Talker) **	3	1
Intuitive(Feel.)	1	-
Symbolic	-	-
Spiritual	-	-
Musical	2	-
Emotional *,**	4	1
	/12 (32%)	/2 (40%)
Cerebral Right:		
Spatial	-	-
Simultaneous	-	-
Synthesizer	-	-
Holistic	2	-
Intuitive(Sol.)	1	-
Artistic	1	-
Creative **	2	1
	/6 (16%)	/1 (20%)

* Most common key descriptor of the group
** Key descriptor that 'Best' describes the group
*** Most commonly chosen quadrant 'Overall'
**** Most commonly chosen quadrant of 'Best' descriptors
\+ For 'Overall' descriptors, Left-mode quadrant preferences were chosen 20 times (52%); Right-mode chosen 18 times (48%).
++ For 'Best' descriptors, Left-mode quadrant preferences were chosen 2 times (40%); Right-mode chosen 3 times (60%).

Table 31

Most Commonly Selected Key Left and Right Hemispheric Dominant Descriptors for Senior Male Students, Ages 36-40, (N=1)

Key Descriptors/ Quadrant	Overall Choice/Frequency +	'Best' Descriptor/Frequency ++
Cerebral Left: ***		
Analytic *	1	-
Logical *	1	-
Mathematical	-	-
Rational	-	-
Critical *	1	-
Quantitative	-	-
Factual *	1	-
	/4 (50%)	/0 (0%)
Limbic Left:****		
Conservative *,**	1	1
Controlled	-	-
Sequential	-	-
Detailed *	1	-
Dominant	-	-
Verbal(Art.)	-	-
Reader(Tech.)	-	-
	/2 (25%)	/1 (100%)
Limbic Right:		
Reader(Pers.)	-	-
Verbal(Talker)	-	-
Intuitive(Feel.)	-	-
Symbolic	-	-
Spiritual	-	-
Musical *	1	-
Emotional	-	-
	/1 (12.5%)	/0 (0%)
Cerebral Right:		
Spatial	-	-
Simultaneous	-	-
Synthesizer	-	-
Holistic *	1	-
Intuitive(Sol.)	-	-
Artistic	-	-
Creative	-	-
	/1 (12.5%)	/0 (0%)

* Most common key descriptor of the group
** Key descriptor that 'Best' describes the group
*** Most commonly chosen quadrant 'Overall'
**** Most commonly chosen quadrant of 'Best' descriptors
+ For 'Overall' descriptors, Left-mode quadrant preferences were chosen 6 times (75%); Right-mode chosen 2 times (25%).
++ For 'Best' descriptors, Left-mode quadrant preferences were chosen 1 time (100%); Right-mode chosen 0 times (0%).

Table 32

Most Commonly Selected Key Left and Right Hemispheric Dominant Descriptors for Senior Female Students, Ages 20 and-Under, (N=3)

Key Descriptors/ Quadrant	Overall Choice/Frequency +	'Best' Descriptor/Frequency ++
Cerebral Left:****		
Analytic	-	-
Logical *,**	3	1
Mathematical	-	-
Rational *,**	3	1
Critical	1	-
Quantitative	-	-
Factual	1	-
	/8 (28%)	/2 (67%)
Limbic Left:		
Conservative	2	-
Controlled	1	-
Sequential	1	-
Detailed	1	-
Dominant	-	-
Verbal(Art.)	1	-
Reader(Tech.)	2	-
	/8 (28%)	/0 (0%)
Limbic Right: ***		
Reader(Pers.)	2	-
Verbal(Talker)	1	-
Intuitive(Feel.)	2	-
Symbolic	-	-
Spiritual	1	-
Musical	1	-
Emotional *,**	3	1
	/10 (34%)	/1 (33%)
Cerebral Right:		
Spatial	1	-
Simultaneous	-	-
Synthesizer	-	-
Holistic	-	-
Intuitive(Sol.)	2	-
Artistic	-	-
Creative	-	-
	/3 (10%)	/0 (0%)

* Most common key descriptor of the group
** Key descriptor that 'Best' describes the group
*** Most commonly chosen quadrant 'Overall'
**** Most commonly chosen quadrant of 'Best' descriptors
\+ For 'Overall' descriptors, Left-mode quadrant preferences were chosen 16 times (56%); Right-mode chosen 13 times (44%).
\++ For 'Best' descriptors, Left-mode quadrant preferences were chosen 2 times (67%); Right-mode chosen 1 time (33%).

Table 33

Most Commonly Selected Key Left and Right Hemispheric Dominant Descriptors for Senior Female Students, Ages 21-25, (N=12)

Key Descriptors/ Quadrant	Overall Choice/Frequency +	'Best' Descriptor/Frequency ++
Cerebral Left:****		
Analytic	3	1
Logical	7	-
Mathematical	2	-
Rational *	8	2
Critical *	8	2
Quantitative	-	-
Factual	4	1
	/32 (28%)	/6 (40%)
Limbic Left:		
Conservative	3	-
Controlled	4	-
Sequential	-	-
Detailed	4	-
Dominant	3	-
Verbal(Art.)	7	1
Reader(Tech.)	4	-
	/25 (22%)	/1 (7%)
Limbic Right: ***,****		
Reader(Pers.)	4	-
Verbal(Talker)	7	1
Intuitive(Feel.)	7	2
Symbolic	3	-
Spiritual	2	-
Musical	3	-
Emotional **	7	3
	/33 (29%)	/6 (40%)
Cerebral Right:		
Spatial	2	-
Simultaneous	2	-
Synthesizer	-	-
Holistic	3	-
Intuitive(Sol.)	7	2
Artistic	4	-
Creative	6	-
	/24 (21%)	/2 (13%)

* Most common key descriptor of the group
** Key descriptor that 'Best' describes the group
*** Most commonly chosen quadrant 'Overall'
**** Most commonly chosen quadrant of 'Best' descriptors
\+ For 'Overall' descriptors, Left-mode quadrant preferences were chosen 57 times (50%); Right-mode chosen 57 times (50%).
++ For 'Best' descriptors, Left-mode quadrant preferences were chosen 7 times (47%); Right-mode chosen 8 times (53%).

Table 34

Most Commonly Selected Key Left and Right Hemispheric Dominant Descriptors for Senior Female Students, Ages 26-30, (N=11)

Key Descriptors/ Quadrant	Overall Choice/Frequency +	'Best' Descriptor/Frequency ++
Cerebral Left:		
Analytic	3	-
Logical	6	1
Mathematical	3	-
Rational	5	1
Critical	5	-
Quantitative	-	-
Factual	-	-
	/22 (18%)	/2 (15.4%)
Limbic Left:****		
Conservative	2	-
Controlled **	6	3
Sequential	3	-
Detailed	4	-
Dominant	4	1
Verbal(Art.)	7	-
Reader(Tech.)	8	1
	/34 (29%)	/5 (38.4%)
Limbic Right: ***		
Reader(Pers.)	8	1
Verbal(Talker)	7	-
Intuitive(Feel.) *	10	1
Symbolic	2	-
Spiritual	1	-
Musical	1	-
Emotional *	10	2
	/39 (33%)	/4 (30.8%)
Cerebral Right:		
Spatial	-	-
Simultaneous	4	-
Synthesizer	-	-
Holistic	2	-
Intuitive(Sol.) *	10	1
Artistic	3	1
Creative	5	-
	/24 (20%)	/2 (15.4%)

* Most common key descriptor of the group
** Key descriptor that 'Best' describes the group
*** Most commonly chosen quadrant 'Overall'
**** Most commonly chosen quadrant of 'Best' descriptors
+ For 'Overall' descriptors, Left-mode quadrant preferences were chosen 56 times (47%); Right-mode chosen 63 times (53%).
++ For 'Best' descriptors, Left-mode quadrant preferences were chosen 7 times (53.8%); Right-mode chosen 6 times (46.2%).

Table 35

Most Commonly Selected Key Left and Right Hemispheric Dominant Descriptors for Senior Female Students, Ages 31-35, (N=10)

Key Descriptors/ Quadrant	Overall Choice/Frequency +	'Best' Descriptor/Frequency ++
Cerebral Left:****		
Analytic	3	-
Logical *,**	9	3
Mathematical	2	-
Rational	7	1
Critical	4	1
Quantitative	-	-
Factual	3	-
	/28 (28%)	/5 (38.4%)
Limbic Left:		
Conservative	5	-
Controlled	3	-
Sequential	1	-
Detailed	3	-
Dominant	1	-
Verbal(Art.)	7	1
Reader(Tech.)	5	1
	/25 (25%)	/2 (15.4%)
Limbic Right: ***		
Reader(Pers.)	5	1
Verbal(Talker)	7	1
Intuitive(Feel.)	8	1
Symbolic	2	-
Spiritual	4	-
Musical	2	-
Emotional	4	-
	/32 (32%)	/3 (23.1%)
Cerebral Right:		
Spatial	-	-
Simultaneous	-	-
Synthesizer	-	-
Holistic	5	1
Intuitive(Sol.)	8	1
Artistic	-	-
Creative	2	1
	/15 (15%)	/3 (23.1%)

* Most common key descriptor of the group
** Key descriptor that 'Best' describes the group
*** Most commonly chosen quadrant 'Overall'
**** Most commonly chosen quadrant of 'Best' descriptors
\+ For 'Overall' descriptors, Left-mode quadrant preferences were chosen 53 times (53%); Right-mode chosen 47 times (47%).
++ For 'Best' descriptors, Left-mode quadrant preferences were chosen 7 times (53.8%); Right-mode chosen 6 times (46.2%).

Table 36

Most Commonly Selected Key Left and Right Hemispheric Dominant Descriptors for Senior Female Students, Ages 36-40, (N=3)

Key Descriptors/ Quadrant	Overall Choice/Frequency +	'Best' Descriptor/Frequency ++
Cerebral Left:		
Analytic	-	-
Logical *	2	-
Mathematical	1	-
Rational	1	-
Critical	-	-
Quantitative	-	-
Factual	1	-
	/5 (17%)	/0 (0%)
Limbic Left: ***		
Conservative **	1	1
Controlled	1	-
Sequential	1	-
Detailed *	2	-
Dominant	-	-
Verbal(Art.) *	2	-
Reader(Tech.) *	2	-
	/9 (30%)	/1 (17%)
Limbic Right: ***		
Reader(Pers.) *	2	-
Verbal(Talker) *	2	-
Intuitive(Feel.)*,**	2	1
Symbolic	1	-
Spiritual **	1	1
Musical	-	-
Emotional	1	-
	/9 (30%)	/2 (33%)
Cerebral Right:****		
Spatial	-	-
Simultaneous *	2	-
Synthesizer	-	-
Holistic *,**	2	1
Intuitive(Sol.)*,**	2	1
Artistic	-	-
Creative**	1	1
	/7 (23%)	/3 (50%)

* Most common Key descriptor of the group
** Key descriptor that 'Best' describes the group
*** Most commonly chosen quadrant 'Overall'
**** Most commonly chosen quadrant of 'Best' descriptors
\+ For 'Overall' descriptors, Left-mode quadrant preferences were chosen 14 times (47%); Right-mode chosen 16 times (53%).
++ For 'Best' descriptors, Left-mode quadrant preferences were chosen 1 time (17%); Right-mode chosen 5 times (83%).

Table 37

Most Commonly Selected Key Left and Right Hemispheric Dominant Descriptors for Senior Female Students, Ages 41-50, (N=2)

Key Descriptors/ Quadrant	Overall Choice/Frequency +	'Best' Descriptor/Frequency ++
Cerebral Left: ***,****		
Analytic	1	-
Logical *,**	2	1
Mathematical	1	-
Rational **	1	1
Critical	-	-
Quantitative	1	-
Factual	1	-
	/7 (35%)	/2 (100%)
Limbic Left: ***		
Conservative *	2	-
Controlled *	2	-
Sequential	-	-
Detailed *	-	-
Dominant	-	-
Verbal(Art.)	1	-
Reader(Tech.) *	2	-
	/7 (35%)	/0 (0%)
Limbic Right:		
Reader(Pers.) *	2	-
Verbal(Talker)	1	-
Intuitive(Feel.)	1	-
Symbolic	-	-
Spiritual	-	-
Musical	-	-
Emotional	1	-
	/5 (25%)	/0 (0%)
Cerebral Right:		
Spatial	-	-
Simultaneous	-	-
Synthesizer	-	-
Holistic	-	-
Intuitive(Sol.)	1	-
Artistic	-	-
Creative	-	-
	/1 (5%)	/0 (0%)

* Most common key descriptor of the group
** Key descriptor that 'Best' describes the group
*** Most commonly chosen quadrant 'Overall'
**** Most commonly chosen quadrant of 'Best' descriptors
\+ For 'Overall' descriptors, Left-mode quadrant preferences were chosen 14 times (70%); Right-mode chosen 6 times (30%).
++ For 'Best' descriptors, Left-mode quadrant preferences were chosen 2 times (100%); Right-mode chosen 0 times (0%).

Table 38

Most Commonly Selected Key Left and Right Hemispheric Dominant Descriptors for Senior Female Students, Ages 51+, (N=1)

Key Descriptors/ Quadrant	Overall Choice/Frequency +	'Best' Descriptor/Frequency ++
Cerebral Left:		
Analytic	-	-
Logical	-	-
Mathematical	-	-
Rational	-	-
Critical	-	-
Quantitative	-	-
Factual	-	-
	/0 (0%)	/0 (0%)
Limbic Left:		
Conservative	-	-
Controlled	-	-
Sequential	-	-
Detailed	-	-
Dominant	-	-
Verbal(Art.) *	1	-
Reader(Tech.) *	1	-
	/2 (18.2%)	/0 (0%)
Limbic Right:		
Reader(Pers.) *	1	-
Verbal(Talker) *	1	-
Intuitive(Feel.) *	1	-
Symbolic	-	-
Spiritual	-	-
Musical	-	-
Emotional *	1	-
	/4 (36.4%)	/0 (0%)
Cerebral Right: ***,****		
Spatial	-	-
Simultaneous *	1	-
Synthesizer	-	-
Holistic *,**	1	1
Intuitive(Sol.) *	1	-
Artistic *	1	-
Creative *	1	-
	/5 (45.4%)	/1 (100%)

* Most common key descriptor of the group
** Key descriptor that 'Best' describes the group
*** Most commonly chosen quadrant 'Overall'
**** Most commonly chosen quadrant of 'Best' descriptors
\+ For 'Overall' descriptors, Left-mode quadrant preferences were chosen 2 times (18.2%); Right-mode chosen 9 times (81.8%).
++ For 'Best' descriptors, Left-mode quadrant preferences were chosen 0 times (0%); Right-mode chosen 1 time (100%).

Table 39

Left and Right Hemispheric Work Elements *
Freshmen Males, Ages 21-40 (N=8)

Quadrants / Work Elements	Age Groups 21-25 N=1	26-30 N=4	31-35 N=1	36-40 N=2
Cerebral Left:				
Analytical	4.0	3.3	2.0-	3.5
Technical Aspects	4.0	1.8-	5.0+	3.0
Problem Solving	4.0	3.0	3.0	3.0
Financial Aspects	2.0-	2.8	2.0-	2.0-
Limbic Left:				
Organization	5.0+	3.8+	4.0	3.0
Planning	5.0+	2.5-	3.0	2.5-
Administrative	1.0-	2.0-	4.0	2.5-
Implementation	3.0	2.8	5.0+	3.5
Limbic Right:				
Teaching/ Training	3.0	3.3	3.0	2.5-
Writing	5.0+	4.0+	4.0	4.5+
Expressing Ideas	3.0	3.8+	5.0+	3.5
Interpersonal Aspects	3.0	3.8+	2.0-	3.5
Cerebral Right:				
Integration	5.0+	3.3	2.0-	4.5+
Conceptualizing	2.0-	3.5	3.0	5.0+
Creative Aspects	4.0	2.8	5.0+	4.5+
Innovating	2.0-	2.3-	4.0	5.0+

* A rating of one (1) represented work done worst of all and a five (5) represented work done best of all. The values shown are averages of the individual ratings. The pluses (+) signify the four highest ratings; the minuses (-) the four lowest.

Table 40

Left and Right Hemispheric Work Elements *
Freshmen Females, Ages 20 and Under-50 (N=50)

Quadrants / Work Elements	20- Und. N=6	21- 25 N=16	26- 30 N=12	31- 35 N=11	36- 40 N=4	41- 50 N=2
	Age Groups					
Cerebral Left:						
Analytical	2.3-	3.0	3.0-	2.9-	3.3	3.0
Technical Aspects	2.5-	2.8-	3.0-	2.8-	2.3-	2.0-
Problem Solving	3.5	3.5	3.3	4.0+	4.3+	3.0
Financial Aspects	3.2	3.0	2.5-	3.6	2.3-	2.5
Limbic Left:						
Organization	3.5	3.9+	3.9+	4.4+	3.5	5.0+
Planning	4.0+	3.9+	3.8+	3.9+	3.8+	4.0+
Administrative	1.3-	2.9-	3.3	2.7-	2.5-	2.5
Implementation	3.3	3.3	3.4	3.5	2.8	4.5+
Limbic Right:						
Teaching/ Training	3.0	3.7	3.4	3.4	3.8+	3.5
Writing	4.0+	3.3	4.0+	3.3	3.0	2.0-
Expressing Ideas	3.7+	3.8+	3.6	3.7+	2.8-	4.0+
Interpersonal Aspects	4.3+	4.0+	3.6	2.9-	4.3+	2.5
Cerebral Right:						
Integration	3.2	2.8-	2.3-	3.5	3.8+	3.5
Conceptualizing	2.7-	3.5	3.4	3.1	4.3+	2.0-
Creative Aspects	3.3	3.7	3.8+	3.1	3.5	2.0-
Innovating	3.0	2.5-	2.8-	2.6-	3.3	4.5+

* A rating of one (1) represented work done worst of all and a five (5) represented work done best of all. The values shown are averages of the individual ratings. The pluses (+) signify the four highest ratings; the minuses (-) the four lowest.

Table 41

Left and Right Hemispheric Work Elements *
Senior Males, Ages 26-40 (N=8)

Quadrants / Work Elements	Age Groups 26-30 N=3	31-35 N=4	36-40 N=1
Cerebral Left:			
Analytical	2.7-	2.5-	2.0
Technical Aspects	3.0	3.0-	1.0-
Problem Solving	4.3+	3.8	3.0
Financial Aspects	2.0-	3.5	1.0-
Limbic Left:			
Organization	3.3	3.3	2.0
Planning	3.7	4.0	4.0+
Administrative	3.3	4.3+	5.0+
Implementation	3.7	4.3+	3.0
Limbic Right:			
Teaching/ Training	4.0	2.5-	2.0
Writing	2.7-	4.3+	4.0+
Expressing Ideas	5.0+	3.3	5.0+
Interpersonal Aspects	4.3+	3.8	2.0
Cerebral Right:			
Integration	3.7	2.5-	1.0-
Conceptualizing	2.7-	3.5	3.0
Creative Aspects	4.3+	4.8+	1.0-
Innovating	3.7	3.0-	3.0

* A rating of one (1) represented work done worst of all and a five (5) represented work done best of all. The values shown are averages of the individual ratings. The pluses (+) signify the four highest ratings; the minuses (-) the four lowest.

Table 42

Left and Right Hemispheric Work Elements *
Senior Females, Ages 20 and Under-51+ (N=42)

Quadrants / Work Elements	20- Und. N=3	21- 25 N=12	26- 30 N=11	31- 35 N=10	36- 40 N=3	41- 50 N=2	51 + N=1
				Age Groups			
Cerebral Left:							
Analytical	2.3-	3.3	2.8-	2.8-	4.0+	3.5	1.0-
Technical Aspects	3.0	2.8-	3.2	3.0	3.3	4.0+	1.0-
Problem Solving	4.0+	3.5	3.8+	2.8-	3.0	4.0+	2.0-
Financial Aspects	3.7+	2.9-	2.9	2.0-	2.3-	2.0-	1.0-
Limbic Left:							
Organization	5.0+	4.1+	4.2+	3.6	5.0+	4.0+	3.0
Planning	3.7+	3.7+	4.3+	4.1+	2.7-	3.5	4.0
Administrative	2.7-	2.4-	2.6-	2.9-	3.7+	5.0	2.0-
Implementation	3.7+	3.3	3.6+	4.1+	3.0	4.0+	3.0
Limbic Right:							
Teaching/ Training	3.7+	3.9+	3.4	4.3+	3.3	3.0	3.0
Writing	4.7+	3.6	2.7-	3.2	2.3-	4.0+	4.0
Expressing Ideas	3.7+	3.6	3.6+	3.8+	2.7-	2.5-	5.0+
Interpersonal Aspects	3.7+	4.5+	4.2+	3.8+	3.3	3.0	5.0+
Cerebral Right:							
Integration	3.0	3.0-	3.1	2.9	3.3	4.5+	4.0
Conceptualizing	2.0-	3.7+	2.1-	3.3	4.7+	2.5-	4.0
Creative Aspects	2.0-	2.9-	2.8-	2.4-	2.7-	2.0-	5.0+
Innovating	2.3	3.1	2.7-	3.1	3.7	2.0-	5.0+

* A rating of one (1) represented work done worst of all and a five (5) represented work done best of all. The values shown are averages of the individual ratings. The pluses (+) signify the four highest ratings; the minuses (-) the four lowest.

Table 43

Handedness Profile

All Freshmen Males, Ages 21-40 (N=8)

Strength and Direction of Handedness *

Ways of Holding a Pencil-Handwriting Position *

Age Group	P-L	L-I	PL-SR	L-S	Both=	R-S	PR-SL	R-I	P-R
21-25 (N=1)						1 (100%)	1 (100%)		
26-30 (N=4)		1 (25%)	1 (25%)			3 (75%)	1 (25%)		2 (50%)
31-35 (N=1)						1 (100%)			1 (100%)
36-40 (N=2)						2 (100%)			2 (100%)
Totals :									
Strength :	0		1 (12%)		0		2 (25%)		5 (63%)
Position :		1 (12%)		0		7 (88%)		0	

-Overall L-Bias- -Overall R-Bias-

* Abbreviations :

Strength: PL=Primary Left; PL-SR=Primary Left-Some Right; PR-SL=Primary Right-Some Left; PR=Primary Right;

Position: L-I=Left Inverted; L-S=Left Straight; R-S=Right Straight; R-I=Right Inverted

Table 44

Handedness Profile

All Freshmen Females, Ages 20+Under-50 (N=50)

Strength and Direction of Handedness *
Ways of Holding a Pencil-Handwriting Position *

Age Group	P-L	L-I	PL-SR	L-S	Both=	R-S	PR-SL	R-I	P-R
20+Under (N=6)			1 (17%)			6 (100%)	2 (33%)		3 (50%)
21-25 (N=15)	1 (6.5%)		1 (6.5%)	2 (13%)		13 (87%)	6 (40%)		7 (47%)
26-30 (N=12)	2 (17%)	2 (17%)	1 (8%)	1 (8%)		8 (67%)	1 (8%)	1 (8%)	8 (67%)
31-35 (N=11)						11 (100%)	2 (18%)		9 (92%)
36-40 (N=4)						4 (100%)	3 (75%)		1 (25%)
41-50 (N=2)						2 (100%)	1 (50%)		1 (50%)
Totals :									
Strength :	3 (6%)		3 (6%)		0		15 (30%)		29 (58%)
Position :		2 (4%)		3 (6%)		44 (88%)		2 (1%)	
	-Overall L-Bias-					-Overall R-Bias-			

* Abbreviations :

Strength: PL=Primary Left; PL-SR=Primary Left-Some Right; PR-SL=Primary Right-Some Left; PR=Primary Right;

Position: L-I=Left Inverted; L-S=Left Straight; R-S=Right Straight; R-I=Right Inverted

Table 45

Handedness Profile

All Senior Males, Ages 26-40 (N=8)

Strength and Direction of Handedness *
Ways of Holding a Pencil-Handwriting Position *

Age Group	P-L	L-I	PL-SR	L-S	Both=	R-S	PR-SL	R-I	P-R
26-30 (N=3)						2 (67%)	2 (67%)	1 (33%)	1 (33%)
31-35 (N=4)						4 (100%)	2 (50%)		2 (50%)
36-40 (N=1)						1 (100%)	1 (100%)		
Totals :									
Strength :	0		0		0		5 (63%)		3 (17%)
Position :		0		0		7 (88%)		1 (12%)	

-Overall L-Bias- -Overall R-Bias-

* Abbreviations :

Strength: PL=Primary Left; PL-SR=Primary Left-Some Right; PR-SL=Primary Right-Some Left; PR=Primary Right;

Position: L-I=Left Inverted; L-S=Left Straight; R-S=Right Straight; R-I=Right Inverted

Table 46

Handedness Profile

All Senior Females, Ages 20+Under-51+ (N=42)

Strength and Direction of Handedness *
Ways of Holding a Pencil-Handwriting Position *

Age Group	P-L	L-I	PL-SR	L-S	Both=	R-S	PR-SL	R-I	P-R
20+Under (N=3)	1 (33%)		1 (33%)	2 (67%)		1 (33%)	1 (33%)		
21-25 (N=12)			1 (8%)	1 (8%)		10 (83%)	4 (33%)	1 (8%)	7 (58%)
26-30 (N=11)				1 (9%)		10 (91%)	4 (36%)		7 (64%)
31-35 (N=10)					1 (10%)	10 (100%)	6 (60%)		3 (30%)
36-40 (N=3)						3 (100%)	1 (33%)		2 (67%)
41-50 (N=2)						2 (100%)	1 (50%)		1 (50%)
51+ (N=1)						1 (100%)			1 (100%)
Totals :									
Strength :	1 (2%)		2 (5%)		1 (2%)		17 (41%)		21 (50%)
Position :		0		4 (10%)		37 (88%)		1 (2%)	

-Overall L-Bias- -Overall R-Bias-

* Abbreviations :

Strength: PL=Primary Left; PL-SR=Primary Left-Some Right; PR-SL=Primary Right-Some Left; PR=Primary Right;

Position: L-I=Left Inverted; L-S=Left Straight; R-S=Right Straight; R-I=Right Inverted

Table 47

Learning Strategies (Methods) Preference Profile
Ratings and Averages of Opposing Pairs of Left- and Right-Brain Oriented Questions *

All Freshmen Males (N=8)

Left-Oriented Questions	Left-Ratings/ Age Groups 21-25	26-30	31-35	36-40	Overall Question Averages (All Groups) L	R	Right-Ratings/ Age Groups 21-25	26-30	31-35	36-40	Right-Oriented Questions
N:	1	4	1	2			1	4	1	2	
1	6.0	5.3	7.0	7.0	6.3	5.7	6.0	5.8	4.0	7.0	17
2	4.0	5.0	5.0	4.5	4.6	5.8	6.0	5.3	7.0	5.0	21
3	4.0	5.0	7.0	6.0	5.5	3.4	3.0	4.5	2.0	4.0	32
6	5.0	4.0	5.0	5.0	4.8	3.8	3.0	5.0	2.0	5.0	20
8	2.0	4.8	6.0	3.5	4.1	4.0	3.0	4.3	3.0	5.5	24
10	5.0	5.8	5.0	5.5	5.3	2.9	3.0	4.5	1.0	3.0	23
12	6.0	4.8	7.0	6.0	6.0	3.8	4.0	3.8	2.0	5.5	4
14	4.0	4.3	7.0	4.5	5.0	6.2	6.0	5.8	7.0	6.0	31
16	6.0	3.8	6.0	3.5	4.8	5.5	4.0	5.3	7.0	5.5	30
18	7.0	5.5	7.0	5.5	6.3	4.8	4.0	5.3	5.0	5.0	27
19	5.0	6.3	7.0	5.0	5.8	5.0	5.0	4.8	5.0	5.0	9
22	5.0	5.3	6.0	6.0	5.6	4.8	4.0	5.8	5.0	4.5	5
25	6.0	5.8	5.0	6.0	5.7	3.5	4.0	3.0	3.0	4.0	11
26	6.0	3.8	5.0	4.0	4.7	3.0	2.0	3.8	1.0	5.0	7
28	5.0	3.3	5.0	6.0	4.8	3.3	4.0	3.3	1.0	5.0	13
29	5.0	4.5	5.0	5.5	5.0	2.1	2.0	2.3	1.0	3.0	15
Ave's:	5.1	4.8	5.9	5.2	5.3	4.2	3.9	4.5	3.5	4.9	
	|-----5.3-----|						|-----4.2-----|				

* Rating Significance:
1= very weak preference
2= weak preference
3= weak-moderate preference
4= moderate preference
5= moderate-strong preference
6= strong preference
7= very strong preference

Table 48

Learning Strategies (Methods) Preference Profile

Ratings and Averages of Opposing Pairs of Left- and Right-Oriented Questions *

All Freshmen Females (N=51)

Left-Oriented Questions	Left-Ratings/ Age Groups 20-Und	21-25	26-30	31-35	36-40	41-50	Overall Question Averages (All groups) L	R	Right-Ratings/ Age Groups 20-Und	21-25	26-30	31-35	36-40	41-50	Right-Oriented Questions
	N:6	16	12	11	4	2			6	16	12	11	4	2	
1	4.3	5.7	6.1	5.9	5.5	5.5	5.5	5 6	4.5	5.6	6.3	5.6	6.5	5.0	17
2	5.3	4.6	6.1	5.0	5.8	3.5	5.1	5.3	5.3	4.9	5.3	5.9	6.5	4.0	21
3	5.5	5.3	5.8	5.6	6.0	4.5	5.5	2.6	2.8	2.9	2.0	1.7	4.0	2.0	32
6	3.3	4.4	4.5	4.9	6.3	4.0	4.5	5.2	5.7	5.3	5.4	5.1	5.5	4.0	20
8	4.2	3.8	4.4	3.9	5.3	3.5	4.2	5.2	4.8	5.1	5.7	5.3	5.5	5.0	24
10	5.7	5.6	5.9	5.6	6.3	4.5	5.6	5.1	4.7	4.9	5.3	4.9	6.3	4.5	23
12	4.7	5.2	5.2	5.5	4.3	5.0	5.0	5.2	4.2	6.1	4.7	5.6	6.0	4.5	4
14	4.5	4.1	5.3	4.6	4.8	4.5	4.6	4.2	3.7	4.3	3.8	4.6	4.5	4.0	31
16	4.2	4.6	4.5	5.4	4.3	3.0	4.3	3.9	2.5	3.8	3.3	5.4	3.8	4.5	30
18	6.0	5.1	5.8	6.0	5.3	4.5	5.5	2.6	3.0	3.4	1.8	1.9	3.3	2.0	27
19	4.0	5.8	6.3	5.3	6.8	5.0	5.5	4.3	5.3	4.0	3.8	3.5	4.0	5.0	9
22	5.2	5.4	4.3	5.0	6.3	4.0	5.0	4.6	3.7	4.3	5.3	4.5	4.5	5.5	5
25	5.3	5.3	4.6	4.5	5.5	5.0	5.0	4.7	4.5	3.1	4.8	5.5	4.8	5.5	11
26	4.2	4.8	5.3	5.7	4.8	5.5	5.1	3.3	3.5	3.1	3.3	4.5	2.5	3.0	7
28	5.2	5.5	5.6	5.5	5.5	5.0	5.4	2.8	3.5	3.1	2.4	2.5	3.0	2.5	13
29	4.3	5.6	5.6	5.9	4.3	3.5	4.9	4.0	3.0	4.0	4.9	3.4	5.0	3.5	15
Ave's:	4.8	5.0	5.3	5.3	5.3	4.4	5.0	4.3	4.1	4.3	4.2	4.3	4.7	4.0	

|---------5.0---------| |----------4.3--------|

* Rating Significance:
1= very weak preference
2= weak preference
3= weak-moderate preference
4=moderate preference
5=moderate-strong preference
6=strong preference
7=very strong preference

Table 49

Learning Strategies (Methods) Preference Profile
Ratings and Averages of Opposing Pairs of Left- and Right-Brain Oriented Questions *

All Senior Males (N=7) **

Left-Oriented Questions	Left-Ratings/ Age Groups			Overall Question Averages (All Groups)		Right-Ratings/ Age Groups			Right-Oriented Questions
	26-30	31-35	36-40	L	R	26-30	31-35	36-40	
N:	2	4	1			2	4	1	
1	4.0	6.5	4.0	4.8	5.3	5.0	6.0	5.0	17
2	3.0	4.3	1.0	2.8	4.9	5.5	5.3	4.0	21
3	6.0	4.3	4.0	4.8	2.5	3.0	2.5	2.0	32
6	4.0	4.5	5.0	4.5	5.8	6.0	5.5	6.0	20
8	4.0	4.3	3.0	3.8	5.7	5.0	6.0	6.0	24
10	6.0	6.3	6.0	6.1	5.7	5.5	5.5	6.0	23
12	4.0	4.0	6.0	4.7	5.3	5.0	4.8	6.0	4
14	3.0	5.3	1.0	3.1	2.5	2.5	3.0	2.0	31
16	3.5	4.5	4.0	4.0	2.8	3.0	3.3	2.0	30
18	5.0	4.5	4.0	4.5	2.8	3.5	3.0	2.0	27
19	5.0	6.3	6.0	5.8	4.3	4.5	2.5	6.0	9
22	5.0	5.5	6.0	5.5	4.2	3.5	4.0	5.0	5
25	4.5	4.3	4.0	4.3	4.6	4.0	5.8	4.0	11
26	5.0	4.8	2.0	3.9	4.3	4.0	5.0	4.0	7
28	3.5	6.0	2.0	3.8	4.1	4.0	2.3	6.0	13
29	5.0	5.3	6.0	5.4	4.0	3.5	3.5	5.0	15
Ave's:	4.4	5.0	4.0	4.5	4.3	4.2	4.3	4.4	
	|---4.5---|					|---4.3---|			

* Rating Significance:
- 1= very weak preference
- 2= weak preference
- 3= weak-moderate preference
- 4= moderate preference
- 5= moderate-strong preference
- 6= strong preference
- 7= very strong preference

** One less student profile than total number for other tests.

Table 50

Learning Strategies (Methods) Preference Profile
Ratings and Averages of Opposing Pairs of Left- and Right-Brain Oriented Questions *

All Senior Females (N=42)

Left-Oriented Questions	Left-Ratings/ Age Groups							Overall Question Averages (All Groups)		Right-Ratings/ Age Groups							Right-Oriented Questions
	20-Und	21-25	26-30	31-35	36-40	41-50	51+	L	R	20-Und	21-25	26-30	31-35	36-40	41-50	51+	
	N:3	12	11	10	3	2	1			3	12	11	10	3	2	1	
1	5.3	4.9	5.1	4.8	6.0	6.0	6.0	5.4	5.5	5.3	5.2	4.8	5.5	5.7	6.0	6.0	17
2	3.7	5.0	4.0	6.0	5.0	6.0	6.0	5.1	5.7	5.7	5.8	5.7	5.5	4.7	6.5	6.0	21
3	5.0	5.3	5.5	5.6	5.0	5.0	5.0	5.2	2.4	3.0	1.9	1.7	2.3	1.0	2.0	5.0	32
6	5.3	4.3	4.2	5.0	4.7	5.5	6.0	5.0	4.9	4.3	5.3	5.2	5.1	2.7	6.5	5.0	20
8	2.0	2.4	2.5	3.0	4.0	3.5	5.0	3.2	5.3	4.0	5.8	4.6	5.3	6.0	5.5	6.9	24
10	5.7	6.2	5.7	6.3	6.3	6.0	6.0	6.0	5.4	5.0	4.9	5.2	5.5	6.0	6.0	5.0	23
12	3.0	4.7	4.6	4.9	4.7	3.5	6.0	4.5	5.3	4.0	5.4	5.4	6.4	4.0	5.0	7.0	4
14	4.7	3.8	4.3	4.6	3.7	5.5	4.0	4.4	3.2	2.7	4.3	3.2	3.4	1.7	3.0	4.0	31
16	3.7	5.4	4.8	3.9	5.0	3.0	7.0	4.7	2.5	2.3	3.3	2.4	2.9	2.3	1.5	3.0	30
18	4.7	4.6	5.4	5.0	7.0	5.0	3.0	5.0	2.7	2.0	3.2	2.5	2.8	1.7	2.5	4.0	27
19	6.3	6.6	5.5	6.2	6.0	7.0	5.0	6.1	3.4	2.3	4.3	4.2	4.8	2.7	2.5	3.0	9
22	4.7	5.4	5.1	4.7	6.0	6.0	6.0	5.4	4.5	5.3	4.1	4.2	4.3	4.0	5.5	4.0	5
25	5.3	4.8	4.1	4.7	4.0	4.0	3.0	4.3	5.1	3.3	5.3	5.2	4.4	4.3	6.0	7.0	11
26	4.3	4.8	5.0	4.6	6.7	5.0	5.0	5.1	2.7	2.0	3.4	2.7	2.8	1.7	4.5	2.0	7
28	5.3	5.1	5.1	5.8	7.0	5.5	6.0	5.7	2.7	2.3	3.7	2.5	2.6	1.0	3.5	3.0	13
29	5.3	5.3	4.5	4.4	4.7	6.0	5.0	5.0	4.5	4.0	4.3	4.2	4.4	5.3	4.0	5.0	15
Ave's:	4.7	5.0	4.7	5.0	5.4	5.2	5.3	5.0	4.1	3.5	4.3	3.9	4.2	3.4	4.3	4.7	
	|-----------5.0-----------|									|-----------4.1-----------|							

* Rating Significance:

1= very weak preference
2= weak preference
3= weak-moderate preference
4= moderate preference
5= moderate-strong preference
6= strong preference
7= very strong preference

Table 51

Mutiple Analysis of Variance Results for Quadrant Means on the Herrmann Instrument for All Community College Nursing Students by Class (alpha=.05)
N=106

Quad.	Source of Variation	df	Ms	SS	F Value	Sig. F	
CL:	Class	1	263.359	263.359	.703	.404	ns
LL:	Class	1	.6524	.6524	.003	.960	ns
LR:	Class	1	.2171	.2171	.001	.982	ns
CR:	Class	1	1.0555	1.0555	.003	.957	ns

Table 52

Mutiple Analysis of Variance Results for Quadrant Means on the Herrmann Instrument for All Community College Nursing Students by Gender (alpha=.05)
N=106

Quad.	Source of Variation	df	Ms	SS	F Value	Sig. F	
CL:	Gender	1	9.3829	9.3829	.025	.875	ns
LL:	Gender	1	457.691	457.691	1.801	.183	ns
LR:	Gender	1	633.621	633.621	1.498	.224	ns
CR:	Gender	1	791.642	791.642	2.235	.138	ns

Table 53

Mutiple Analysis of Variance Results for Quadrant Means on the Herrmann Instrument for All Community College Nursing Students by Gender and Class (alpha=.05)
N=106

Quad.	Source of Variation	df	Ms	SS	F Value	Sig. F	
CL:	GenderxClass	1	18.837	18.837	.050	.823	ns
LL:	GenderxClass	1	6.420	6.420	.025	.874	ns
LR:	GenderxClass	1	49.189	49.189	.116	.734	ns
CR:	GenderxClass	1	125.409	125.409	.354	.553	ns

Table 54

Mutiple Analysis of Variance Results for Quadrant Means on the Herrmann Instrument for All Community College Nursing Students and All Nursing Faculty by Class (alpha=.05)
N=118

Quad.	Source of Variation	df	Ms	SS	F Value	Sig. F	
CL:	Class	3	972.674	2918.021	2.387	.073	ns
LL:	Class	3	352.077	1056.230	1.381	.252	ns
LR:	Class	3	152.065	456.194	.347	.791	ns
CR:	Class	3	118.112	354.335	.319	.812	ns

Table 55

Pearson Product-Moment Correlation Coefficients for Quadrant Means for All Freshmen Male Community College Nursing Students *:alpha=.01/**:alpha=.001
N=8

Quadrants	Quadrant Correlation Coefficients/Quadrant			
	CL	LL	LR	CR
CL	1.0000	.8876*	-.5568	-.7590
LL	.8876*	1.0000	-.6081	-.7123
LR	-.5568	-.6081	1.0000	-.0253
CR	-.7590	-.7123	-.0253	1.0000

Table 56

Pearson Product-Moment Correlation Coefficients for Left/Right Overall Quadrant Scale Scores and Quadrant Means for All Freshmen Male Community College Nursing Students *:alpha=.01/**:alpha=.001
N=8

Left/Right Total Scores	Quadrant Correlation Coefficients/Quadrant			
	CL	LL	LR	CR
L-Totals Scores	.9574**	.9828**	-.6045	-.7508
R-Total Scores	-.9148**	-.9273**	.7880	.5954

Table 57

Pearson Product-Moment Correlation Coefficients for Left/Right Overall Quadrant Scale Scores and Key Descriptors for All Freshmen Male Community College Nursing Students *:alpha=.01/**:alpha=.001
N=8

Left/Right Total Scores	Key Descriptor Correlation Coefficients/Quadrant			
	CL	LL	LR	CR
L-Totals Scores	.6160	.8324*	-.5869	-.7202
R-Total Scores	-.5948	-.7973*	.6923	.6165

Table 58

Pearson Product-Moment Correlation Coefficients for Left/Right Overall Quadrant Scale Scores and Work Elements for All Freshmen Male Community College Nursing Students *:alpha=.01/**:alpha=.001
N=8

Left/Right Total Scores	Work Element Quadrant Correlation Coefficients/Quadrant			
	CL	LL	LR	CR
L-Totals Scores	.8309*	.7616	-.5094	.2825
R-Total Scores	-.7587	-.7667	.6175	-.3164

Table 59

Pearson Product-Moment Correlation Coefficients for Key Descriptors for All Freshmen Male Community College Nursing Students *:alpha=.01/**:alpha=.001
N=8

Quadrants	Key Descriptors Quadrant Correlation Coefficients/Quadrant			
	CL	LL	LR	CR
CL	1.0000	.5000	-.3074	-.5689
LL	.5000	1.0000	-.3586	-.7395
LR	-.3074	-.3586	1.0000	-.1137
CR	-.5689	-.7395	-.1137	1.0000

Table 60

Pearson Product-Moment Correlation Coefficients for Work Elements for All Freshmen Male Community College Nursing Students *:alpha=.01/**:alpha=.001
N=8

Quadrants	Work Element Quadrant Correlation Coefficients/Quadrant			
	CL	LL	LR	CR
CL	1.0000	.6832	-.6097	.2942
LL	.6832	1.0000	-.4150	-.3372
LR	-.6097	-.4150	1.0000	-.2793
CR	-.2942	-.3372	-.2793	1.0000

Table 61

Pearson Product-Moment Correlation Coefficients for Key Descriptors and Work Elements for All Freshmen Male Community College Nursing Students
*:alpha=.01/**:alpha=.001
N=8

Work Element/ Quadrant	Key Descriptor Quadrant			
	CL	LL	LR	CR
CL	.3813	.6142	-.4004	-.6615
LL	.2355	.4801	-.8896*	-.1283
LR	-.6082	-.4730	.4570	.3460
CR	-.0523	.5145	-.4061	-.0521

Table 62

Pearson Product-Moment Correlation Coefficients for Left/Right Overall Quadrant Scale Scores and Hand Position and Hand Strength for All Freshmen Male Community College Nursing Students
*:alpha=.01/**:alpha=.001
N=8

Left/Right Total Scores	Hand Position/Strength Quadrant Coefficients	
	Hand Position	Hand Strength
L-Totals Scores	.4836	.3266
R-Total Scores	-.3776	-.2376

Table 63

Pearson Product-Moment Correlation Coefficients for Hand Position and Hand Strength for All Freshmen Male Community College Nursing Students
*:alpha=.01/**:alpha=.001
N=8

Handedness Factor	Quadrant Correlation Coefficients/Quadrant	
	Hand Position	Hand Strength
Hand Position	1.0000	.9449**
Hand Strength	.9449**	1.0000

Table 64

Pearson Product-Moment Correlation Coefficients for Quadrant Means for All Freshmen Female Community College Nursing Students *:alpha=.01/**:alpha=.001
N=51

Quadrants	Quadrant Correlation Coefficients/Quadrant			
	CL	LL	LR	CR
CL	1.0000	.0122	-.7237**	-.3532*
LL	.0122	1.0000	-.3566*	-.5873**
LR	-.7237**	-.3566*	1.0000	.2536
CR	-.3532*	-.5873**	.2536	1.0000

Table 65

Pearson Product-Moment Correlation Coefficients for Left/Right Overall Quadrant Scale Scores and Quadrant Means for All Freshmen Female Community College Nursing Students *:alpha=.01/**:alpha=.001
N=51

Left/Right Total Scores	Quadrant Correlation Coefficients/Quadrant			
	CL	LL	LR	CR
L-Totals Scores	.7644**	.6540**	-.7774**	-.6459**
R-Total Scores	-.7027**	-.5786**	.8391**	.7390**

Table 66

Pearson Product-Moment Correlation Coefficients for Left/Right Overall Quadrant Scale Scores and Key Descriptors for All Freshmen Female Community College Nursing Students *:alpha=.01/**:alpha=.001
N=51

Left/Right Total Scores	Key Descriptor Correlation Coefficients/Quadrant			
	CL	LL	LR	CR
L-Totals Scores	.6423**	.3583*	-.6835**	-.5844**
R-Total Scores	-.6049**	-.3718*	.7284**	.6758**

Table 67

Pearson Product-Moment Correlation Coefficients for Left/Right Overall Quadrant Scale Scores and Work Elements for All Freshmen Female Community College Nursing Students *:alpha=.01/**:alpha=.001
N=51

Left/Right Total Scores	Work Element Quadrant Correlation Coefficients/Quadrant			
	CL	LL	LR	CR
L-Totals Scores	.4652**	.4814**	-.3517*	-.1932
R-Total Scores	-.3224	-.3115	.3780*	.2248

Table 68

Pearson Product-Moment Correlation Coefficients for Key Descriptors for All Freshmen Female Community College Nursing Students *:alpha=.01/**:alpha=.001
N=51

Quadrants	Key Descriptors Quadrant Correlation Coefficients/Quadrant			
	CL	LL	LR	CR
CL	1.0000	-.1936	-.6080**	-.5061**
LL	-.1936	1.0000	-.1541	-.4412**
LR	-.6080**	-.1541	1.0000	.2461
CR	-.5061**	-.4412**	.2461	1.0000

Table 69

Pearson Product-Moment Correlation Coefficients for Work Elements for All Freshmen Female Community College Nursing Students *:alpha=.01/**:alpha=.001
N=51

Quadrants	Work Element Quadrant Correlation Coefficients/Quadrant			
	CL	LL	LR	CR
CL	1.0000	.2499	-.3842*	-.1029
LL	.2499	1.0000	-.3058	-.2887
LR	-.3842*	-.3058	1.0000	.1690
CR	-.1029	-.2887	.1690	1.0000

Table 70

Pearson Product-Moment Correlation Coefficients for Key Descriptors and Work Elements for All Freshmen Female Community College Nursing Students
*:alpha=.01/**:alpha=.001
N=51

Work Element/ Quadrant	Key Descriptor Quadrant			
	CL	LL	LR	CR
CL	.2601	-.1417	-.3160	-.0114
LL	.2649	.0346	-.2515	-.0847
LR	.0194	-.1551	.1415	.1246
CR	.1026	-.2229	.0073	.1211

Table 71

Pearson Product-Moment Correlation Coefficients for Left/Right Overall Quadrant Scale Scores and Hand Position and Hand Strength for All Freshmen Female Community College Nursing Students
*:alpha=.01/**:alpha=.001
N=51

Left/Right Total Scores	Hand Position/Strength Quadrant Coefficients	
	Hand Position	Hand Strength
L-Totals Scores	-.0662	-.0430
R-Total Scores	.0907	.0570

Table 72

Pearson Product-Moment Correlation Coefficients for Hand Position and Hand Strength for All Freshmen Female Community College Nursing Students
*:alpha=.01/**:alpha=.001
N=51

Handedness Factor	Quadrant Correlation Coefficients/Quadrant	
	Hand Position	Hand Strength
Hand Position	1.0000	.7561**
Hand Strength	.7561**	1.0000

Table 73

Pearson Product-Moment Correlation Coefficients for Quadrant Means for All Senior Male Community College Nursing Students *:alpha=.01/**:alpha=.001
N=6

Quadrants	Quadrant Correlation Coefficients/Quadrant			
	CL	LL	LR	CR
CL	1.0000	.1709	-.1951	-.9468*
LL	.1709	1.0000	-.5087	-.3946
LR	-.1951	-.5087	1.0000	.3670
CR	-.9468**	-.3946	.3670	1.0000

Table 74

Pearson Product-Moment Correlation Coefficients for Left/Right Overall Quadrant Scale Scores and Quadrant Means for All Senior Male Community College Nursing Students *:alpha=.01/**:alpha=.001
N=6

Left/Right Total Scores	Quadrant Correlation Coefficients/Quadrant			
	CL	LL	LR	CR
L-Totals Scores	.6494	.8602	-.4936	-.7945
R-Total Scores	-.7275	-.5396	.7934	.8574

Table 75

Pearson Product-Moment Correlation Coefficients for Left/Right Overall Quadrant Scale Scores and Key Descriptors for All Senior Male Community College Nursing Students *:alpha=.01/**:alpha=.001
N=6

Left/Right Total Scores	Key Descriptor Correlation Coefficients/Quadrant			
	CL	LL	LR	CR
L-Totals Scores	.0444	.1858	-.0698	-.1832
R-Total Scores	-.5982	-.0041	.5248	.5962

Table 76

Pearson Product-Moment Correlation Coefficients for Left/Right Overall Quadrant Scale Scores and Work Elements for All Senior Male Community College Nursing Students *:alpha=.01/**:alpha=.001
N=6

Left/Right Total Scores	Work Element Quadrant Correlation Coefficients/Quadrant			
	CL	LL	LR	CR
L-Totals Scores	.3014	.0385	-.3724	-.2411
R-Total Scores	-.0500	-.1265	.2960	.6056

Table 77

Pearson Product-Moment Correlation Coefficients for Key Descriptors for All Senior Male Community College Nursing Students *:alpha=.01/**:alpha=.001
N=6

Quadrants	Key Descriptors Quadrant Correlation Coefficients/Quadrant			
	CL	LL	LR	CR
CL	1.0000	-.4763	-.7143	-.5112
LL	-.4763	1.0000	-.1588	.0379
LR	-.7143	-.1588	1.0000	.3067
CR	-.5112	-.0379	.3067	1.0000

Table 78

Pearson Product-Moment Correlation Coefficients for Work Elements for All Senior Male Community College Nursing Students *:alpha=.01/**:alpha=.001
N=6

Quadrants	Work Element Quadrant Correlation Coefficients/Quadrant			
	CL	LL	LR	CR
CL	1.0000	.3120	-.3441	.1532
LL	.3120	1.0000	-.8896*	-.3376
LR	-.3441	-.8896*	1.0000	.6226
CR	-.1532	-.3376	.6226	1.0000

Table 79

Pearson Product-Moment Correlation Coefficients for Key Descriptors and Work Elements for All Senior Male Community College Nursing Students
*:alpha=.01/**:alpha=.001
N=6

Work Element/ Quadrant	Key Descriptor Quadrant			
	CL	LL	LR	CR
CL	-.3891	-.3901	.8469	-.0109
LL	.0612	-.6913	.1835	.5546
LR	-.3243	.7128	-.0216	-.2733
CR	-.9002*	.6048	.5035	.2439

Table 80

Pearson Product-Moment Correlation Coefficients for Left/Right Overall Quadrant Scale Scores and Hand Position and Hand Strength for All Senior Male Community College Nursing Students *:alpha=.01/**:alpha=.001
N=6

Left/Right Total Scores	Hand Position/Strength Quadrant Coefficients	
	Hand Position	Hand Strength
L-Totals Scores	-.2298	-.0686
R-Total Scores	.5340	.1665

Table 81

Pearson Product-Moment Correlation Coefficients for Hand Position and Hand Strength for All Senior Male Community College Nursing Students *:alpha=.01/**:alpha=.001
N=6

Handedness Factor	Quadrant Correlation Coefficients/Quadrant	
	Hand Position	Hand Strength
Hand Position	1.0000	-.6325
Hand Strength	-.6325	1.0000

Table 82

Pearson Product-Moment Correlation Coefficients for Quadrant Means for All Senior Females Community College Nursing Students *:alpha=.01/**:alpha=.001
N=41

Quadrants	Quadrant Correlation Coefficients/Quadrant			
	CL	LL	LR	CR
CL	1.0000	-.0146	-.7408**	-.5934**
LL	-.0146	1.0000	-.2044	-.3677**
LR	-.7408**	-.2044	1.0000	.2564
CR	-.5934**	-.3677**	.2564	1.0000

Table 83

Pearson Product-Moment Correlation Coefficients for Left/Right Overall Quadrant Scale Scores and Quadrant Means for All Senior Female Community College Nursing Students *:alpha=.01/**:alpha=.001
N=41

Left/Right Total Scores	Quadrant Correlation Coefficients/Quadrant			
	CL	LL	LR	CR
L-Totals Scores	.8254**	.5524**	-.7329**	-.7023**
R-Total Scores	-.8390**	-.3636**	.7797**	.8052**

Table 84

Pearson Product-Moment Correlation Coefficients for Left/Right Overall Quadrant Scale Scores and Key Descriptors for All Senior Female Community College Nursing Students *:alpha=.01/**:alpha=.001
N=41

Left/Right Total Scores	Key Descriptor Correlation Coefficients/Quadrant			
	CL	LL	LR	CR
L-Totals Scores	.6306**	.2653	-.5545**	-.6023**
R-Total Scores	-.7281**	-.1755	.6831**	.7065**

Table 85

Pearson Product-Moment Correlation Coefficients for Left/Right Overall Quadrant Scale Scores and Work Elements for All Senior Female Community College Nursing Students *:alpha=.01/**:alpha=.001
N=41

Left/Right Total Scores	Work Element Quadrant Correlation Coefficients/Quadrant			
	CL	LL	LR	CR
L-Totals Scores	.5337**	.5074**	-.4481*	-.6009**
R-Total Scores	-.5002**	.3764*	-.3555	-.6520**

Table 86

Pearson Product-Moment Correlation Coefficients for Key Descriptors for All Senior Female Community College Nursing Students *:alpha=.01/**:alpha=.001
N=41

Quadrants	Key Descriptors Quadrant Correlation Coefficients/Quadrant			
	CL	LL	LR	CR
CL	1.0000	-.2199	-.5525**	-.6856**
LL	-.2199	1.0000	-.0921	-.2901
LR	-.5525**	-.0921	1.0000	.2625
CR	-.6856**	-.2901	.2626	1.0000

Table 87

Pearson Product-Moment Correlation Coefficients for Work Elements for All Senior Female Community College Nursing Students *:alpha=.01/**:alpha=.001
N=41

Quadrants	Work Element Quadrant Correlation Coefficients/Quadrant			
	CL	LL	LR	CR
CL	1.0000	.0950	-.4291*	-.2956
LL	.0950	1.0000	-.2987	-.4111*
LR	.4291*	-.2987	1.0000	-.0059
CR	-.2956	-.4111*	-.0059	1.0000

Table 88

Pearson Product-Moment Correlation Coefficients for Key Descriptors and Work Elements for All Senior Female Community College Nursing Students
*:alpha=.01/**:alpha=.001
N=41

Work Element/ Quadrant	Key Descriptor Quadrant			
	CL	LL	LR	CR
CL	.2202	-.0926	-.3095	-.1369
LL	.2688	.0152	-.0596	-.1958
LR	.0666	-.2011	.1124	-.0289
CR	-.5341**	-.2607	.3843*	.5983**

Table 89

Pearson Product-Moment Correlation Coefficients for Left/Right Overall Quadrant Scale Scores and Hand Position and Hand Strength for All Senior Female Community College Nursing Students
*:alpha=.01/**:alpha=.001
N=41

Left/Right Total Scores	Hand Position/Strength Quadrant Coefficients	
	Hand Position	Hand Strength
L-Totals Scores	-.0782	-.0010
R-Total Scores	.0554	.0645

Table 90

Pearson Product-Moment Correlation Coefficients for Hand Position and Hand Strength for All Senior Female Community College Nursing Students
*:alpha=.01/**:alpha=.001
N=41

Handedness Factor	Quadrant Correlation Coefficients/Quadrant	
	Hand Position	Hand Strength
Hand Position	1.0000	.6445**
Hand Strength	.6445**	1.0000

Table 91

Pearson Product-Moment Correlation Coefficients for Quadrant Means for All Community College Nursing Students
*:alpha=.01/**:alpha=.001
N=106

Quadrants	Quadrant Correlation Coefficients/Quadrant			
	CL	LL	LR	CR
CL	1.0000	.0632	-.6886**	-.4865**
LL	.0632	1.0000	-.3139**	-.5049**
LR	-.6886**	-.3139**	1.0000	.2065
CR	-.4865**	-.5049	.2065	1.0000

Table 92

Pearson Product-Moment Correlation Coefficients for Left/Right Overall Quadrant Scale Scores and Quadrant Means for All Community College Nursing Students
*:alpha=.01/**:alpha=.001
N=106

Left/Right Total Scores	Quadrant Correlation Coefficients/Quadrant			
	CL	LL	LR	CR
L-Totals Scores	.7867**	.6659**	-.7089**	-.6761**
R-Total Scores	-.7614**	-.5218**	.7973**	.7553**

Table 93

Pearson Product-Moment Correlation Coefficients for Left/Right Overall Quadrant Scale Scores and Key Descriptors for All Community College Nursing Students
*:alpha=.01/**:alpha=.001
N=106

Left/Right Total Scores	Key Descriptor Correlation Coefficients/Quadrant			
	CL	LL	LR	CR
L-Totals Scores	.6083**	.3521**	-.5880**	-.5914**
R-Total Scores	-.6440**	-.2982**	.6846**	.6777**

Table 94

Pearson Product-Moment Correlation Coefficients for Left/Right Overall Quadrant Scale Scores and Work Elements for All Community College Nursing Students
*:alpha=.01/**:alpha=.001
N=106

Left/Right Total Scores	Work Element Quadrant Correlation Coefficients/Quadrant			
	CL	LL	LR	CR
L-Totals Scores	.4792**	.5090**	-.3906**	-.3173**
R-Total Scores	-.3880**	-.3378**	.3715**	.3749**

Table 95

Pearson Product-Moment Correlation Coefficients for Key Descriptors for All Community College Nursing Students
*:alpha=.01/**:alpha=.001
N=106

Quadrants	Key Descriptors Quadrant Correlation Coefficients/Quadrant			
	CL	LL	LR	CR
CL	1.0000	-.1852	-.5586**	-.5770**
LL	-.1852	1.0000	-.1313	-.3771**
LR	-.5586**	-.1313	1.0000	.2091
CR	-.5770**	-.3771**	.2091	1.0000

Table 96

Pearson Product-Moment Correlation Coefficients for Work Elements for All Community College Nursing Students
*:alpha=.01/**:alpha=.001
N=106

Quadrants	Work Element Quadrant Correlation Coefficients/Quadrant			
	CL	LL	LR	CR
CL	1.0000	.1968**	-.4057**	-.3125**
LL	.2595*	1.0000	-.3125**	-.2915*
LR	.0162	-.1630	1.0000	.7000
CR	-.1609	-.2915*	.0700	1.0000

Table 97

Pearson Product-Moment Correlation Coefficients for Key Descriptors and Work Elements for All Community College Nursing Students *:alpha=.01/**:alpha=.001
N=106

Work Element/ Quadrant	Key Descriptor Quadrant			
	CL	LL	LR	CR
CL	.1933	.2595*	.0162	-.2303*
LL	-.0973	.0304	-.1630	-.1457
LR	-.2283*	-.2132	.1380	.1017
CR	-.1019	-.1033	.0457	.3138**

Table 98

Pearson Product-Moment Correlation Coefficients for Left/Right Overall Quadrant Scale Scores and Hand Position and Hand Strength for All Community College Nursing Students *:alpha=.01/**:alpha=.001
N=106

Left/Right Total Scores	Hand Position/Strength Quadrant Coefficients	
	Hand Position	Hand Strength
L-Totals Scores	-.0436	.0025
R-Total Scores	.0716	.0414

Table 99

Pearson Product-Moment Correlation Coefficients for Hand Position and Hand Strength for All Community College Nursing Students *:alpha=.01/**:alpha=.001
N=106

Handedness Factor	Quadrant Correlation Coefficients/Quadrant	
	Hand Position	Hand Strength
Hand Position	1.0000	.6872**
Hand Strength	.6872**	1.0000

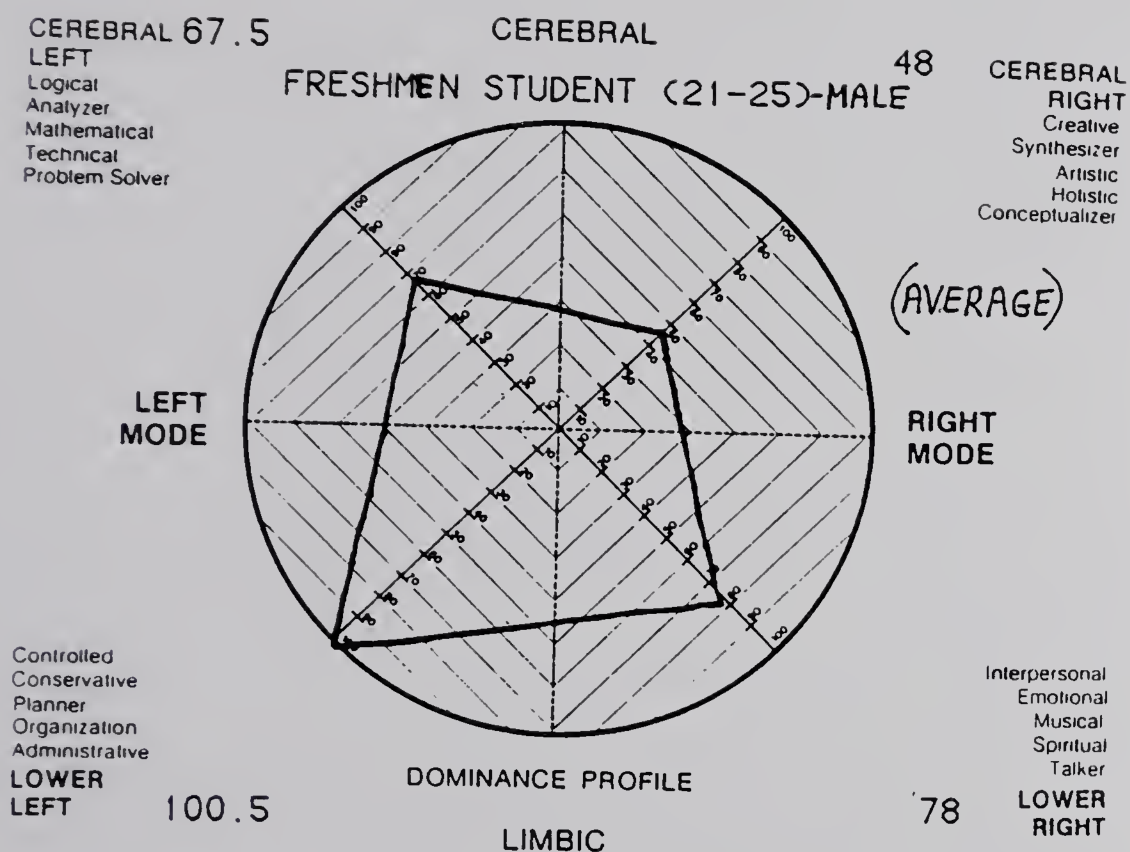


Figure 35
Freshmen Male 21-25 Profile

Figure 35

Thinking Preference Profile

Freshmen Male-21-25
N=1

Group Average Profile 1-1-1-2

This profile indicates that the one Freshmen 21-25-aged Male preferred Left-oriented Thinking Preferences fairly strongly over Right-oriented preferences, and yields a triple primary, with a double preference (dominance) in the left mode featuring logical, analytic, rational, quantitative thinking in the Cerebral Left quadrant, coupled with controlled, conservative, structured, organized and planned mental activities in the Limbic Left quadrant. This profile also features a third primary in the Limbic Right quadrant, dealing with emotional and interpersonal processing.

Distinctly secondary, but still functional would be the Cerebral Right quadrant dealing with integration, synthesizing, intuitive processing, conceptualizing and holistic processing. The person with this profile would typically find themselves as people-oriented managers of technical work with high administrative content.

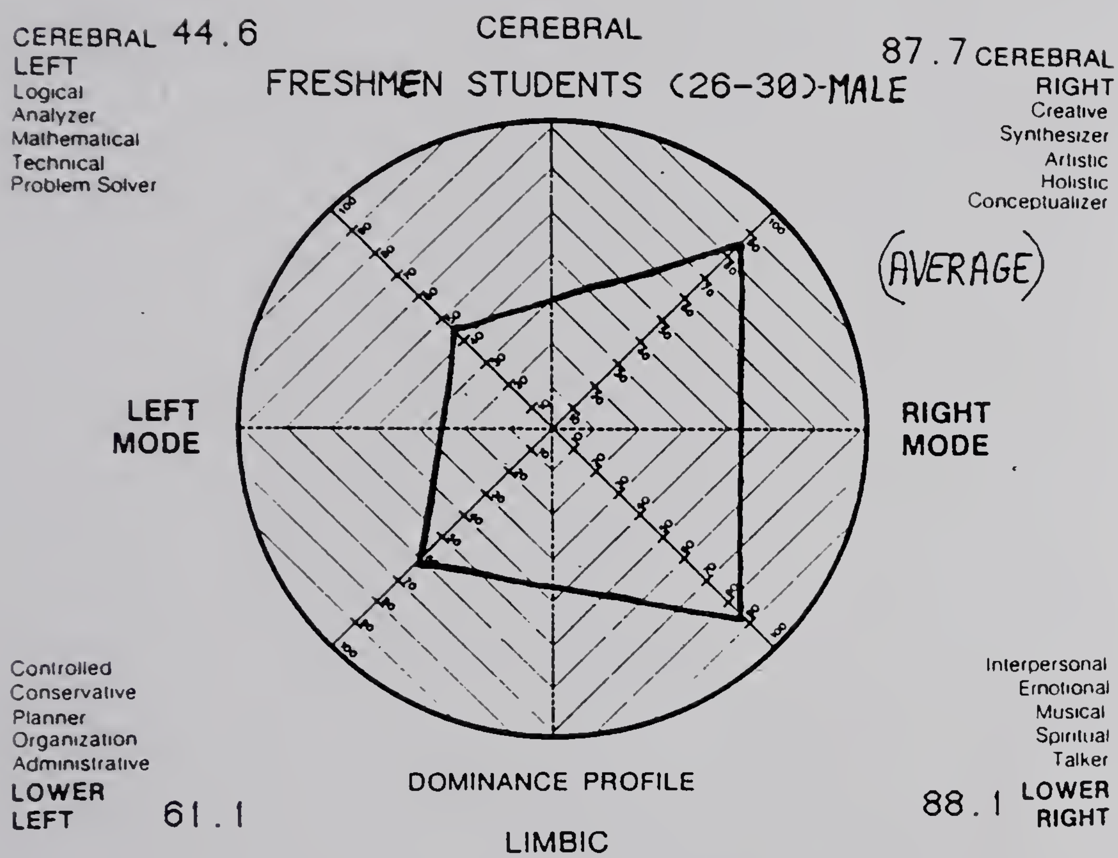


Figure 36
Freshmen Males 26-30 Profile

Figure 36

Thinking Preference Profile

Freshmen Males-26-30
N=4

Group Average Profile 2-2-1-1

This profile yields primaries in the two right mode quadrants and secondaries in the two left mode quadrants. The Cerebral Right primary is characterized by strong preferences in the creative, synthesizing, artistic, holistic, conceptual mode, coupled with the Limbic Right primary which shows strong preferences in the interpersonal, emotional, spiritual and musical modes. Taken together, these two right mode primaries show a combined preference for intuitive, insightful thinking in both the feeling and problem solving modes.

The two secondary preferences in the left mode would tend to balance quite well with the two right mode primaries. Cerebral Left features logical, analytic, rational, factual processing, and the Limbic Left shows preferences for planning, organizing activities and more structured and controlled thinking. This profile would support entrepreneurial behavior, since it would feature imaginative, innovative, creative approaches appropriately moderated, but not controlled, by the logical, analytic and planned and organized thinking of the left mode.

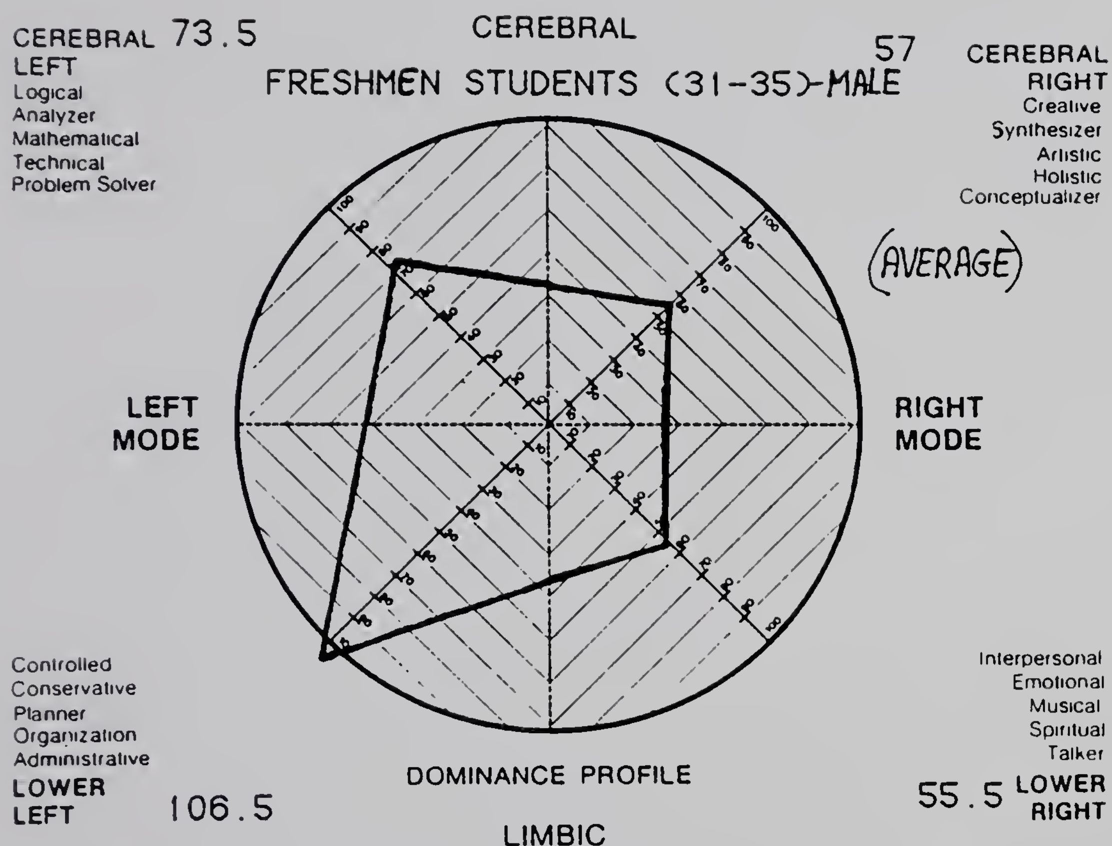


Figure 37
Freshmen Males 31-35 Profile

Figure 37

Thinking Preference Profile

Freshmen Male-31-35
N=1

Group Average Profile 1-1-2-2

This profile indicates that for the one 31-35-aged Freshmen Male, he preferred Left-oriented Thinking Preferences fairly strongly over Right-preferences, and indicates that he has a double dominance in the left mode compared to a subordinate secondary dominance in the right mode. Typical descriptors for this profile would be logical, analytic, rational and quantitative.

The person with this profile is technically-oriented, effective at problem solving, conservative, controlled and structured in thinking, but effective in planning, organizing and administrative activities.

In a secondary mode, this person also has interpersonal skills, is able to deal with emotions effectively, and is able to integrate, synthesize and think holistically. Conceptual and intuitive capabilities are secondary, but quite functional.

A person with this profile would distinctly prefer left mode processing rather than right, but still is able to function quite effectively in right mode activiites.

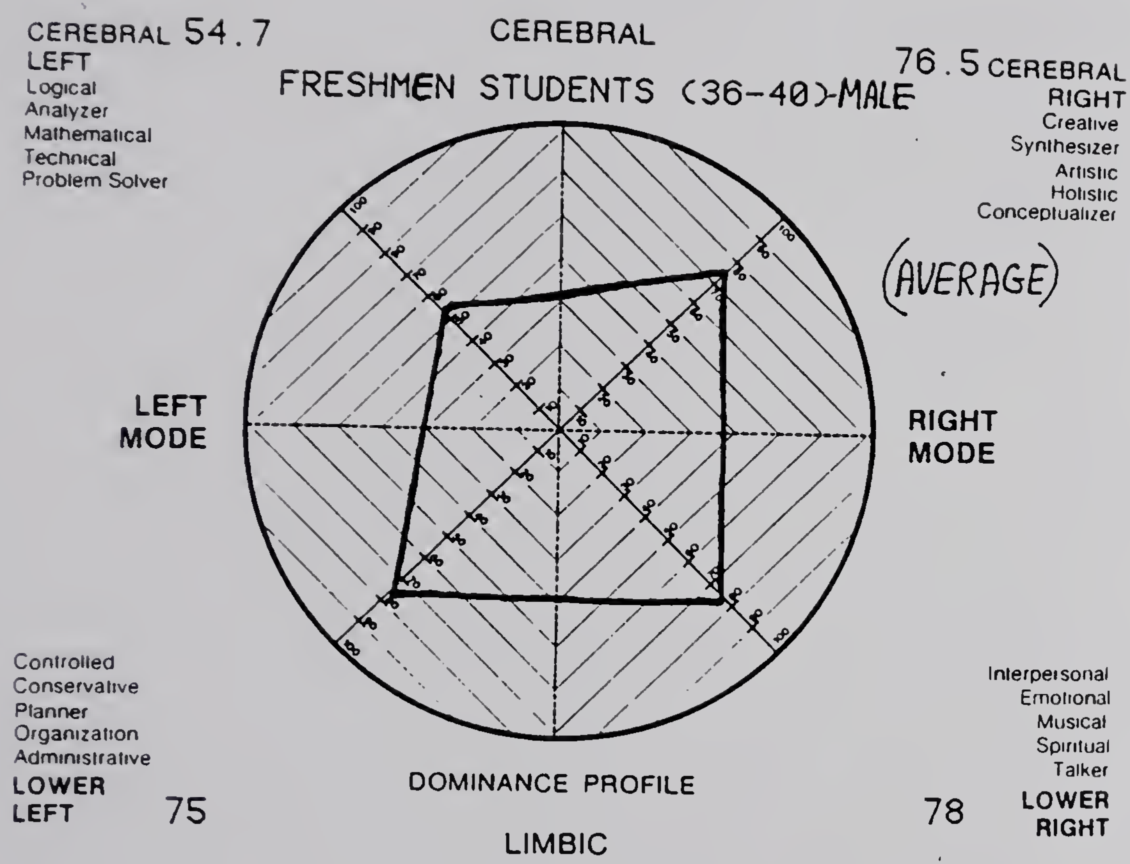


Figure 38
Freshmen Males 36-40 Profile

Figure 38

Thinking Preference Profile

Freshmen Males-36-40
N=2

Group Average Profile 2-1-2-1

This profile features yields two primaries in distinctly opposite modes. The experimental mode lies in the Cerebral Right quadrant and is featured by innovative, experimental thinking with the ability to synthesize and integrate and think in holistic and conceptual terms. In contrast, the primary in the Limbic Left quadrant is characterized as safe-keeping and features rather conservative, controlled, structured mental processes involving planning, organizing and administrative activities.

The person with this profile might feel a distinct duality in their approach to work and life experiences. On one occasion they might be quite controlled and structured in their thinking, and in another situation, quite loose and free-wheeling. The combination of these two primaries can be very powerful if the very strong Limbic Left mode is able to stand aside to permit the more imaginative and experimental Cerebral Right mode to make its contribution.

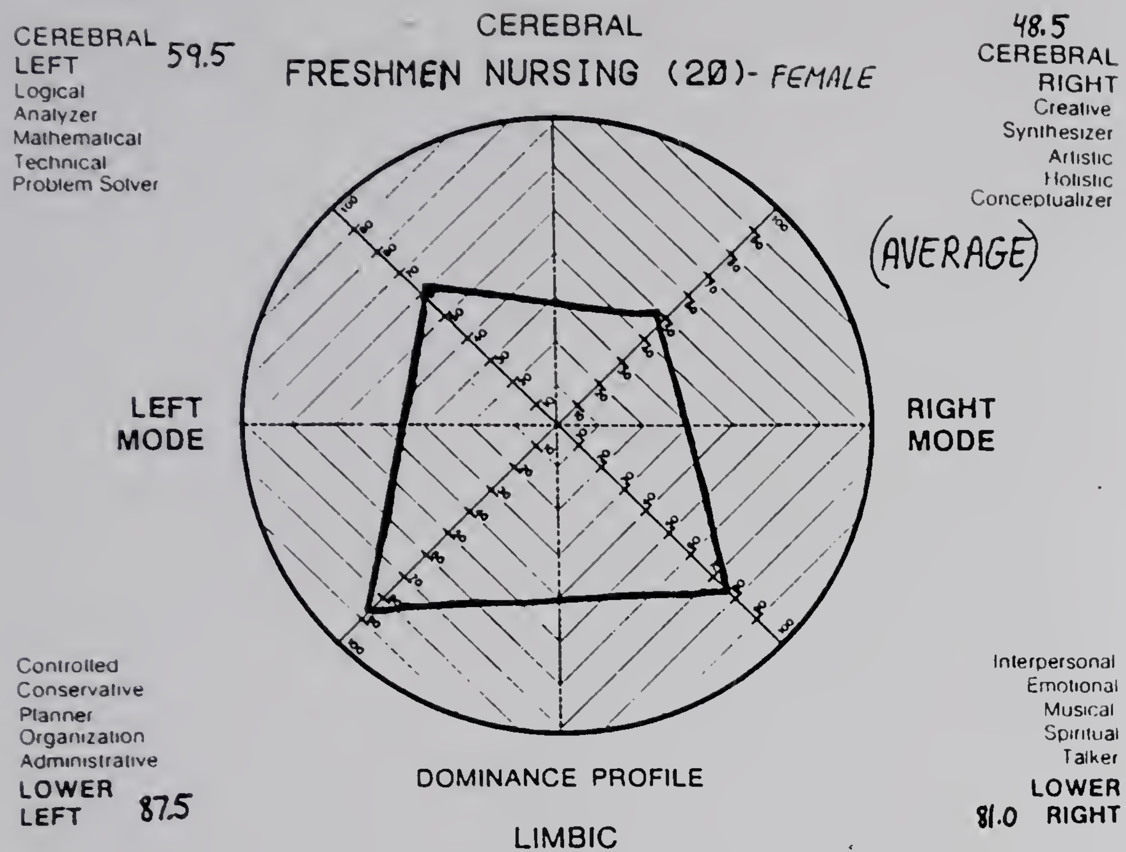


Figure 39
Freshmen Females 20-and-Under Profile

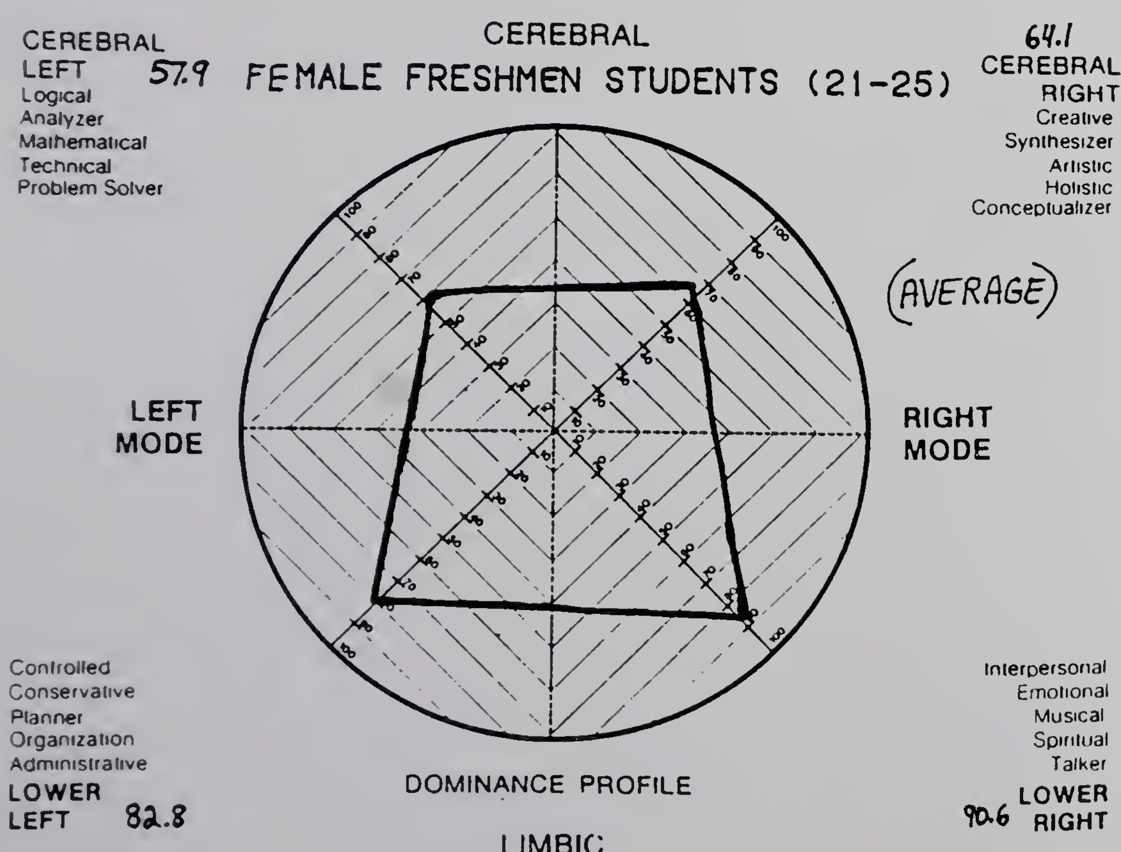


Figure 40
Freshmen Females 21-25 Profile

Figures 39 and 40

Thinking Preference Profile

Freshmen Females-20-and-Under
N=6
Freshmen Females-21-25 N=16
Group Average Profile 2-1-1-2

This profile yields a double primary in the limbic area. It is a mirror image reversal of profile 1-2-2-1, which has a double primary in the cerebral area. This profile, 2-1-1-2, is characterized by very strong (primary) preferences in the Limbic Left and Right Quadrants. Primary preferences in the Limbic Left quadrant focus on conservative thinking and controlled behavior with a desire for organization and structure and a preference for detail and accuracy. Persons with a preference in this quadrant tend to be perfectionists.

This profile would also feature an equal preference in the Limbic Right quadrant, which would be characterized by emotional and interpersonal processing coupled with an interest in music and a sense of sprituality. Persons with preferences in this quadrant would also tend to be intuitive with respect to their feelings. The combination of the two primaries in the Limbic quadrants would represent a duality for the person to resolve within themselves, and would involve the opposing qualities of control, structure and dominance compared with the emotional qualities associated with interpersonal interaction, musical, spiritual interests and intuitive feelings.

Another important characteristic of this limbic-oriented profile is the clear secondary preferences in the cerebral area, both in the left mode and the right mode. This indicates that logical, analytic processing is a secondary rather than a primary preference, and that holistic, conceptual, integrative thinking is similarly secondary rather than primary. The two primaries involved in this profile could be described as safe-keeping on one hand and emotional on the other.

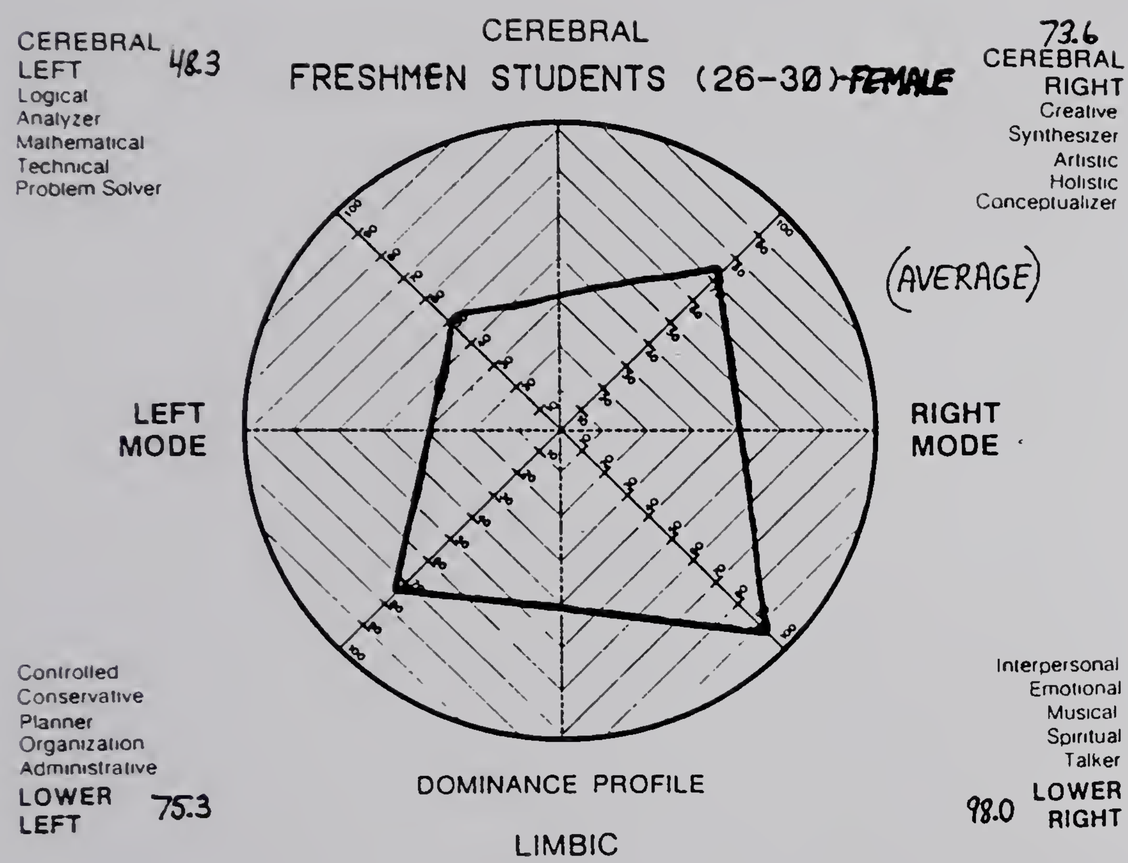


Figure 41
Freshmen Females 26-30 Profile

Figure 41

Thinking Preference Profile

Freshmen Females-26-30
N=12

Group Average Profile 2-1-1-1

This multi-dominant profile indicates yields primaries in the Cerebral Right, Limbic Right and Limbic Left quadrants. This profile is charaterized by strong preferences in the creative, synthesizing, artistic, holistic and conceptual modes of the Cerebral Right quadrant, as well as strong preferences in the interpersonal, emotional, musical and spiritual modes of the Limbic Right quadrant. The third primary in this profile is in the safe-keeping Limbic Left quadrant with contrasting preferences in the area of planning, organizing and administrative capabilities.

This profile is also characterized by a relatively low preference in the Cerebral Left quadrant dealing with logical, analytic and mathematical processing. People with this profile would exhibit strong interpersonal and emotional characteristics, but would also experience a duality between a more experimental Cerebral Right mode and a contrasting safe-keeping Limbic Left mode.

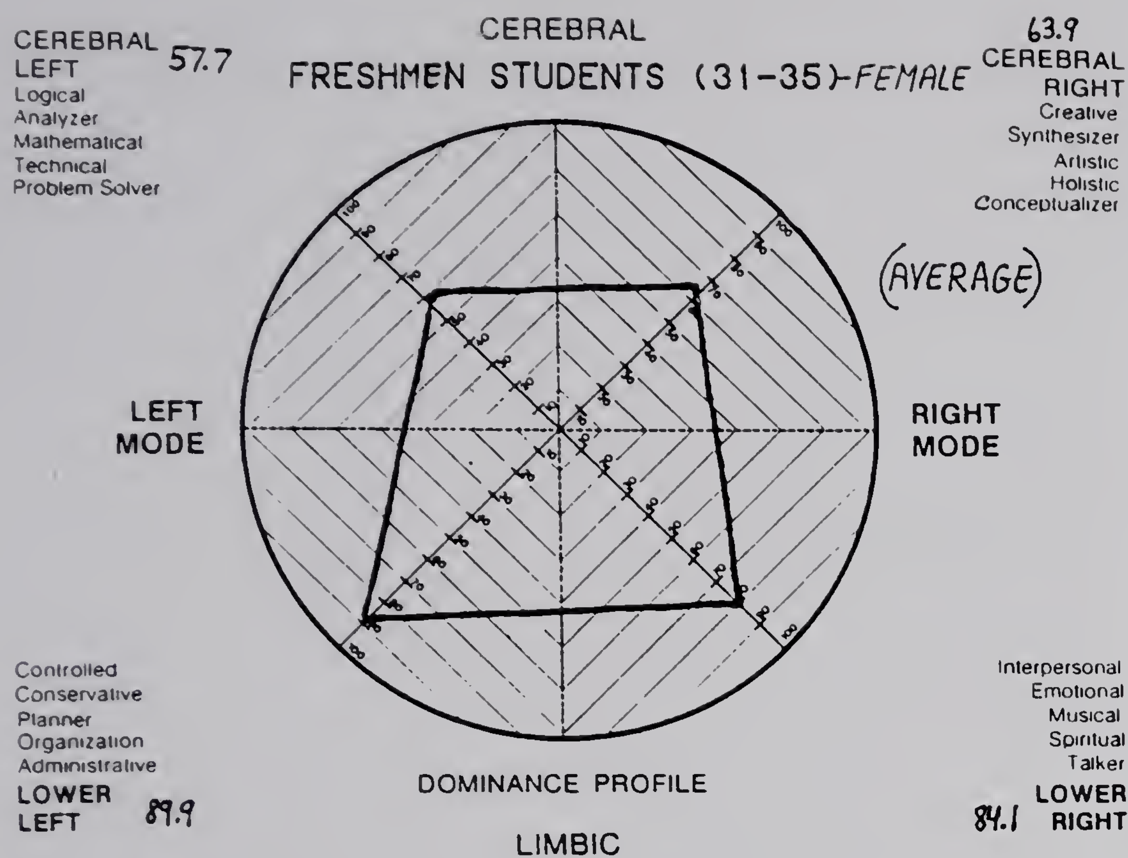


Figure 42
Freshmen Females 31-35 Profile

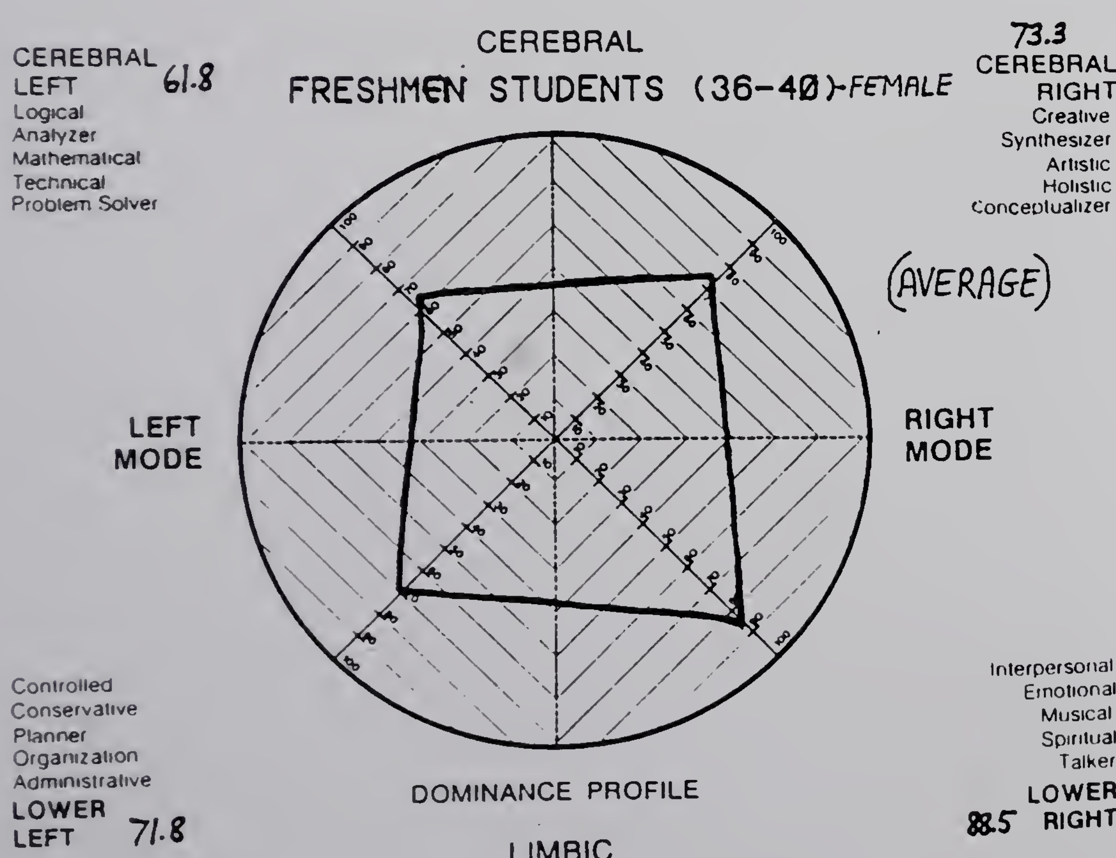


Figure 43
Freshmen Females 36-40 Profile

Figures 42 and 43

Thinking Preference Profile

Freshmen Females-31-35
N=11
Freshmen Females-36-40 N=11
Group Average Profile 2-1-1-2

This profile yields a double primary in the limbic area. It is a mirror image reversal of profile 1-2-2-1, which has a double primary in the cerebral area. This profile, 2-1-1-2, is characterized by very strong (primary) preferences in the Limbic Left and Right Quadrants. Primary preferences in the Limbic Left quadrant focus on conservative thinking and controlled behavior with a desire for organization and structure and a preference for detail and accuracy. Persons with a preference in this quadrant tend to be perfectionists.

This profile would also feature an equal preference in the Limbic Right quadrant, which would be characterized by emotional and interpersonal processing coupled with an interest in music and a sense of sprituality. Persons with preferences in this quadrant would also tend to be intuitive with respect to their feelings. The combination of the two primaries in the Limbic quadrants would represent a duality for the person to resolve within themselves, and would involve the opposing qualities of control, structure and dominance compared with the emotional qualities associated with interpersonal interaction, musical, spiritual interests and intuitive feelings.

Another important characteristic of this limbic-oriented profile is the clear secondary preferences in the cerebral area, both in the left mode and the right mode. This indicates that logical, analytic processing is a secondary rather than a primary preference, and that holistic, conceptual, integrative thinking is similarly secondary rather than primary. The two primaries involved in this profile could be described as safe-keeping on one hand and emotional on the other.

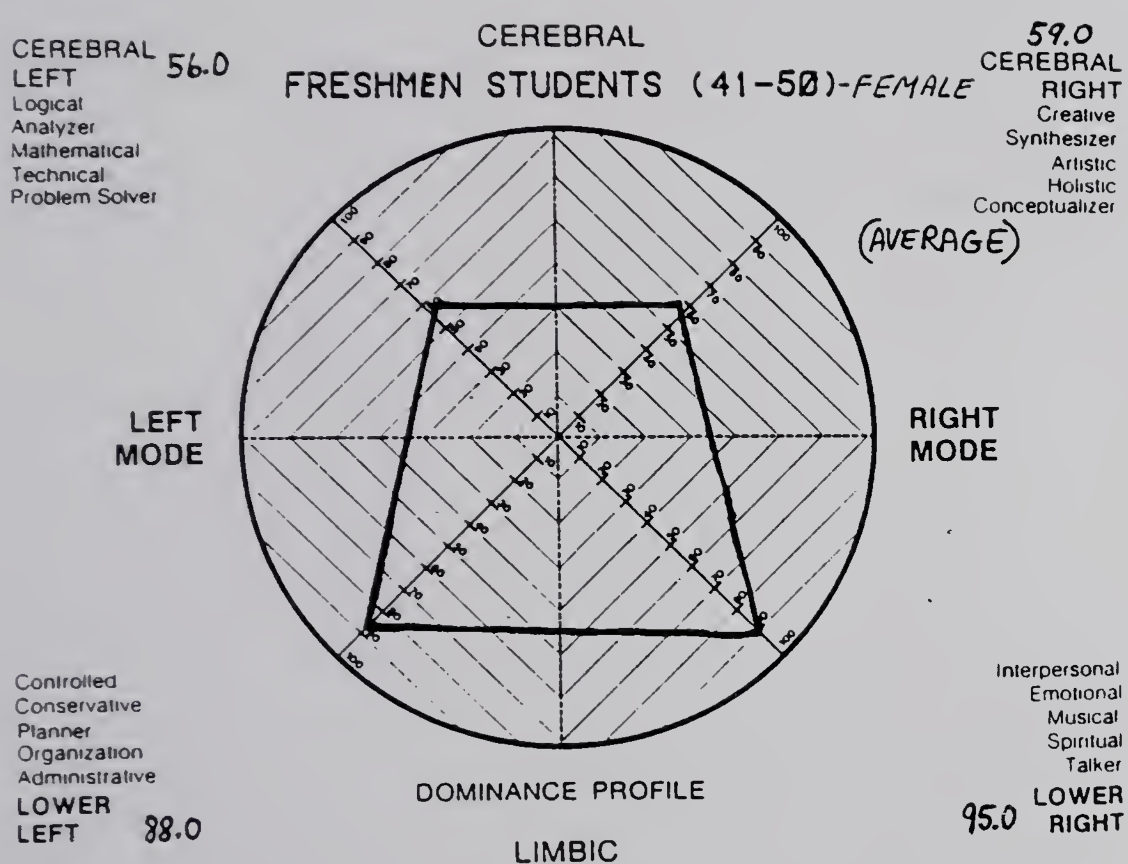


Figure 44
Freshmen Females 41-50 Profile

Figure 44

Thinking Preference Profile

Freshmen Females-41-50
N=2

Group Average Profile 2-1-1-2

This profile yields a double primary in the limbic area. It is a mirror image reversal of profile 1-2-2-1, which has a double primary in the cerebral area. This profile, 2-1-1-2, is characterized by very strong (primary) preferences in the Limbic Left and Right Quadrants. Primary preferences in the Limbic Left quadrant focus on conservative thinking and controlled behavior with a desire for organization and structure and a preference for detail and accuracy. Persons with a preference in this quadrant tend to be perfectionists.

This profile would also feature an equal preference in the Limbic Right quadrant, which would be characterized by emotional and interpersonal processing coupled with an interest in music and a sense of sprituality. Persons with preferences in this quadrant would also tend to be intuitive with respect to their feelings. The combination of the two primaries in the Limbic quadrants would represent a duality for the person to resolve within themselves, and would involve the opposing qualities of control, structure and dominance compared with the emotional qualities associated with interpersonal interaction, musical, spiritual interests and intuitive feelings.

Another important characteristic of this limbic-oriented profile is the clear secondary preferences in the cerebral area, both in the left mode and the right mode. This indicates that logical, analytic processing is a secondary rather than a primary preference, and that holistic, conceptual, integrative thinking is similarly secondary rather than primary. The two primaries involved in this profile could be described as safe-keeping on one hand and emotional on the other.

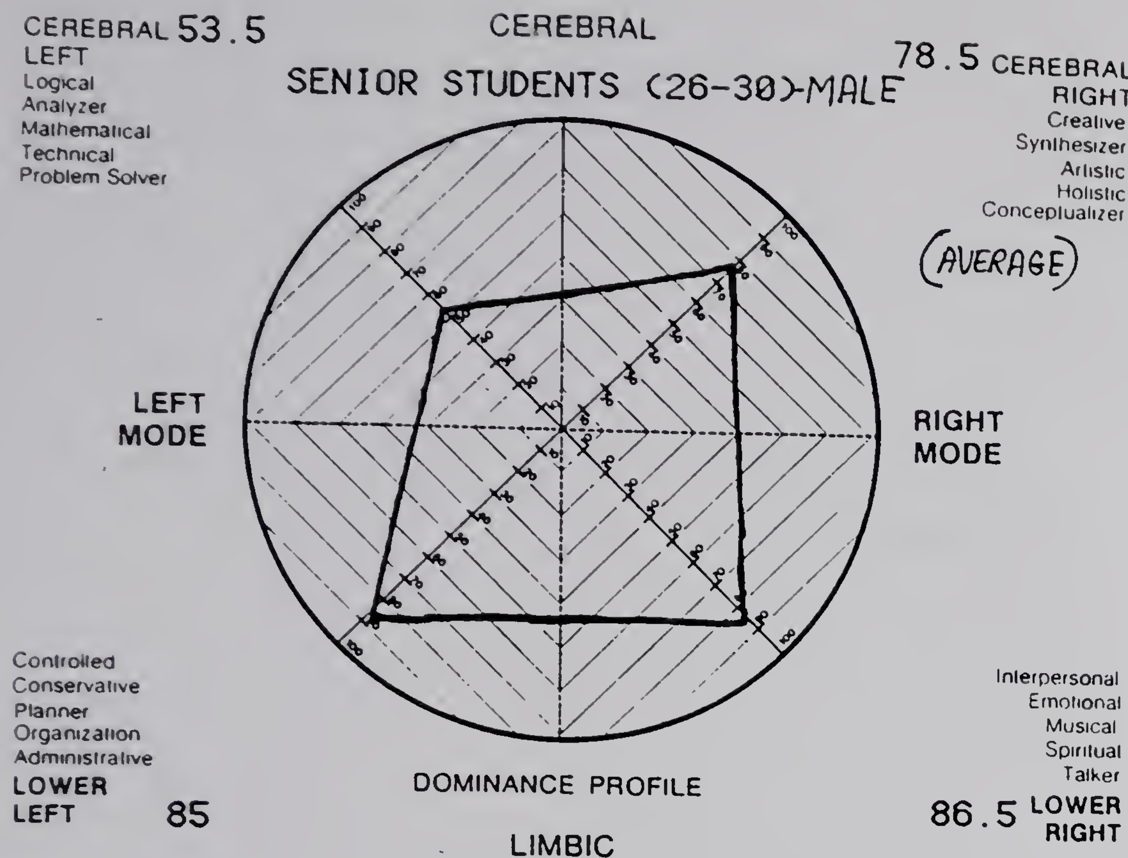


Figure 45
Senior Males 26-30 Profile

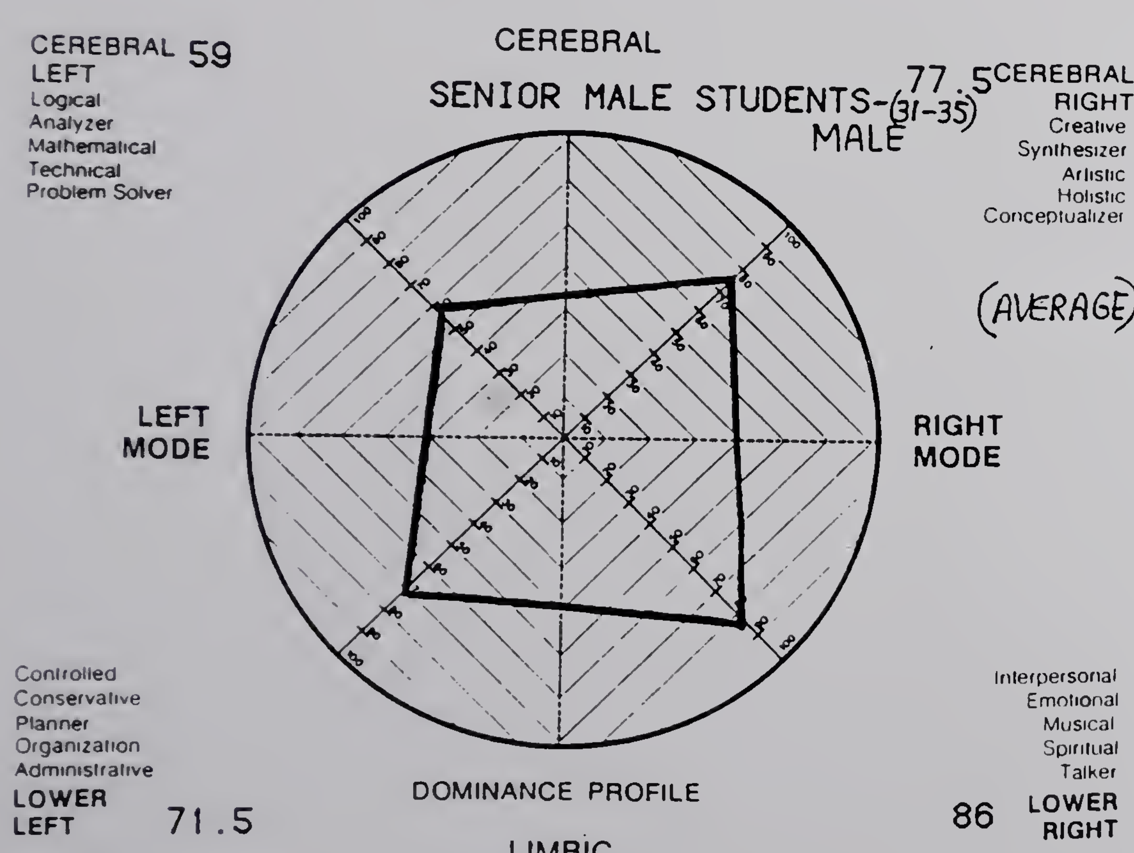


Figure 46
Senior Males 31-35 Profile

Figure 45 and 46

Thinking Preference Profile

Senior Males-26-30
N=3
Senior Males-31-35
N=3

Group Average Profile 2-1-1-1

This multi-dominant profile yields primaries in the Cerebral Right, Limbic Right and Limbic Left quadrants. This profile is charaterized by strong preferences in the creative, synthesizing, artistic, holistic and conceptual modes of the Cerebral Right quadrant, as well as strong preferences in the interpersonal, emotional, musical and spiritual modes of the Limbic Right quadrant. The third primary in this profile is in the safe-keeping Limbic Left quadrant with contrasting preferences in the area of planning, organizing and administrative capabilities.

This profile is also characterized by a relatively low preference in the Cerebral Left quadrant dealing with logical, analytic and mathematical processing. People with this profile would exhibit strong interpersonal and emotional characteristics, but would also experience a duality between a more experimental Cerebral Right mode and a contrasting safe-keeping Limbic Left mode.

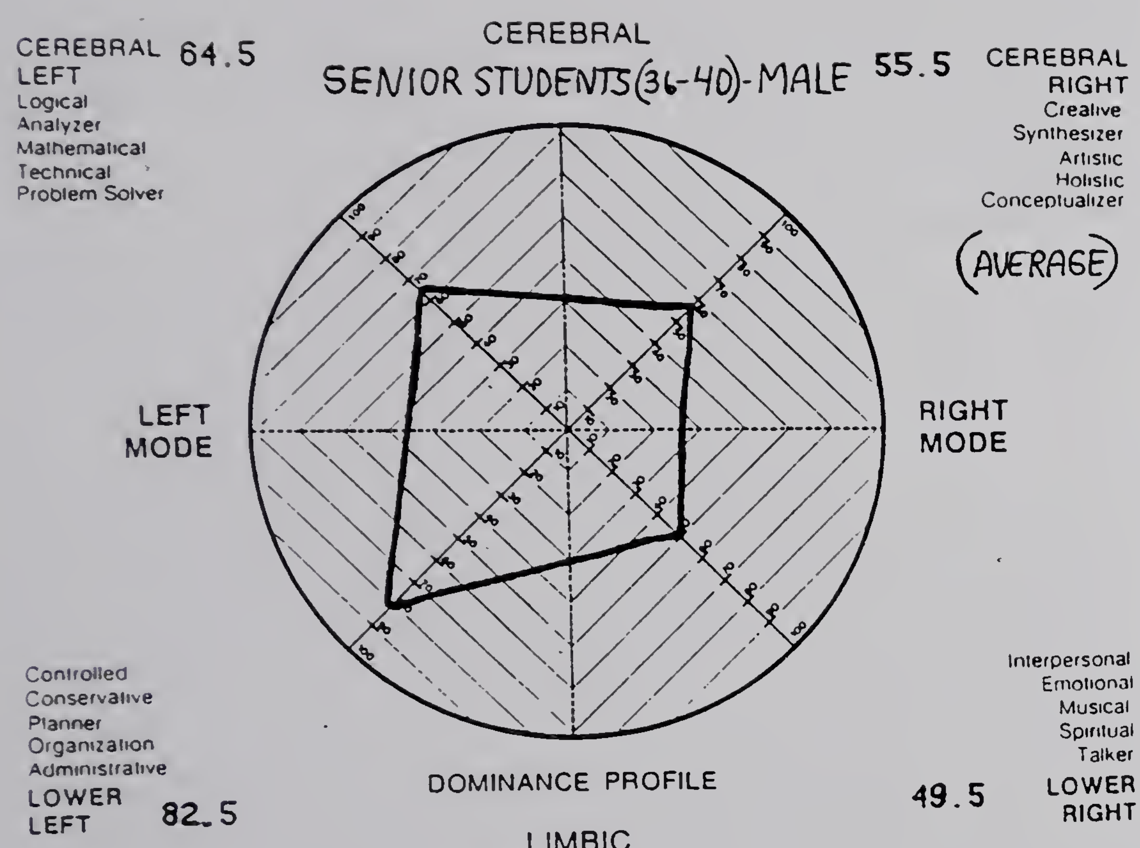


Figure 47
Senior Males 36-40 Profile

Figure 47

Thinking Preference Profile

Senior Males-36-40
N=1

Group Average Profile 2-1-2-2

This profile indicates that the one Senior 36-40-aged Male preferred Left-oriented Thinking Preferences fairly strongly over Right-preferences, and yields a primary in the Limbic left Quadrant indicating a person who is quite structured, controlled, conservative and safe-keeping in behavior and would tend to be a perfectionist. This individual would be primarily interested in planning, organizing and administrative activities.

The three secondary quadrants indicate that this person has lesser preferences for those areas. Those other three areas, however, are balanced in terms of logical, analytic, mathematical thinking, emotional, intuitive, musical and interpersonal processing and integration, synthesizing, concceptualizing and holistic thinking.

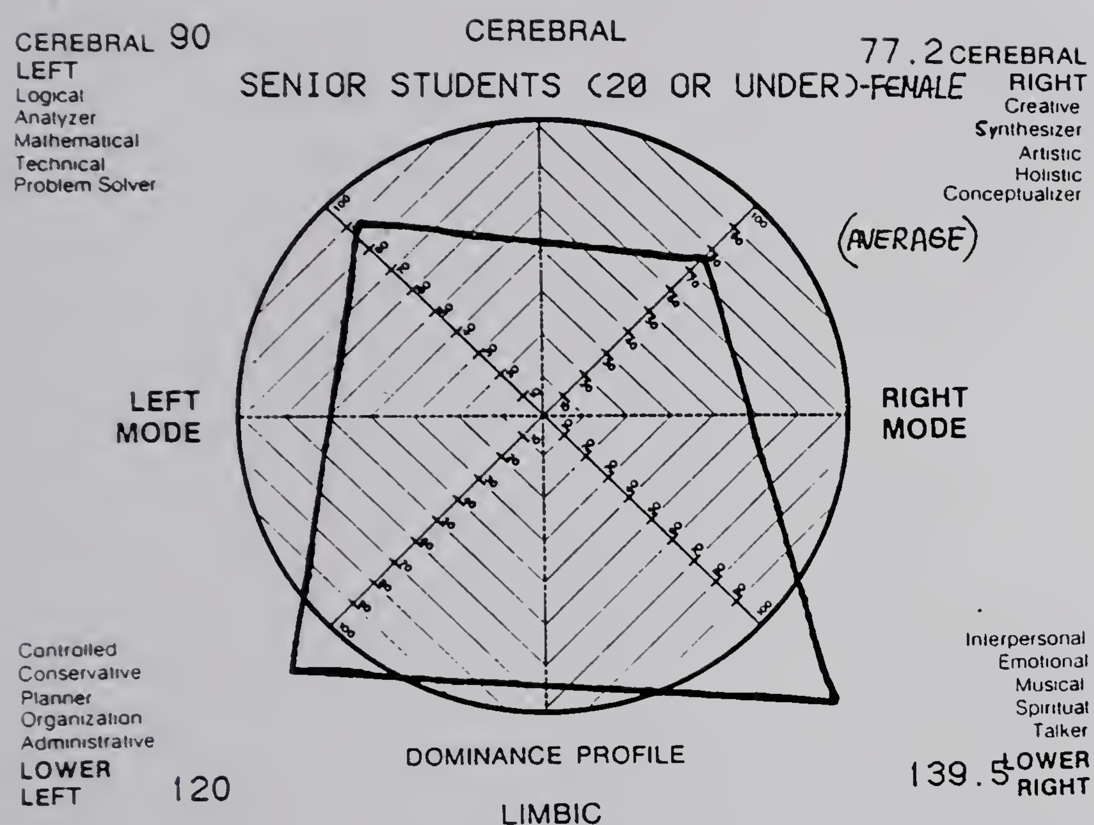


Figure 48
Senior Females 20-and-Under Profile

Figure 48

Thinking Preference Profile

Senior Females-20-and-Under
N=3

Group Average Profile 3-2-2-3

This profile indicates that this group displays no very strong (primary) preferences in any thinking mode, yet exhibit secondary preferences in the Limbic Left and Limbic Right quadrants, with tertiary modes in the Cerebral Left and Cerebral Right quadrants. At the secondary level, they would be somewhat controlled, conservative, oriented to planning, organizing and administrative activity, as well as being emotional and interpersonally-oriented.

With this mode, they also have a very low level of preference for logical, analytic, rational, quantitative thinking of the Cerebral Left quadrant, coupled with a very low preference for integration, cenceptual, intuitive and insightful thinking of the Cerebral Right quadrant.

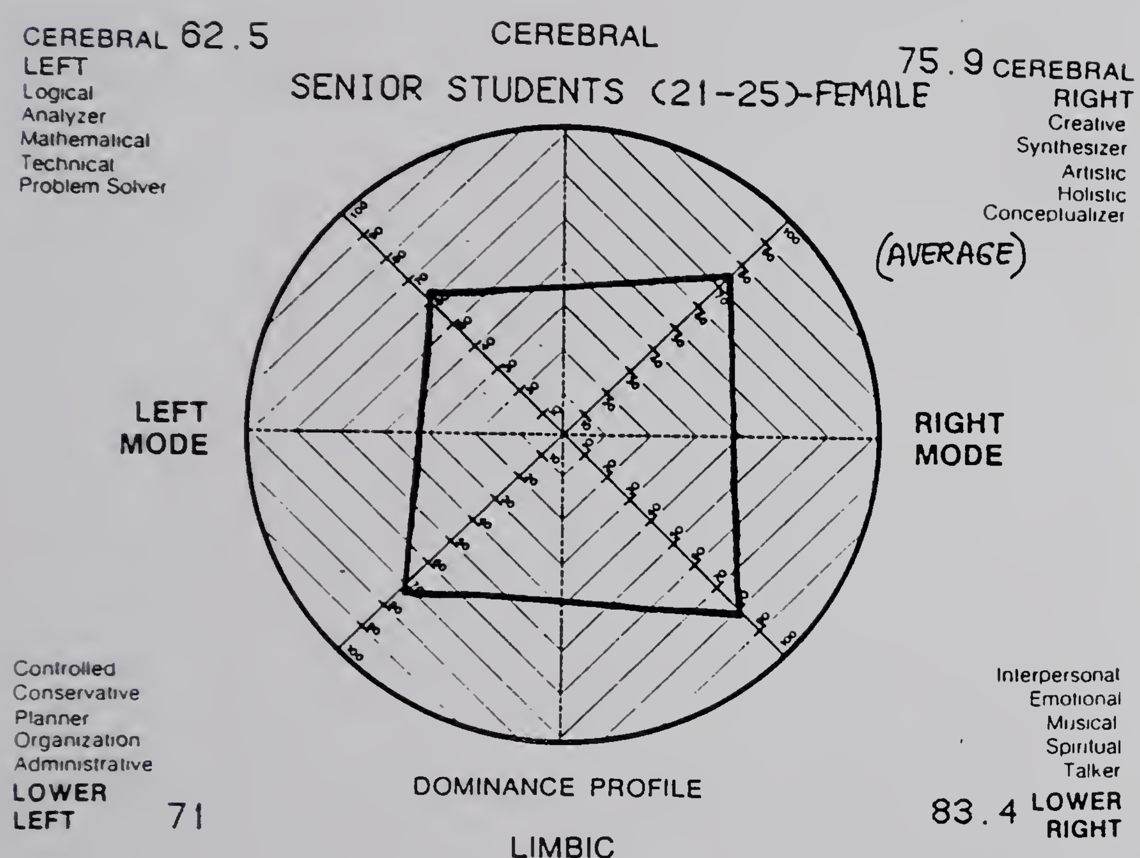


Figure 49
Senior Females 21-25 Profile

Figure 49

Thinking Preference Profile

Senior Females-21-25
N=11

Group Average Profile 2-1-1-1

This is multi-dominant profile yields primaries in the Cerebral Right, Limbic Right and Limbic Left quadrants. This profile is charaterized by strong preferences in the creative, synthesizing, artistic, holistic and conceptual modes of the Cerebral Right quadrant, as well as strong preferences in the interpersonal, emotional, musical and spiritual modes of the Limbic Right quadrant. The third primary in this profile is in the safe-keeping Limbic Left quadrant with contrasting preferences in the area of planning, organizing and administrative capabilities.

This profile is also characterized by a relatively low preference in the Cerebral Left quadrant dealing with logical, analytic and mathematical processing. People with this profile would exhibit strong interpersonal and emotional characteristics, but would also experience a duality between a more experimental Cerebral Right mode and a contrasting safe-keeping Limbic Left mode.

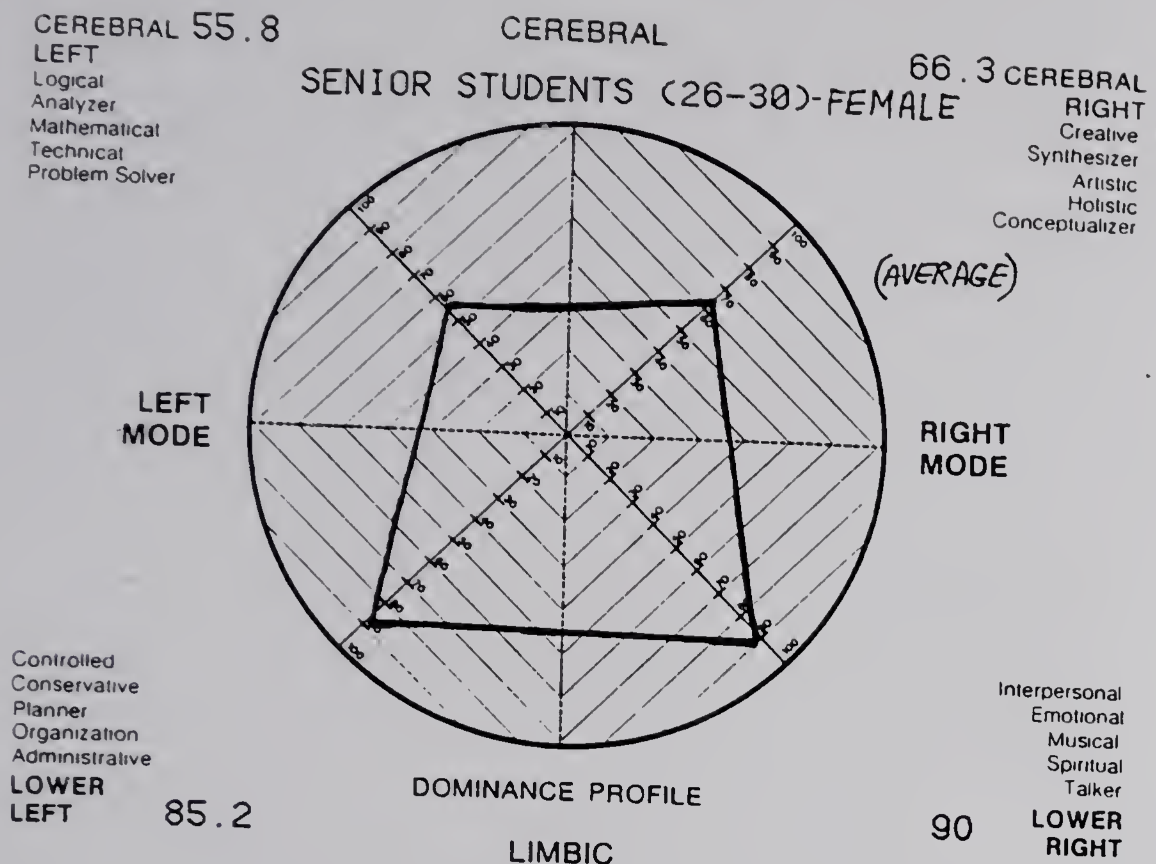


Figure 50
Senior Females 26-30 Profile

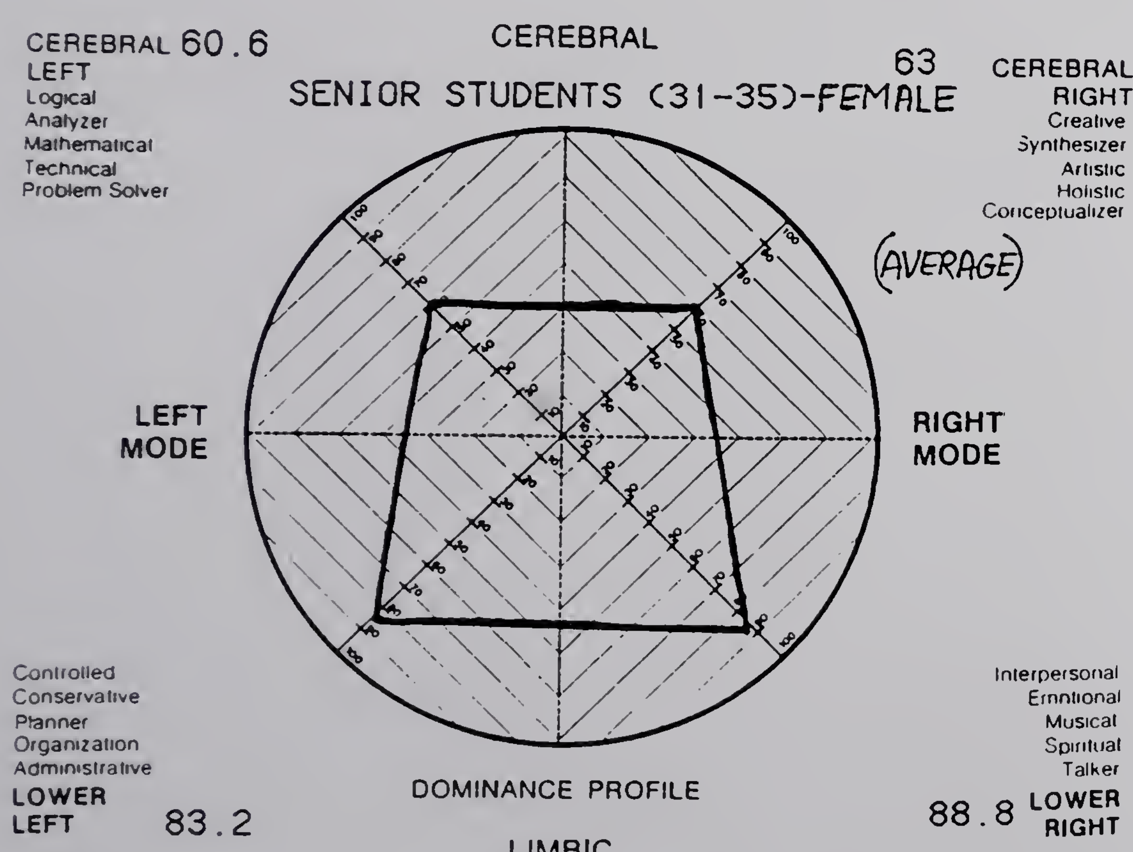


Figure 51
Senior Females 31-35 Profile

Figures 50 and 51

Thinking Preference Profile

Senior Females-26-30
N=11
Senior Females-31-35
N=10

Group Average Profile 2-1-1-2

This profile yields a double primary in the limbic area. It is a mirror image reversal of profile 1-2-2-1, which has a double primary in the cerebral area. This profile, 2-1-1-2, is characterized by very strong (primary) preferences in the Limbic Left and Right Quadrants. Primary preferences in the Limbic Left quadrant focus on conservative thinking and controlled behavior with a desire for organization and structure and a preference for detail and accuracy. Persons with a preference in this quadrant tend to be perfectionists.

This profile would also feature an equal preference in the Limbic Right quadrant, which would be characterized by emotional and interpersonal processing coupled with an interest in music and a sense of sprituality. Persons with preferences in this quadrant would also tend to be intuitive with respect to their feelings. The combination of the two primaries in the Limbic quadrants would represent a duality for the person to resolve within themselves, and would involve the opposing qualities of control, structure and dominance compared with the emotional qualities associated with interpersonal interaction, musical, spiritual interests and intuitive feelings.

Another important characteristic of this limbic-oriented profile is the clear secondary preferences in the cerebral area, both in the left mode and the right mode. This indicates that logical, analytic processing is a secondary rather than a primary preference, and that holistic, conceptual, integrative thinking is similarly secondary rather than primary. The two primaries involved in this profile could be described as safe-keeping on one hand and emotional on the other.

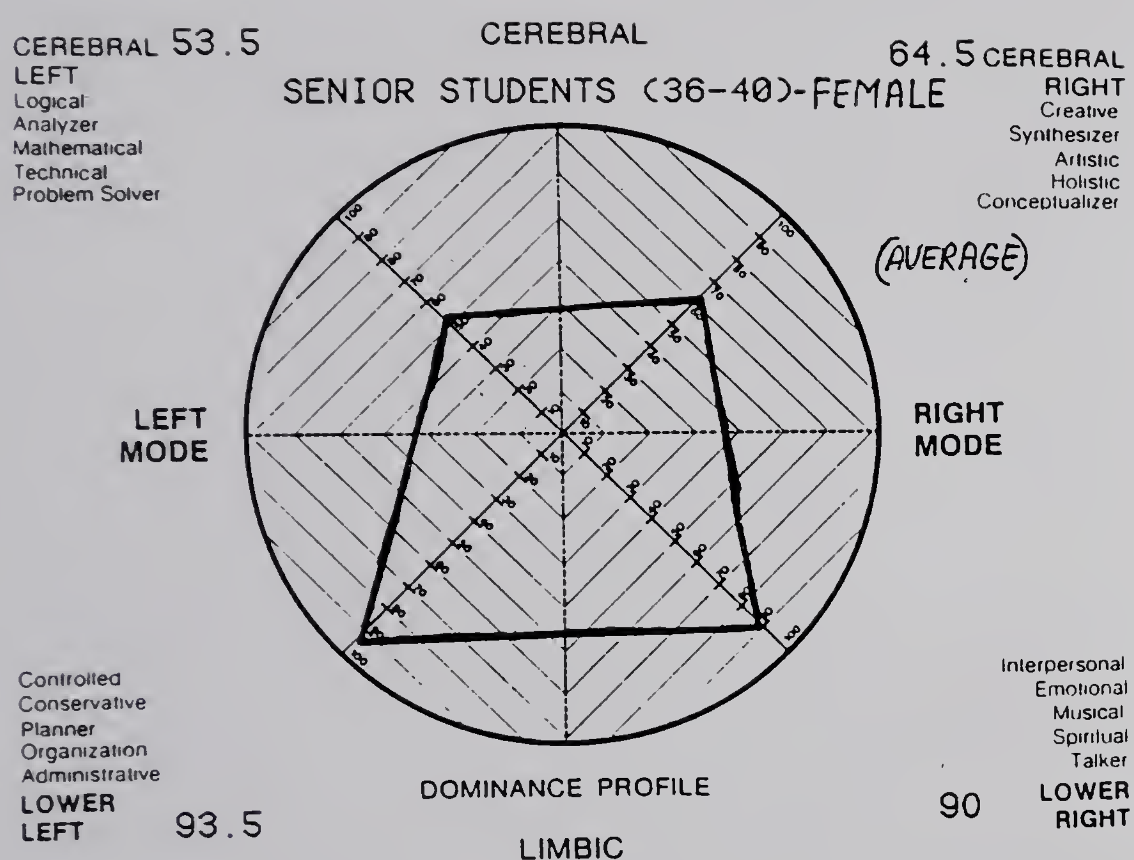


Figure 52
Senior Females 36-40 Profile

Figure 52

Thinking Preference Profile

Senior Females-36-40
N=3

Group Average Profile 2-1-1-2

This profile yields a double primary in the limbic area. It is a mirror image reversal of profile 1-2-2-1, which has a double primary in the cerebral area. This profile, 2-1-1-2, is characterized by very strong (primary) preferences in the Limbic Left and Right Quadrants. Primary preferences in the Limbic Left quadrant focus on conservative thinking and controlled behavior with a desire for organization and structure and a preference for detail and accuracy. Persons with a preference in this quadrant tend to be perfectionists.

This profile would also feature an equal preference in the Limbic Right quadrant, which would be characterized by emotional and interpersonal processing coupled with an interest in music and a sense of sprituality. Persons with preferences in this quadrant would also tend to be intuitive with respect to their feelings. The combination of the two primaries in the Limbic quadrants would represent a duality for the person to resolve within themselves, and would involve the opposing qualities of control, structure and dominance compared with the emotional qualities associated with interpersonal interaction, musical, spiritual interests and intuitive feelings.

Another important characteristic of this limbic-oriented profile is the clear secondary preferences in the cerebral area, both in the left mode and the right mode. This indicates that logical, analytic processing is a secondary rather than a primary preference, and that holistic, conceptual, integrative thinking is similarly secondary rather than primary. The two primaries involved in this profile could be described as safe-keeping on one hand and emotional on the other.

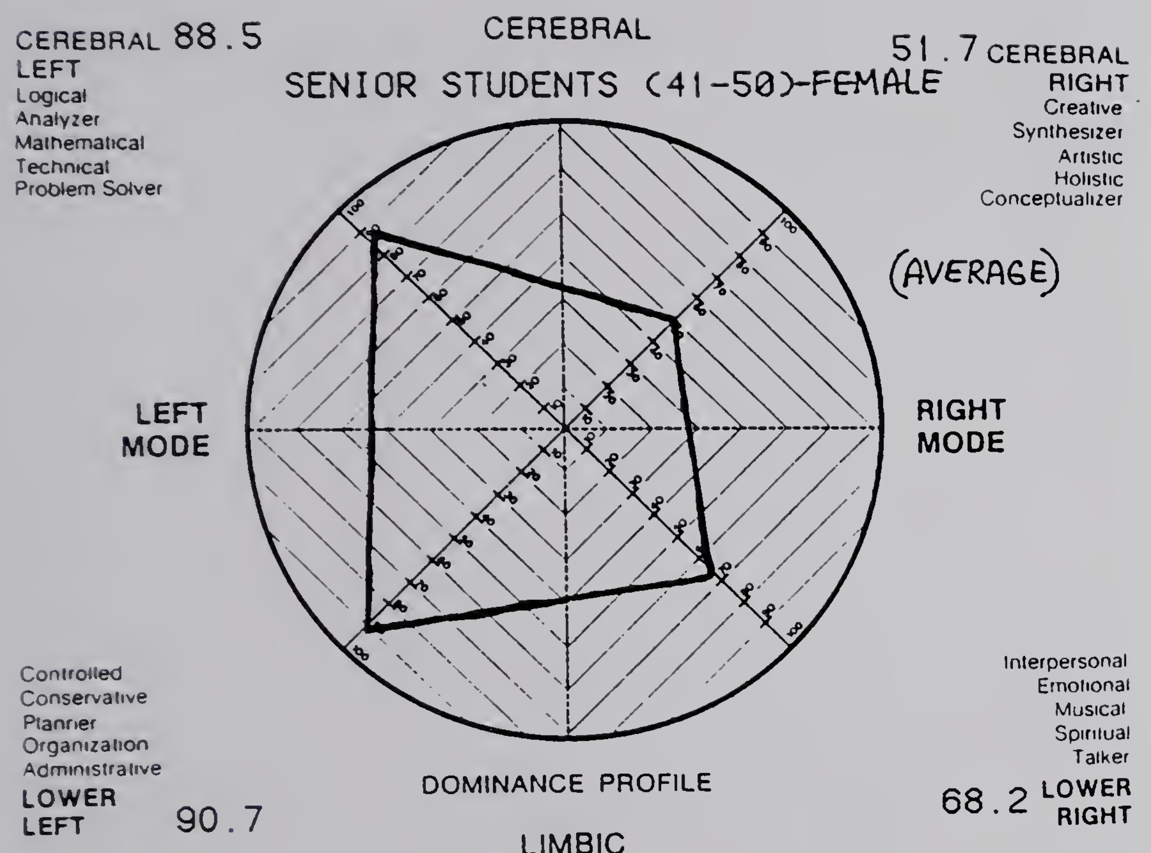


Figure 53
Senior Females 41-50 Profile

Figure 53

Thinking Preference Profile

Senior Females-41-50
N=2

Group Average Profile 1-1-2-2

This profile yields a double dominant in the left mode compared to a subordinate secondary dominance in the right mode. Typical descriptors for this profile would be logical, analytic, rational and quantitative.

People with this profile are technically-oriented, effective at problem solving, conservative, controlled and structured in thinking, but also effective in planning, organizing and administrative activities.

In a secondary mode, they also have interpersonal skills, are able to deal with emotions effectively, and are able to integrate, synthesize and think holistically. Conceptual and intuitive capabilities are secondary, but quite functional.

People with this profile would distinctly prefer left mode processing rather than right, but still are able to function quite effectively in right mode activiites.

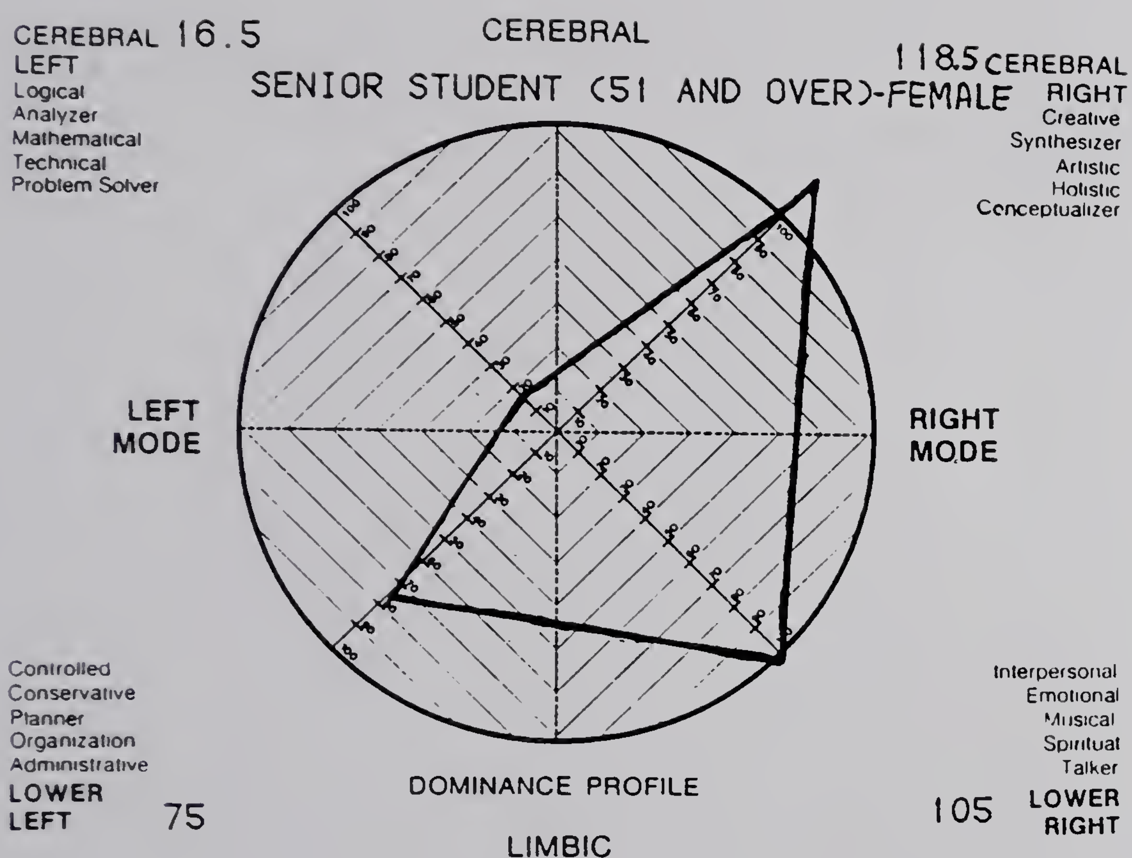


Figure 54
Senior Female 51-and-Over Profile

Figure 54

Thinking Preference Profile

Senior Female-51+
N=1

Group Average Profile 3-1-1-1

This profile indicates that the one Senior 51-and-over-aged Female preferred Right-oriented Thinking Preferences, and yields a multi-dominant array of primaries with two occuring in the right mode and two in the more limbic area of brain processing. In sharp contrast with these three primaries, the profile is further characterized by a very low Cerebral Left preference, avoiding this type of thinking.

A person with this profile has strong Limbic Right interpersonal and emotional preferences, and has the contrasting preferences in the safe-keeping Limbic Left and the experimental Cerebral Right quadrants. This contrasting set of primaries would produce feelings of duality within the person as they attempt to sort out the preference for more conservative, controlled behavior and structured, detailed thinking, in contrast to the looser, more open behavior characterized by the simultaneous, holistic, imaginative thinking.

BIBLIOGRAPHY

Adams, R., and Victor, M. Principles of Neurology, second edition, McGraw-Hill Book Co., 1981.

Aisenstein, T. The BSN Dispute Will Destroy Nursing! RN, pp.49-50, Dec., 1985.

Alvino, J. Do Gifted and Nongifted Children Learn Differently? Principal, pp. 38-40, May, 1981.

Annett, M. Handedness in the Children of Two Left-Handed Parents. British Journal of Psychology, 65 :29-31, 1974.

Arlin, P. Cognitive Development in Adulthood: A Fifth Stage? Developmental Psychology, 11 :602-606, 1975.

Arlin, P. Piagetian Operations in Problem Finding. Developmental Pyschology, 13(3) :297-298, 1977.

Arons, A. Cultivating the Capacity for Formal Reasoning: Objectives and Procedures in an Introductory Physical Science Course. American Journal of Physics 44(a) :834-838, 1976.

Arons, A. Development of the Capacity for Abstract Logical Reasoning. Journal of College Science Teaching, March:248-249, 1977.

Ausebel, D. The Transition from Concrete to Abstract Cognitive Functioning: Theoretical Issues and Implications for Education. Journal of Research in Science Teaching, 2 :261-266, 1964.

Bakan, P. Hypnotizability, Laterality of Eye Movements, and Functional Brain Asymmetry. Perceptual and Motor Skills, 28 :927-932, 1969.

Bakan, P.(a) The Eyes Have It. Psychology Today, pp. 64-67, April, 1971.

Bakan, P.(b) Handedness and Birth Order. Nature, 229 195, 1971.

Bakan, P. Handedness and Birth Order Revisited. Neuropsychologia, 15 :837-839, 1977.

Baker, S., and Talley, L. The Relationship of Visualization Skills to Achievement in Freshman Chemistry. Journal of Chemical Education , 49 775-777, 1972.

Banks, S. Creativity, Mental Imagery and Cerebral Dominance. Dis. Ab's Int'l , 41(10)A :4334, 1980.

Baskin, Y. The Way We Act. Science 85 , 6(9) :100-101, Nov., 1985.

Bauman, R. Applicability of Piagetian Theory to College Teaching. Journal of College Science Teaching , 6(7) 94-96, 1976.

Benbow, C., and Stanley, J. Sex Differences in Mathematical Ability: Fact or Artifact? Science , 210 :1262-1264, 1980.

Benderly, B.(a) The Multi-Lingual Mind. Psychology Today March: 9-12, 1981.

Benderly, B.(b) Flashbulb Memory. Psychology Today , pp. 71-74, June, 1981.

Benham, B. Thought on the Failure of Curriculum Reform. Educational Leadership , 35 :205-208, Dec., 1977.

Bennett, C. Teaching Students as They Would Be Taught: The Importance of Cultural Perspective. Educational Leadership , pp. 259-268, January, 1979.

Bennett, R. Effects of Previous High School Programs on Achievement in College Biology. Journal of College Science Teaching ,pp. 242-244, March, 1975.

Bever, T. and Chiarello, R. Cerebral Dominance in Musicians and Non-Musicians. Science , 185 537-539, 1974.

Bhatnagar, S. and Andy, O. Language in the Non-Dominant Right Hemisphere. Archives of Neurology , 40 728-731, Nov., 1983.

Bish, J., Bowman, B., and Sarachek, A. Lecture-Laboratory vs. structured Audio- Tutorial Approaches: Student Achievement. Journal of College Science Teaching , 7(3) :168-171, 1978.

Bishop, J. Developing Students' Spatial Ability. The Science Teacher , 45(8) : 20-23, Nov., 1978.

Block, J. The Difference Between Boys and Girls: How Gender Roles Are Shaped. Principal , pp. 41-45, May, 1981.

Blonston, G. The Translator. Science 85 , pp. 79-85, July/August, 1985.

Bogen, J., and Gordon, H. Musical Tests for Functional Lateralization with Intracarotid Amobarbital. Nature 230 :524-525, April, 1971.

Boraas, A. Technology and the Origin of Human Hemispheric Asymmetry. Dis. Ab's Int'l , 43A :1883-1884, 1983.

Borowy, T., and Goebel, R. Cerebral Lateralization for Speech: The Effects of Age, Race, and Socioeconomic Class. Neuropsychologia , 14 :363-370, 1976.

Bower, G. Mood and Memory. Psychology Today , pp. 60-69, June, 1981.

Bradshaw, J. Hemispheric Lateralization and an Evolutionary Perspective. The Behavioral and Brain Sciences , 4 :21-22, 1981.

Branch, C., Milner, B., and Rasmussen, T. Intracarotid Sodium Amytal for the Lateralization of Cerebral Speech Dominance. Journal of Neurosurgery , 21 399-405, 1964.

Brandt, R. Toward a Better Definition of Teaching. Educational Leadership , 42(8) :3, May, 1985.

Brandwein P. and Ornstein, R. The Duality of the Mind. Instructor , pp. 54-58, January, 1977.

Bratt, E. and Vockell, E. Using Computers to Teach Basic Facts in the Nursing Curriculum. Journal of Nursing Education , 25(6) :247-251, June, 1986.

Brekke, M. 4MAT: A Method of Stimulating Holistic Learning. Journal of Nursing Education , 25(5) 215-217, May, 1986.

Brooks, M. We Are Not Testing Epstein's Ideas: A Response to Richard McQueen. Educational Leadership , page 72, February, 1984.

Brooks, M., Fusco, E., and Grennon, J. Cognitive Levels Matching. Educational Leadership , 40(6) :4-8, 1983.

Brown, S., and Martin, C. Contract Learning: A Leadership Experience for the RN Student in a BSN Program. Nursing Management , 18(4) :66-70, April, 1987.

Browne, M., and Kelley, S. Achieving Excellence: Advice to New Teachers. College Teaching , 333(2) :78-83, 1985.

Bryden, M., and Rainey, C. Left-Right Differences in Tachistoscopic Recognition. Journal of Experimental Psychology , 66 :568-571, 1963.

Bunch, R. Hemispheric Dominance Patterns and Reading Achievement. Dis. Ab's. Int'l. , 44A :654, 1983.

Bundeson, C., Olser, J., and Herrmann, N. Patterns of Brain Dominance and Their Relationships to Tests of Cognitive Processing, Personality, and Learning Style- a Factor Analysis . Personal Communication, 1981.

Burney, G. The Construction and Validation of An Objective Formal Reasoning Instrument . Unpublished Doctoral Dissertation. University of Northern Colorado, 1974.

Burnham, L. Adults: Not Grown-Up Children. Community and Junior College Journal , pp. 22;24;26;46, November, 1982.

Bush, C. Cognitive Style and Lateral Brain Dominance In Relation to Career Choice and Job Satisfaction of Computer Professionals . Unpublished Doctoral Dissertation, University of Texas, at Arlington, 1984.

Bushsbaum, M. The Mind Readers. Psychology Today , pp. 58-62, July, 1983.

Butler, S., and Glass, A. Asymmetries in the Electroencephalogram Associated with Cerebral Dominance. Electroencephalography and Clinical Neuropsychology , 36 :481-491, 1974.

Butterfield, S. Professional Nursing Education: What is its Purpose? Journal of Nursing Education , 24(3) 99-103, March, 1985.

Cafferty, E. An Analysis of Student Performance Based Upon the Degree of Match Between the Educational Cognitive Style of the Teacher and the Educational Cognitive Style of the Students. Dis. Ab's Int'l , 41A :2908, 1981.

Cagley, C. Field Dependence/Independence as a Predictor of Inferencing and Problem Solving Abilities in Community College Students. Dis. Ab's. Int'l , 44A 3257, 1984.

Carlson, G. Insight into Piaget's Theory: The Foundation. Journal of College Science Teaching , 9(1) :22-23, 1979.

Carpenter, M. Human Neuroanatomy . The Williams and Wilkins Co., Seventh edition, 1977.

Carter, T. Later Adolescence. Education , 94 :66-70, 1973.

Cattell, R. Fluid and Crystallized Intelligence. Psychology Today , 3 :56-62, 1968.

Cerato, K. The Effects of a Graduate Nursing Curriculum on the Professional Value Systems of Students. Dis. Ab's Int'l , 45/12A :3528, 1984.

Claxton, C. and Ralston, Y. Learning Styles: Their Impact on Teaching and Administration. AAHE-ERIC Higher Education Report Number 10 , ED167065 ,pp. 1-74, 1978.

Coltheart, M., Hull, E., and Slater, D. Sex Differences in Imagery and Reading. Nature , 253 :438-440, 1975.

Conger, G. What's A Good Teacher? Community and Junior College Journal , pp. 24-25, Dec./Jan., 1983-84.

Cooke, J., and Haipt, M. Thinking with the Whole Brain: An Integrative Teaching/Learning Model (K-8). National Education Association Professional Library, Washington, D.C., 1986.

Coombs, A. The Personal Approach to Good Teaching. Educational Leadership , 21 :369-77, 1964.

Coop, R. and Brown, L. Effects of Cognitive Style and Teaching Methods on Categories of Achievement. Journal of Educational Psychology , 61 :400-405, 1970.

Coren, S., and Porac, C. Fifty Centuries of Right-Handedness: the Historical Record. Science , 198 :632-633, 1977.

Coren, S., Porac, C., and Duncan, P. Lateral Preference Behaviors in Preschool Children and Young Adults. Child Development , 52 :443-450, 1981.

Coulson, L. and Strickland, A. The Minds at the Top: An Analysis of the Thinking Style Preferences of Superintendents of Schools and Chief Executive Officers. Journal of Creative Behavior , 17(3) 163-175, Third Quarter, 1983.

Cowan, D. and Wiens, V. Mock Hospital: A Preclinical Laboratory Hospital. Nurse Educator , 11(5) :30-32, September/October, 1986.

Cranston, C. and McCort, B. A Learner Analysis Experiment: Cognitive Style Versus Learning Style in Undergraduate Nursing Education. Journal of Nursing Education , 24(4) :136-138, April, 1985.

Creager, J. Plaudits for Piaget- And Some Implications for Teachers. American Biology Teacher , 37(8) :463, 1975.

Creamer, D. and Akins, E. Program Design for Adult Students. Community College Frontiers , 9(3) :22-30, Spring, 1981.

Cronin-Golomb, A. Intrahemispheric Processing and Subcortical Transfer of Non-Verbal Information in Subjects with Complete Forebrain Commissurotomy. Dis. Ab's. Int'l. , 45A :1949, Dec., 1984.

Cross, K. P. On the New Frontier. Community College Frontiers , 9(2) :10-16, Winter, 1981.

Cross, K. P. Consider the Possibilities . Unpublished Speech Prepared for the Massachusetts Community College Association, Worcester, Mass., pp. 1-19, September 30, 1982.

Crovitz, H., and Zener, K. A Group-Test for Assessing Hand- and Eye-Dominance. American Journal of Psychology , 73 :271-276, 1962.

Cullen, M. An Investigation Into the Cognitive Styles of Community College Students and the Effects of Instructional Treatment On Their Mathematics Achievement. , Unpublished Doctoral Dissertation, The University of Massachusetts, 1980.

Damasio, A., Lima, A., and Damasio, H. Nervous Function after Right- Hemispherectomy. Neurology , 25 :89-93, 1975.

Dart, R. The Predatory Implemental Technique of Australopitheces. American Journal of Anthropology , 7 :1-38, 1949.

Dasen, P. Cross-Cultural Research: A Summary. Journal of Cross-Cultural Psychology , 3(1) :23-39, 1972.

Davenport, J. and Davenport, J. Andragogical-Pedagogical Orientation and its Relationship to Selected Variables Among University Students. College Student Journal , Summer :130-138, 1986.

Davis, R. and Farrand, E. A Modified System of Individualized Instruction in Biology: Rethinking Individualized Instruction at the Community College Level. Journal of College Science Teaching , pp. 152-153, January, 1977.

Davisson, S., and Rush, J. Older Adults as Art Students: An Unrealized Clientele for Community Colleges. Community College Frontiers , 9(3) :19-21, Spring, 1981.

Dawson, A., and Baller, W. Relationship Between Creative Activity and Health of Elderly Persons. The Journal of Psychology , 82 :49-58, 1972.

Day, M. An Eye Movement Phenomenon Related to Attention, Thought and Anxiety. Perceptual and Motor Skills , 19 :443-446, 1964.

Dean, R., Schwartz, N., and Smith, L. Lateral Preference Patterns as a Discriminator of Learning Difficulties. Journal of Consulting and Clinical Psychology , 49(2) :227-235, 1981.

DeLisi, R. The Educational Implications of Piagets' Theory and Assessment Techniques. ERIC Clearinghouse (Report 68) , Princeton, N.J., 1979.

Douglass, M. The Effects of Instructional Sequence and Cognitive Style on the Achievement of High School Biology Students. Dis. Ab's Int'l , 37A :4980, 1977.

DeRussy, E. and Futch, E. Field Dependence-Independence as Related to College Curricula. Perceptual and Motor Skills , 33 :1235-1237, 1971.

Deutsch, D. Pitch Memory: An Advantage for the Left-Handed. Science , 199 : 559-560, 1978.

Dimond, S., Farrington, L. and Johnson, P. Differing Emotional Response from Right and Left Hemispheres. Nature , 261 :690-692, June 24, 1976.

Doebler, L. and Eicke, F. Effects of Teacher Awareness of the Educational Implications of Field Dependence/Field Independence Cognitive Style in Selected Classroom Variables. Journal of Educational Psychology , 71(2) :226-232, 1978.

Dolphin, W. Designing for Individual Differences in Large Biology Classes Journal of College Science Teaching 10(2) :105-108, November, 1980.

Druart, C. The Arts in Education, A Possible Key to Whole Brain Utilization and Positive Self-Concept. Dis. Ab's Int'l , 44(11)A :3364, 1983.

Druger, M. Humanizing the Introductory College Biolgy Course. Journal of College Science Teaching , 8(3) 164-167, Jan., 1979.

Dunn, R. A Learning Styles Primer. Principal , pp., 31-34, May, 1981.

Dunn, R. Learning Style and Its Relation to Exceptionality at Both Ends of the Spectrum. Exceptional Children , 49(6) :496-506, April, 1983.

Dunn, R., Cavanaugh, D., Eberle, B., and Zenhausen, R. Hemispheric Preference: the Newest Element of Learning Style. Journal of the National Association of Biology Teachers , 44(5) :791-794, 1982.

Dunn, R., and Dunn, K. Learning Styles/Teaching Styles: Should they...Can They...Be Matched? Educational Leadership , pp. 238-244, January, 1979.

Durst, H. An Evaluation of an Experimental Biology Course Employing Some Cognitive and Non-Cognitive Achievements as Criterion. Dis. Ab's Int'l , 28(3)A 2438, 1968.

Eaton, S. and Evans, S. The Effect of Nonspecific Imaging Practice on the Mental Imagery Ability of Nursing Students. Journal of Nursing Education , 25(5) 193-196, May 1986.

Edwards, C. Brain Functions: Implications for Schooling. Contemporary Education , 53(2) :58-60, Winter, 1982.

Ehrlichman, H., and Weinberger, H. Lateral Eye Movements and Hemispheric Asymmetry: A Critical Review. Psychological Bulletin , 85 :1080-1111, 1978.

Ehrlichman, H., Weiner, S., and Baker, A. Effects of Verbal and Spatial Questions On Initial Gaze Shifts. Neuropsychologia , 12 :265-277, 1974.

Ellis, S. Models of Teaching: A Solution to the Teaching Style/Learning Dilemma. Educational Leadership , pp. 274-277, January, 1979.

Epstein, H. "Growth Spurts During Brain Development: Implications for Educational Policy and Practice", in Wittrock, M. Education and the Brain , Chapter Ten, pp. 342-70, 1978, op. cit.

Epstein, H. Cognitive Growth and Development. Colorado Journal of Educational Research , 19 :3-4, 1979.

Epstein, H. EEG Developmental Stages. Developmental Psychobiology , 13(6) : 629-631, 1980.

Epstein, H. Brain Growth and Cognitive Development: A Response to Richard McQueen. Educational Leadership pp. 72-75, February, 1984.

Estabrook, B. More Power To You. Nursing 86 , 16(4) 89-90, April, 1986.

Even, M. Adapting Cognitive Style Theory in Practice. LifeLong Learning: The Adult Years , pp. 14-17;27, January, 1982.

Fall, A. A Survey on Hemispheric Lateralization of the Human Brain and Pedagogical Consideration in Professional Preparation of Teachers. Dis.Ab's Int'l 45A :3493, 1984.

Fazio, F. and Zambotti, G. Some Cognitive Style Variables and Their Relationship to Chemistry Acheivement. Journal of College Science Teaching , pp. 154-55, January, 1977.

Fiedler, F., and Gillo, M. Correlates of Performance in Community Colleges. Journal of Higher Education , 65(9) :672-679, Dec., 1974.

Finch, G. Chimpanzee Handedness. Science , 94 :117-118, 1941.

Fischer, B. and Fischer, L. Styles in Teaching and Learning. Educational Leadership , pp. 245-254, January, 1979.

Fleishman, R. Majors and Non-Majors Happy Together. Journal of College Science Teaching , 11(1) 237-238, Feb., 1982.

Foster, S. Hemisphere Dominance and the Art Process. Art Education , 3 :28-29, Feb., 1977.

Fox, R. In the Beginning: Aspects of Hominid Behavioral Evolution, in Perspectives on Human Evolution , Washburn, S., and Dolhinow, P. eds., pp. 358-381, 1972.

Frank, K. Use of Brain Functions Concepts by Social Studies Teachers. Dis. Ab's Int'l , 44A :656, 1983.

Froyen, L. Mastery Learning as a Function of Learners Cognitive Style, Teacher Diagnostic Intervention, and Time on an Independent Learning Task. Dis. Ab's Int'l , 31A :5842, 1970.

Galaburda, A., Lemay, M., Kemper, T., and Geschwind, N. Right-Left Asymmetries in the Brain. Science , 199 852-856, 1978.

Galin, D. and Ellis, R. Asymmetry in Evoked Potentials as an Index of Lateralized Cognitive Processes: Relation to EEG Alpha Asymmetry. Neuropsychologia , 13 :45-50, 1975.

Galin, D. and Ornstein, R. Individual Differences in Cognitive Style- I. Reflective Eye Movements. Neuropsychologia , 12 :367-376, 1974.

Galyean, B-C. Guided Imagery in the Curriculum. Educational Leadership , 40(6) :54-58, March., 1983.

Gannon, P. Future Outlook: 'World Class' Colleges Coming. Community and Junior College Journal , pp. 41-42; 58-64, April, 1983.

Garcia, R. A Comparison of the Formal Operational Thinking Abilities of Remedial With That of Regular Biology Students in a Community College . Unpublished Doctoral Dissertation, The University of Texas at Austin, 1979.

Gardner, H. How a Split Brain Gets a Joke. Psychology Today , pp. 74-78, Feb., 1981.

Garnett, E., Firnan, G. and Nahmias, C. Dopamine Visualized in the Basal Ganglia of Living Man. Nature , 305 :137-138, Sept., 1983.

Garrett, S. Putting Our Whole Brain to Use; A Fresh Look at the Creative Process. Journal of Creative Behavior , 10(4) :239-249, 1976.

Gazzaniga, M., Rose, G., Springer, S., Clark, A., and Wilson, D. Psychologic and Neurologic Consequences of Partial and Complete Cerebral Commissurotomy. Neurology , 25 :10-15, 1975.

Gazzaniga, M., and Smylie, C. Dissociation of Language and Cognition: A Psychological Profile of Two Disconnected Right-Hemispheres. Brain , 107 : 145-153, 1984.

Geffen,C. Interhemispheric Effects in Reaction Time to Verbal and Nonverbal Visual Stimuli. Journal of Experimental Psychology , 87 :415-422, 1971.

Geschwind, N. Specialization in the Human Brain. Scientific American , 241 : 180-199, Sept., 1979.

Geschwind, N., Galaburda, A., and Kemper, T. Left-Handedness Association with Immune Diseases and Developmental Disorders. Proceedings of the National Academy of Sciences , 79 :2, 1982.

Geschwind, N., and Levitsky, W. Human Brain: Left-Right Asymmetries in Temporal Speech Region. Science , 161 186-187, 1968.

Gevins, A., Zeitlin, G., Doyle, J., Yingling, C., Schaffer, R., Callaway, J., and Yeager, C. Electroencephalogram Correlates of Higher Cortical Functions. Science , 203 :66-68, 1979.

Gibas, M. Reactions of Older Students to an Introductory Chemistry Class. Journal of College Science Teaching 10(1) :43-45, Sept., 1980.

Glass, D., Cohen, S., and Singer, J. Urban Din Fogs the Brain. Psychology Today , pp. 94-98, May, 1973.

Goldman-Rakic, P. and Schwartz, M. Interdigitation of Contralateral and Ipsilateral Columnar Projections to Frontal Association Cortex in Primates. Science 216 :755-757, 1982.

Goodenough, D. The Role of Individual Differences in Field Dependence as a Factor in Learning and Memory. Psychological Bulletin , 83(4) :675-694, 1975.

Goodlad, J. Improving Schooling in the 1980's: Toward the Non-Replication of Non-Events. Educational Leadership , 40(6) :4-7, March, 1983.

Gorovitz, E. The Creative Brain II: A Revisit With Ned Herrmann. Training and Development Journal , pp. 74-88, December, 1982.

Gowan, J. Spatial Ability and Testosterone. Journal of Creative Behavior , 18 : 187-190, third quarter, 1984.

Grady, M. Hemispheric Implications for Education. School Research and Development , 18 :27-30, 1981.

Gray, E. Brain Hemispheres and Thinking Styles. The Clearing House , pp. 127-132, November, 1980.

Graybill, L. Sex Differences in Problem-Solving Ability. Journal of Research in College Science Teaching , 12(4) :341-346, 1975.

Greenberg, J., Reivich, M., Alavi, A., Hand, P., Rosenquist, A., Rintelmann,W., Stein, A., Tusa, R., Dann, R., Cristman, D., Fowler, J., MacGregor, B., and Wolf, A. Metabolic Mapping of Functional Activity in Human Subjects with the [18]Fluorodeoxyglucose Technique. Science , 212 678-680, 1981.

Greenfield, T. Cerebral Hemisphericity and Its Relationship to Academic Achievement, Sex, and Career Preference of High School Science and Mathematics Students. , Unpublished Doctoral Dissertation, Northern Illinois University, 1984.

Griggs, S. and Price, G. "Learning Styles of the Gifted", in Student Learning Styles: Diagnosing and Prescribing Progress . National Association of Secondary School Principals, Reston, Virginia, 1979.

Gullette, M. The Art and Craft of Teaching . Harvard-Danforth Center for Teaching and Learning. Cambridge, Mass., 1983.

Gur, Raquel, Gur, Ruben, and Harris, L. Cerebral Activation, As Measured by Subjects' Lateral Eye Movements, is Influenced by Experimenter Location. Neuropsychologia , 13 :35-44, 1975.

Gur, Rubin, Gur, Raquel, Obrist, W., Hungerbuhler, J., Younkin, D., Rosen, A., Skolnick, B., and Reivich, M. Sex and Handedness Differences in Cerebral Blood Flow During Rest and Cognitive Activity. Science , 217 :659-661, 1982.

Gur, Rubin, Gur, Raquel, Rosen, A., Warach, S., Alairi, A., Greenberg, J., and Reivich, M. A Cognitive-Motor Network Demonstrated by Positron Emission Tomography. Neuropsychologia , 21 :601-606, 1983.

Hall, D. The Effect of Teacher-Student Congruence Upon Student Learning in College Classrooms. Journal of Educational Psychology , 61 :205-213, 1970.

Hammes, M. and Duryea, E. Problem Base Learning: A Teaching Technique to Enhance Skills for Problem-Solving. Health Education , 17(6) :44-45, Dec., 1986/Jan., 1987.

Handel, M. Human Emotion and Cerebral Lateralization: A Study of Depression as an Expression of Right Hemispheric Activity (Neuropsychology, Sex Differences, Cognition). Dis. Ab's. Int'l , 45A 1273, 1984.

Harmon, W., and McNeill, B. Institute of Noetic Sciences Newsletter , 12(2) : Summer, 1984.

Harris, T. The Rise of the Right-Headed People. Psychology Today , page 34, May, 1973.

Hart, L. Brain, Language, and New Concepts of Learning. Educational Leadership , 38 :443-445, March, 1981.

Hart, L. Classrooms Are Killing Learning. Principal , pp. 8-11, May, 1981.

Heilman, K., and Van Den Abell, T. Right Hemispheric Dominance for Attention: the Mechanism Underlying Hemispheric Asymmetries of Inattention (Neglect). Neurology , 30 :327-330, 1980.

Heiman, M., and Slomianko, J. Critical Thinking Skills . National Education Association Professional Library, Washington, D.C., 1985.

Heister, G. Sex Differences and Cognitive/Motor Interference with Visual Half-Field Stimulation. Neuropsychologia , 22 :205-214, 1984.

Helige, J. Feature Similarity and Laterality Effects in Visual Masking. Neuropsychologia , 21 :633-639, 1983.

Henninger, P. Problem Solving Strategies of Musically Trained and Untrained Subjects and Hemisphere Activation. Dis. Ab's. Int'l , 43(12)B :4192, 1982.

Herbert, W. Remembrance of Things Partly. Science News , 134 :378-381, Dec., 1983.

Herbsleb, J. Cerebral Hemispheric Asymmetry: Basis of Dual Cognitive Systems? Dis. Ab's Int'l , 45A 2341, 1984.

Herrmann, N. The Creative Brain. Training and Development Journal , pp. 10-16, October, 1981.

Herrmann, N.(a) The Creative Brain. NASSP Bulletin , pp. 1-16, September, 1982.

Herrmann, N.(b) The Brain and Management Learning. The Beureaucrat , pp. 17-21, Fall, 1982.

Herrmann, N. Male/Female Brain Dominance Characteristics Personal Communication., Dec. 4, 1984.

Herron, J., Galin, D., Johnstone, J., and Ornstein, R. Cerebral Specialization, Writing Posture, and Motor Control of Writing in Left-Handedness. Science , 205 :1285-1289, 1979.

Herrscher, B. Moving Toward Instructional Excellence in the 80's in the Competency Based Education Bandwagon. Community College Frontiers , pp. 23-25, Winter, 1981.

Hicks, R., Pellegrini, R., and Evans, E. Handedness and Birth Risk. Neuropsychologia , 16 :243-245, 1977.

Hier, A., and Crowley, W. Spatial Ability in Androgen-Deficient Men. New England Journal of Medicine , 306 :1202-1205, 1982.

Hines, M. Prenatal DiethylStilbestrol (DES) Exposure, Human Sexually Dimorphic Behavior and Cerebral Lateralization. Dis. Ab's. Int'l , 42(1)B :423, 1981.

Hochberg, F., and LeMay, M. Arteriographic Correlates of Handedness. Neurology , 25 :218-222, 1975.

Hodgkinson, H. The Changing Face of Tomorrow's Student. Change , pp. 38-39, May/June, 1985.

Holloway, R. The Casts of Fossil Hominid Brains, in Human Ancestors: Scientific American Readings . W.H. Freeman Co., 1979.

Hudgens, G. Hemisphericity and Its Implications for the Redesign of Developmental Studies Programs . Unpublished Doctoral Dissertation, University of Texas at Austin, 1979.

Hunter, W. Relationships Between Learning Styles, Grades, and Student Ratings of Instruction. ERIC Clearinghouse , ED181974 ,pp. 1-30, 1979.

Hurewitz, C., and Hurewitz, P. Teacher Relationship to Cognitive and/or Affective Learning. Improving College and University Teaching , 26(2) :135-138, 1978.

Husband, D. An Audio-Tutorial Course for Nonmajor Biology Students. Journal of College Science Teaching , 2(4) 42-44, April, 1973.

Inglis, J., and Lawson, J. Sex Differences in the Effects of Unilateral Brain Damage on Intelligence. Science 212 :693-695, 1981.

Ironson, D. Your Brain: Using Both Halves for Enhanced Communication. International Television , pp. 17-21, July, 1984.

Isaac, G. The Food-Sharing Behavior of Protohominids, in Human Ancestors: Scientific American Readings , W.H. Freeman Co., 1979.

Jones, M. Advantages and Disadvantages of Individualized Instruction. Journal of College Science Teaching , 6(3) :232-233, March, 1977.

Johnson, M. A Message for the Teacher. Nursing Times , 82(52) :41-43, December 31, 1986.

Joyce, B. "Selecting Learning Experiences: Linking Theory and Practice", Association for Supervision and Curriculum Development, Washington, D.C., 1978, in Ellis, 1979, op. cit.

Joyce, B. Models for Teaching Thinking. Educational Leadership , 42(8) :4-7, May, 1985.

Kandel, E., and Schwartz, J. Principles of Neural Science Elsevier-North Holland, Inc., 1982.

Kangas, J. and Bradway, K. Intelligence at Middle Age: A Thirty-Eight-Year Follow-Up. Developmental Psychology , 5(2) :333-337, 1971.

Katz, A. Creativity and the Right Cerebral Hemisphere: Towards a More Physiological Based Theory of Creativity. Journal of Creative Behavior , 12 : 253-264, 1978.

Kelly, A. Mathematical Ability: Is Sex a Factor? Science 212 :118, 1981.

Kemp, V. Concept Analysis as a Strategy for Promoting Critical Thinking. Journal of Nursing Education , 24(9) :382-384, November, 1985.

Kerensky, P. A Study of Reported Cerebral Dominance as it Relates to Administrative Behavior. Dis. Ab's Int'l 44A :344, 1983.

Kerwin, M. Andragogy in the Community College. Community College Review , 9(3) :12-14, Winter, 1981-82.

Kimura, D.(a) Manual Activity During Speaking-I. Right Handers. Neuropsychologia , 11 :45-50, 1973.

Kimura, D.(b) Manual Activity During Speaking-II. Left Handers. Neuropsychologia , 11 :51-55, 1973.

Kimura, D., and Folb, S. Neural Processing of Backward Speech Sounds. Science , 161 :395-396, 1968.

Kinsbourne, M. Eye and Head Turning Indicates Cerebral Lateralization. Science , 176 :539-541, 1972.

Kinsbourne, M. Direction of Gaze and Distribution of Cerebral Thought Processes. Neuropsychologia , 12 279-281, 1974.

Kinsbourne, M. Sad Hemisphere, Happy Hemisphere. Psychology Today , page 92, 1981.

Kinsbourne, M. Hemispheric Specialization and the Growth of Human Understanding. American Psychologist , 37(4) :411-420, April, 1982.

Kinsbourne, M. and Hiscock, M. "Cerebral Laterality and Cognitive Development", in Wittrock, M. Education and the Brain , Chapter 6, pp. 169-222, 1978, op. cit.

Kirby, P. Cognitive Style, Learning Style, and Transfer Skill Acquisition. ERIC Clearinghouse , ED186685 , 123 pp., 1979.

Knauft, R. A New Instructional Approach for Teaching Evolutionary Theory in Introductory College Biology. Dis. Ab's. Int'l , 43A :2622, 1983.

Kohlberg, L. and Gilligan, C. The Adolescent as a Philospher: The Discovery of the Self in a Post-Conventional World. Daedalus , 100 :1051-1086, 1971.

Kolata, G. Math and Sex: Are Girls Born with Less Ability? Science , 210 : 1234-1235, 1980.

Konicek, R. Seeking Synergism for Man's Two-Hemisphere Brain. Phi Delta Kappan , 57 :37-39, 1975.

Kolodiy, G. Piagetian Theory and College Science Teaching. Journal of College Science Teaching , pp. 261-262, April, 1974.

Kolodiy, G. The Cognitive Development of High School and College Science Students. Journal of College Science Teaching , 5(1) :20-22, 1975.

Kuchinskas, G. Whose Cognitive Style Makes the Difference? Educational Leadership , pp. 269-271, January, 1979.

Languis, M. and Kraft, R. "Brain Functioning: Clues to Understanding Science Learning", paper presented to the Association of Physics Teachers, Chicago, Illinois, 1977.

Lassan, R. Learning Style Differences: Registered Nurse Students versus Generic Student Nurses at the Baccalaureate Level. Eric Clearinghouse , ED240318 29 pp., 1984.

Lawson, A. Developing Formal Thought Through Biology Teaching. The American Biology Teacher , 37(2) 411-429, 1975.

Lawson, A. and Renner, J. A Quantitative Analysis of Responses to Piagetian Tasks and its Implications for Curriculum. Science Education , 58(4) :454-459, 1974.

Lawson, A. and Renner, J. Piagetian Theory and Biology Teaching. The American Biology Teacher , pp. 336-343, September, 1975 (a).

Lawson, A. and Renner, J. Relationships of Science Subject Matter and Developmental Levels of Learners. Journal of Research in Science Teaching , 12(4) 347-358, 1975 (b).

Leaffer, T. Left Brain-Right Brain: Domination or Cooperation? Journal of Creative Behavior , 15(4) 242-251, 1981.

LeMay, M., and Culebras, A. Human Brain- Morphologic Differences in the Hemispheres Demonstrated by Carotid Arteriography. New England Journal of Medicine , 287 :168-170, 1970.

Lenard, L. The Dynamic Brain. Science Digest , 91(12) 65-67; 118-119, Dec., 1983.

Levy, J. Possible Basis for the Evolution of Lateral Specialization of the Human Brain. Nature , 224 614-615, 1978.

Levy, J.(a) Research Synthesis on Right and Left Hemispheres: We Think with Both Sides of the Brain. Educational Leadership , pp. 66-71, January, 1983.

Levy, J.(b) Human Brain Built to be Challenged. Brain-Mind Bulletin , 8(9) :3, May, 1983.

Levy, J., and Levy J. Human Lateralization from Head to Foot: Sex-Related Factors. Science , 200 :1291-1292, 1978.

Levy, J., and Nagylaki, T. A Model for the Genetics of Handedness. Genetics , 72 :129-142, 1972.

Levy, J., and Reid, M. Variations in Writing Posture and Cerebral Organization. Science , 194 :337-339, 1976.

Lewin, R. The Birth of Mankind, in the Thread of Life . Smisthsonian Books, Wash., D.C., W.W. Norton and Co., N.Y., 1982.

Lobuts,J. and Pennewill, C. Do We Dare Restructure the Classroom Environment? Journal of Creative Behavior , 18(4) :237-246, 1984.

Lord, T. A Plea for Right Brain Usage. Journal of College Science Teaching , 14(2) :100-102, Nov., 1984.

Lord, T.(a) Enhancing the Visuo-Spatial Aptitude of Students. Journal of Research in Science Teaching , 22(5) :395-405, 1985.

Lord, T.(b) Biology and The Right Brain. The American Biology Teacher , 47(5) :289-293, May, 1985.

Lotwich, G. and Ward, L. Field Dependence-Independence in Male Engineering, Science, and Education Students. Perceptual and Motor Skills , 51 :1289-1290, 1980.

Lumsden, C., and Wilson, E. The Dawn of Intelligence: Reflections on the Origin of the Mind. The Sciences pp. 22-31, March/April, 1983.

MacLean, P. A Mind of Three Minds: Educating the Triune Brain, in Education and the Brain . The Seventy-Seventh Yearbook, Part II, National Society for the Study of Education, M.C. Wittrock, ed. Chicago Press, 1978.

Mahlias, M. Implications of Cognitive Style for Teachers and Learners. ERIC Clearinghouse , ED152704 , pp. 1-15, February, 1978.

Malek, C. A Model for Teaching Critical Thinking. Nurse Educator , 11(6) :20-23, November/December, 1986.

Mallon, E. Cognitive Development and Processes: A Review of the Philosophy of Jean Piaget. The American Biology Teacher , 38(4) :28-47, 1976.

Marchant, L. Hand Preference Among Captive Island Groups of Chimpanzees (Pan Troglodytes). Dis. Ab's Int'l, 42(1A):281, 1981.

Martinez, L. Adult Education: A Key to Aiding the Mexican-American. Education, 94:120-121, 1973.

Marx, J. Autoimmunity in Left-Handers. Science, 217 141-144, 1982.

McCabe, M. Analysis of Learning Styles of Nursing Students at University of Central Florida. Eric Clearinghouse, ED249834, 49 pp., Nova University, September, 1983.

McCallum, R. and Glynn, S. Hemispheric Specialization and Creative Behavior. Journal of Creative Behavior, 13:263-273, 1979.

McCormack, A. Unidentified Flying Omelets. Science and Children, 11:11-14, Sept., 1973.

McCormack, A. Training Creative Thinking in General Science Education. Journal of College Science Teaching, 4(1):10-15, Sept., 1974.

McDermott, L., Piternick, L., and Rosenquist, M. Helping Minority Students Succeed in Science I. Development of a Curriculum in Physics and Biology. Journal of College Science Teaching, 9(3):135-140, Jan, 1980.

McGee, M. Human Spatial Abilities: Psychometric Studies and Environmental, Genetic, Hormonal and Neurological Influences. Psychological Bulletin, 86(5):889-918, Sept., 1979.

McGee-Cooper, A. Time Management-Cashing in on Both Brains. AORN Journal, 44(2):178-183, August, 1986.

McGlone, J. Sex Differences in the Cerebral Organization of Verbal Emotions in Patients with Unilateral Brain Lesion. Brain, 100:775-93, 1977.

McKean, K. Of Two Minds..Selling the Right Brain. Discover, pp. 30-41;61, April, 1985.

McKeever, W., and Van Deventer, A. Inverted Handwriting Position, Language Laterality, and the Levy-Nagylaki Genetic Model of Handedness and Cerebral Organization. Neuropsychologia , 18 :99-102, 1980.

McKinnon, J. Earth Science, Density, and the College Freshman. Journal of Geologic Education , 19 218-220, 1971.

McKinnon, J. and Renner, J. Are Colleges Concerned With Intellectual Development? American Journal of Physics , 39 :1047-1052, 1971.

McQueen, R. Spurts and Plateaus in Brain Growth: A Critique of the Claims of Herman Epstein. Educational Leadership , pages 66-71, February, 1984.

Meissner, J. Nurses: Are We Eating Our Young? Nursing 86 16(3) :51-53, March, 1986.

Melner, B., Taylor, L., and Sperry, R. Lateralized Suppression of Dichotically Presented Digits after Commissural Section in Man. Science , 161 :184-185, 1968.

Miller, J. Brain Watch. Science News , 119 :76-78, 1981.

Mintzberg, H. Planning on the Left Side and Managing on the Right. Harvard Business Review , pp. 49-58, July-August, 1976.

Morton, R. Thinking and Knowing. Improving College and University Teaching , 26(2) :106, 1978.

Moscovitch, M., and Smith, L. Differences in Neural Organization Between Individuals with Inverted and Non-Inverted Handwriting Postures. Science , 205 :710-713, 1979.

Murphy, E. Whole-Brain Management: Part I. Nursing Management , 16(3) :66-68, March, 1985.

Murphy, E., and Neuhauser, P. (a) Whole-Brain Management: Part II. Nursing Management , 16(4) :49-52, April, 1985.

Murphy, E., and Neuhauser, P. (b) Whole-Brain Management: Part III. Nursing Management , 16(5) :50-52, May, 1985.

Myers, J. Hemsipheric Research: An Overview with Some Implications for Problem Solving. Journal of Creative Behavior , 16(3) :197-211, 1982.

Nachson, I. Handedness and Dichotic Listening to Nonverbal Features of Speech. Perceptual and Motor Skills , 47 :1111-1114, 1978.

Napier, J. Evolution of the Hand, in Human Ancestors: Scientific American Readings , pp. 43-49, 1979.

Nebes, R. Hemispheric Specialization in Commissurotomized Man. Psychological Bulletin , 81 :1-14, 1974.

Nichelli, P., Mauvi, A., and Faglioni, P. Relationship Between Speed, Accuracy of Performance and Hemispheric Superiorities for Visualspatial Pattern Processing in the Two Sexes. Neuropsychologia , 21 625-632, 1983.

Noback, C. and Demarest, R. The Human Nervous System . McGraw-Hill Book Co., second edition, 1975.

Nordeen, E. and Yahr, P. Hemispheric Asymmetries in the Behavior and Hormonal Effects of Sexually Differentiating Mammalian Brain. Science , 218 391-394, 1982.

Nordland, F., Lawson, A., and Kahle, J. A Study of Levels of Concrete and Formal Reasoning Ability in Disadvantaged Junior and Senior High School Science Students. Science Education , 58(4) :569-575, 1974.

Norris, R., Heikkinen, M., and Armstrong, T. Alternatives for Individualized Biology: The Importance of Cognitive Style and Conceptual Complexity. The American Biology Teacher , pp. 291-97, May, 1975.

Ober, L., Woodward, S., and Albert, M. Changes in Cerebral Lateraliztion in Aging? Neuropsychologia , 22 :235-240, 1984.

Oke, A., Keller, R., Mefford, I. and Adams, R. Lateralization of Norepinephrine in Human Thalamus. Science, 200 : 1411-1413, June 23, 1978.

O'Keefe, M. What Ever Happened to the Crash of '80, '81, '82, '83, '84, '85? Change , pp. 37-41, May/June, 1985.

Ornstein, R. Right and Left Thinking. Psychology Today , pp. 87-92, May, 1973.

Ornstein, R. The Split and Whole Brain. Human Nature , 1 76-83, 1978.

Osterman, D. Classroom Lecture Management: Increasing Individual Involvement and Learning in the Lecture Style. Journal of College Science Teaching , 12(1) 22-23, Sept./Oct., 1982.

Ostrow, C. Comparison of Interactive Effects of Cognitive Style, GPA and Teaching Methodology in Nursing Content Area. Dis. Ab's Int'l , 45/05A :1311, 1984.

Ostrow, C. The Interaction of Cognitive Style, Teaching Methodology and Cumulative GPA in Baccalaureate Nursing Students. Journal of Nursing Education , 25(4) :148-155, April, 1986.

Pallrand, G. and Seeber, F. Spatial Ability and Achievement in Introductory Physics. Journal of Research in Science Teaching , 21(5) :507-516, 1984.

Peterson, J., and Lansky, L. Left-Handedness Among Architects: Some Facts and Speculation. Perceptual and Motor Skills , 38 :547-550, 1974.

Peterson, J., and Lansky, L. Left-Handedness Among Architects: Partial Replication and Some New Data. Perceptual and Motor Skills , 45 :1216-1218, 1977.

Pfeiffer, J. Early Man Stages a Summit Meeting in New York City, in Smithsonian , pp. 51-57, August, 1984.

Phelps, M., Kuhl, D., and Mazziotta, J. Metabolic Mapping of the Brain Response to Visual Stimulation: Studies in Humans. Science , 211 :1445-1448, 1981.

Piaget, J. Cognitive Development in Children: Development and Learning. Journal of Research in Science Teaching , 2 :176-186, 1964.

Piaget, J. Intellectual Evolution from Adolescence to Adulthood. Human Development , 15 :1-12, 1972.

Piatt, J. Hemisphericity and Divergent Youth: A Study of Right-Brained Students, their School Problems and Personality Traits. Dis. Ab's Int'l , 40A :2582, 1979.

Pieniadz, J., and Naeser, M. Computed Tomographic Scan Cerebral Asymmetries and Morphologic Brain Asymmetries. Archives of Neurology , 41 :403-409, 1984.

Pilbeam, D. The Descent of Hominoids and Hominids. Scientific American , 250 :84-96, March, 1984.

Pinkerton, S., Primm, P., Smeltzer, C. and Walker, M. Entry Into Practice Round Table. Current Concepts in Nursing , 1(1) :2-12, 1987.

Policoff, S. In Search of the Elusive Aha! New Age Journal , pp. 43-44, March, 1985.

Presseisen, B. Thinking Skills: Research and Practice . National Education Association Professional Library, Washington, D.C., 1986.

Raven, R., Hannah, A., and Doran, R. Relationships of Piaget's Logical Operations With Science Achievement and Related Aptitudes in Black College Students. Science Education , 58(4) :561-568, 1974.

Ray, W., Morrell, M., Frediani, A., and Tucker, D. Sex Differences and Lateral Specialization of Hemispheric Functioning. Neuropsychologia , 14 391-394, 1976.

Renfrow, M. The Truth in Error. Journal of Creative Behavior , 18(4) :227-236, 1984.

Rennels, M. Cerebral Symmetry: An Urgent Concern for Education. The Science Teacher , pp. 471-472, March, 1976.

Renner, J. and Lawson, A. Promoting Intellectual Development Through Science Teaching. The Physics Teacher , pp. 273-276, May, 1973.

Renner, J. and Lawson, A. Intellectual Development in Preservice Elementary School Teachers: An Evaluation. Journal of College Science Teaching , pp. 89-92, November, 1975.

Renner, J. and Paske, W. Quantitative Competence of College Students. Journal of College Science Teaching , pp. 283-292, May, 1977.

Renner, J. and Stafford, D. Inquiry, Children, and Teachers. The Science Teacher , pp. 55-57, April, 1970.

Restak, R. The Other Difference Between Boys and Girls. Educational Leadership , pp. 232-235, Dec., 1979.

Restak, R. The Brain , Bantam Books, Inc., N.Y., October, 1984.

Reynolds, C. and Torrance, E.P. Perceived Changes in Styles of Learning and Thinking (Hemisphericity) Through Direct and Indirect Training. Journal of Creative Behavior , 12(4) :247-251, 1978.

Riley, P. A Comparison of Brain Dominance and Placement Examination Scores of Entering Students: Cero Community College. Dis. Ab's Int'l , 42A :518, 1981.

Risse, G., and Gazzaniga, M. Well-Kept Secrets of the Right Hemisphere: A Carotid Amytal Study of Restricted Memory Transfer. Neurology , 28 :950-953, Sept., 1978.

Roe, A. A Psychologist Examines 64 Eminent Scientists. Scientific American , 187(5) :21-22, Nov., 1952.

Roueche, J. Creating an Environment for Learning. Community and Junior College Journal , pp. 48-50, March, 1976.

Rosen, R. Creativity and Cerebral Functioning: An Investigation of Neuropsychological and Developmental Variables . Unpublished Doctoral Dissertation, University of Georgia, 1982.

Ross, E. The Aprosodias: Functional-Anatomical Organization of the Affective Components of Language in the Right Hemisphere. Archives of Neurology , 38 561-569, Sept., 1981.

Russel, W. Some Comparisons of the Audio-Tutorial Method with the Conventional Method in Introductory College Biology. Dis. Ab's Int'l , 29A :3535, 1969.

Sagan, C. The Dragons of Eden . Ballantine Books, N.Y., 1977.

Samples, R. Educating for Both Sides of the Human Mind. The Science Teacher , pp. 21-23, January, 1975.

Samples, R. Toward a Synergy of Mind: Psychological Premises for Education Before 1984. Human Behavior , pp. 16-23, Feb., 1975.

Samples, R. The Metaphoric Mind . Addison-Wesley Pub. Co., 1976.

Sananman, M. EEG versus Computerized Tomography of Brain in Neurological Diagnosis. Clinical Electroencephalography , 14 :116-129, 1983.

Sanders, S. The Importance of the Piaget Learning Theory for the College Teacher. Journal of College Science Teaching , 7(5) :283-287, 1978.

Saral, T. "Consciousness Theory and Intercultural Communication." Paper presented at the International Communication Association, Portland, Oregon, April 14-17, 1976, in Bennet, 1979, op. cit.

Sayre, S. and Ball, D. Piagetian Development in Students. Journal of College Science Teaching , 5(1) :23, 1975.

Scerba, J. Compatibility of Teaching Strategies and Learning Styles as a Determinant of Academic Success. ERIC Clearinghouse , ED171752 , pp. 1-29, 1979.

Schinoff, R. No Nonsense at Miami-Dade. Community and Junior College Journal , pp. 34-35; 44-45, Nov., 1982.

Schneeberger, B. Registered Nurses in Generic Baccalaureate Programs of Nursing in New York State: Learning Needs Assessment As a Basis for Curriculum Development and/or Curriculum Revitalization. Dis. Ab's Int'l , 45/03A :741, 1984.

Schwartz, G. Right Hemisphere Lateralization for Emotions in the Human Brain: Interaction With Cognition. Sciences , 190 :286-288, 1975.

Schwartz, M. Left-Handedness and High-Risk Pregnancy. Neuropsychologia , 15 :341-344, 1977.

Schwartz, J., and Tallal, P. Rate of Acoustic Change May Underlie Hemispheric Specialization for Speech Perception. Science , 207 :1380-1381, 1980.

Searleman, A., Porac, C., and Coren, S. Writing Hand Posture and Four Indexes of Lateral Preference. Brain and Cognition , 3 :86-93, 1984.

Seubert, J. Adult Learners: Are They Really Different? Radiologic Technology , 54 :28-33, 1983.

Shallcross, D. Teaching Creative Behavior . Prentice-Hall, Inc., 1981.

Shanon, B. Writing Positions in Americans and Israelis. Neuropsychologia , 16 :587-591, 1978.

Sibitani, A. It May Turn Out that the Language We Have Alters the Physical Operation of Our Brains. Science 80 , pp. 24-26, Dec., 1980.

Siemankowski, F., and MacKnight, F. Spatial Cognition: Success Prognosticator in College Science Courses. Journal of College Science Teaching , 1 :56-59, Oct., 1971.

Sinatra, R. Brain Research Sheds Light on Language Learning. Educational Leadership , pp. 9-12, May, 1983.

Snyder, S. Wonders of the Brain, in On the Brink of Tomorrow: Frontiers of Science. National Geographic Society, pp. 172-93, 1982.

Sperry, R. The Great Cerebral Commissure. Scientific American , 210(1) :42-52, Jan., 1964.

Sperry, R. Hemisphere Deconnection and Unity in Conscious Awareness. American Psychologist , 23 :723-733, 1968.

Sperry, R. Effects of Disconnecting the Cerebral Hemispheres. Science , 217 : 1223-1226, 1982.

Spiegler, B., and Yeni-Komshian, G. Incidence of Left-Handed Writing in a College Population with Reference to Family Patterns of Hand Preference. Neuropsychologia , 21 :651-659, 1983.

Stafford, T. Racial Patterns in Community College Attendance. Community College Review , pages 27-39, Spring, 1976.

Steere, M. The Black/White Dichotomy and the Classroom. Journal of Creative Behavior , 18(4) :247-255, 1984.

Stepp-Gilbert, E. and Wong, S. Creativity in Clinical Nursing. Journal of Nursing Education , 24(1) :32-33, January, 1985.

Stetar, J. Community Colleges and the Educational Needs of Older Adults. Journal of Higher Education , 55(9) :717-721, Dec., 1974.

Stewart, D. Teachers Aim at Turning Loose the Mind's Eye. Smithsonian , pp. 44-54, Aug., 1985.

Stiles-Davis, J. Construction of Spatial and Class Relations in Four Children with Right Cerebral Hemisphere Damage. Dis. Ab's. Int'l , 44A 1037-1038, 1983.

Strong, R., Silver, H., and Hanson, R. Integrating Teaching Strategies and Thinking Styles with the Elements of Effective Instruction. Educational Leadership , 42(8) :9-15, May, 1985.

Styles, M. How Can We Encourage Nursing's Voyagers to Soar? The American Nurse , 19(3) :1-20, March, 1987.

Sutherland, E. The Effects of Hypnosis Upon Cerebral Hemispheric Lateralization. Dis. Ab's Int'l , 44B 3545, 1983.

Tapley, S., and Bryden, M. Handwriting Position and Hemispheric Asymmetry in Right-Handers. Neuropsychologia , 21 :129-138, 1983.

Tegano, D. Divergent Thinking and Hemisphericity. Dis. Ab's Int'l , 42B :2324, 1981.

Teng, E., Lee, P., Yang, K., and Chang, P. Handedness in a Chinese Population: Biological, Social, and Pathological Factors. Science , 193 :1148-1150, 1976.

Thomsen, D. Split Brain and Free Will. Science News , 105 256-57,April, 1974.

Thornell, J. Research on Cognitive Styles: Implications for Teaching and Learning. Educational Leadership , 33(7) :502-504, 1976.

Tillery, G. CPR for Your Nursing Career. Nursing Management , 18(14) :80R-80V, April, 1987.

Toepfer, C. Brain Growth Periodization- A New Dogma for Education. Middle School Journal , 10(3) :3-20, 1979.

Tollefson, N. Selected Student Variables and Perceived Teacher Effectiveness. Education , 94(1) :30-35, 1973.

Tomer, R., and Mintz, M. Hemispheric Laterality and Smooth Pursuit in Normal Individuals. Perceptual and Motor Skills , 51 :31-35, 1980.

Tomizuka, C., and Tobias, S. Mathematical Ability: Is Sex a Factor? Science , 212 :114-116, 1981.

Torrance, E. P. Implications of Whole-Brained Theories of Learning and Thinking for Computer-Based Instruction. Journal of Computer-Based Instruction , 7(4) :99-105, May, 1981.

Torrance, E.P. Hemisphericity and Creative Functioning. Journal of Research and Development in Education , 15(3) :29-37, 1982.

Torrance, E.P., and Ball, O. Which Gifted Students Apply What They Learn in Special Programs? GCT , 7 :7; 9; 62, March-April, 1979.

Torrance, E.P., and Mourad, S. Some Creativity and Style of Learning and Thinking Correlates of Guglielmino's Self-Directed Learning Readiness Scale. Psychological Reports , 43 :1167-1171, 1978.

Towler, J. and Wheatley, G. Conservation Concepts in College Students: A Replication and Critique. The Journal of Genetic Psychology , 118 :265-270, 1971.

Tracy, S. and Schuttenberg, E. The Desirable and the Possible: Four Instructional Models. College Teaching , 34(4) :155-160, 1986.

Trevarthen, C. Hemispheric Modes of Consciousness in the Human Brain. Nature , 294 :112-113, 1981.

Trotter, R. Sinister Psychology. Science News , 106 220-222, 1974.

Turner, R. The Value of Variety in Teaching Styles. Educational Leadership , pp. 257-258, January, 1979.

Van Allen, G. Educational Attitudes in a State System of Community Colleges. Community College Review , 10(2) 17-20, Fall, 1982.

Van Meter, M. What Lies Ahead for Nursing? RN , page 82, March, 1986.

Walizer, M. Caution: Minds at Work. The College Board Review , 139 :23-36, Spring, 1986.

Wallas, G. "The Art of Thought", 1945, in Ironson, D., 1984, op. cit.

Warren, J. Handedness in the Rhesus Monkey. Science , 118 622-623, 1953.

Washburn, S. Tools and Human Evolution, in Perspectives on Human Evolution- Scientific American Readings , pp. 9-21, 1979.

Way, K. Cerebral Lateralization and Its Relation to Academic Variables in a Community College Population Unpublished Doctoral Dissertation, University of Massachusetts, 1981.

Webb, J. and Carras, J. A Strategy for Teaching Physical Science to "Older" Students. Journal of College Science Teaching , 10(6) :370-371, May, 1981.

Wende, B. A Comparative Study of Psychomotor Nursing Skills of the Baccalaureate and Associate Degree Senior Nursing Student. Dis. Ab's Int'l , 45/08A 2383, 1984.

Whitehead, A.F. The Aims of Education . Free Press, The MacMillan Co., N.Y., 1967.

Wilson, A. The Molecular Basis of Evolution. Scientific American , 253(4) :164-173, Oct., 1985.

Witelson, S. Sex and the Single Hemisphere: Specialization of the Right Hemisphere for Spatial Processing. Science , 193 :425-427, 1976.

Witelson, S., and Pallie, W. Left Hemisphere Specialization for Language in the Newborn- Neuroanatomical Evidence of Asymmetry. Brain , 96 41-46, 1973.

Witkin, H. and Moore, C.A. Cognitive Style and the Teaching-Learning Process. Paper prepared for presentation at the annual meeting of the American Educational Research Association, Chicago, Illinois, pp. 1-23, April 15-20, 1974.

Witkin, H., Moore, C., Goodenough, D. and Cox, P. Field-dependent and Field-Independent Cognitive Style and Their Educational Implications. Review of Educational Research , 47 :1-64, 1977.

Wittrock, M. Education and The Brain . The Seventy-Seventh Yearbook of the National Association for the Study of Education, Part II. Chall, J. and Mirsky, A., eds., University of Chicago Press, 1978.

Woodham, R. and Taube, K. Relationship of Nursing Program Predictors and Success on the NCLEX-RN Examination for Licensure in a Selected Associate Degree Program. Journal of Nursing Education , 25(3) 112-117, March, 1986.

Yeni-Komshian, G., and Benson, D. Anatomical Study of Cerebral Asymmetry in the Temporal Lobe of Humans, Chimpanzees, and Rhesus Monkeys. Science , 192 :387-389, 1976.

Zubari, M.Y. Science Education for Nursing and Other Paramedical Students. *Journal of College Science Teaching*, *3(1)*:58-60, Oct., 1973.