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An Investigation Into Problem-Solving in Physical Therapy Education: Prerequisites and Curriculum

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AN INVESTIGATION INTO PROBLEM - SOLVING IN PHYSICAL THERAPY EDUCATION: PREREQUISITES AND CURRICULUM

by

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DEDICATION

To my husband, Fred,

without whose love and support

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and to my parents, Joseph and Grace Utz,

who long ago instilled in me

a love of learning and

a value for education.

VITA

The author, Judith Utz Arand, was born on January 26, 1951 in Newark, New Jersey, the daughter of Joseph and Grace (Tomasko) Utz. She is married to Frederick Arand, and is the proud and happy mother of an infant son, Joseph.

Her elementary education was obtained at St. Jerome's Grammar School in West Long Branch, New Jersey. Secondary education was obtained in Red Bank Catholic High School in Red Bank, New Jersey, where she was graduated with honors in 1969.

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Since the birth of her son, Joseph, the author has enjoyed mothering and consulting in education and physical therapy.

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CHAPTER I

INTRODUCTION

There have been many changes in the field of medicine in recent years. The trend has been to move away from the physician-oriented, physician- centered hospital settings to home health care, clinic settings, and preventive medicine. These changes have largely been necessitated by population growth, economic restrictions, and an insufficient number of medical and allied health personnel to meet the increasing and demanding needs of a growing population. Furthermore, this growing population is more educated and demanding of its right to quality health care.

The field of physical therapy has grown due to professional and societal demands since its inception in 1914. It has changed from a technique-oriented field with on-the-job training in skills taught to nurses following World War I, to its status today as a recognized allied health profession, with educational preparation at the baccalaureate degree level and professional licensure. The profession continues to grow, as leadership in the national association of physical therapists calls upon the profession to establish itself with greater autonomy, and to insure educational preparation for this through entry-level professional education at the master's degree level or through another post-baccalaureate mechanism. The American Physical Therapy Association

(A.P.T.A.) has mandated that all baccalaureate degree programs in physical therapy be converted to post-baccalaureate degree programs by 1990 (A.P.T.A.,1979).

In response to societal needs and the trends within physical therapy, the profession has the obligation to insure that the professionals within the field can meet the demands arising out of these changes. To do so, professionals entering the field must be prepared in their educational programs now. Therefore, the professional educational programs must select and then educate those applicants possessing the qualities that will most enable that the needs of the patient and the consumer be met in this vastly changing and evolving health field.

In this movement toward independent practice begun in physical therapy, the role of the physical therapist has drastically changed from that of an applier of techniques to that of an evaluator of patient status and a decision-maker regarding appropriate treatment programs. In this regard, the physical therapist is seen as a problem-solver, involved in the problem-solving process by evaluating a patient's status, planning for goals of treatment, managing a patient's care, and appraising the results of treatment (Barr, 1976).

To prepare students to assume this role in the delivery of health care, changes in the professional phase of a physical therapy educational program have been advocated. A major thrust has been emphasis on the problem-solving process as an educational tool within a problem-solving curriculum. It has been suggested that through such a curricular emphasis, the problem-solving abilities of physical therapy students can be enhanced or improved so that the physical therapists entering the profession may be more adequately prepared to handle the demands to be placed upon them. This would then enable physical therapy, as a profession, to meet the changing needs and demands of society and the health care delivery system.

To determine how a problem-solving curriculum can, in fact, meet the the needs of the profession, problem-solving skills of students preparing for the profession must be assessed. Questions such as what problem-solving skills are necessary for entering the profession of physical therapy; whether or not a problem-solving curriculum can improve students' problem-solving skills; and which problem-solving skills can be improved need to be answered.

The purposes of this study were twofold: (1) to assess problem-solving skills held by entering students in a problem-solving curriculum in physical therapy in order to assist in admissions policies; and (2) to determine if education within a problem-solving curricular framework improves the student's ability to problem-solve. This study consisted of two phases designed to achieve these ends.

The problem-solving skills of entering physical therapy students prior to involvement in a problem-solving curriculum were assessed in Phase I. Learning styles (e.g. Collaborative, Participative, Dependent, Independent) were also determined at this time, and entering academic transcripts from previously attended institutions were systematically evaluated. An attempt was made to determine if prerequisite coursework, institution, major field of study, or learning style have any relationship to entering problem-solving skills. A baseline of problem-solving status for each subject was also established so this baseline could be used for Phase II of this investigation.

The changes occurring in problem-solving skills as the student is involved in the problem-solving curriculum were investigated in Phase II. An attempt was made to determine if changes, such as improvement in problem-solving skills, do occur, and if so, when in the curriculum (e.g. following basic science courses in the Summer Quarter, following basic physical therapy procedure courses in Fall Quarter, or following more advanced physical therapy treatment courses in Winter Quarter) the greatest change occurs. Finally, the relationships among changes in problem-solving skills, learning style preference, specific types of courses (e.g. lecture courses vs. practical experience courses) and grade-point averages (G.P.A.) were also investigated.

CHAPTER II

REVIEW OF RELATED LITERATURE

Health Care Trends

The changes seen in health care in recent years have been necessitated by changes in needs, societal expectations, and governmental support of the delivery of health care. In the years between 1960 and 1970, the number of health care professionals greatly increased (Mahoney, 1980) in response to the increasing needs of a growing population. During that time, health care delivery systems revolved around the traditional hospital setting, with strong governmental support of health care.

During the 1970's, the trends in patient care included: advances in scientific knowledge resulting in an increased use of technology and equipment; a continuing increase in the population accompanied by higher health expectations and demands for health care by the public; a need for increasing numbers of physicians and other health professionals to meet these needs and demands of the public; an expanding role of the government in overseeing the delivery of health care services; and an ever-rising cost for these health care services (Coggleshell, 1966). In the 1980's, however, the predictions seem to indicate that changes in health care delivery will be necessitated by a decrease in federal spending for health care, accompanied by governmental regulations regarding health manpower, the education of health professionals, and professional licensure (Breegle & King, 1982; Daniels, 1974; Johnson, G.R., 1974b; Mahoney, 1980). It also appears that with the decreases in federal monies available and the use of third-party payers, the movement is away from the traditional hospital setting toward an increasing amount of patient care being provided on an ambulatory and home care basis (Barr, 1976; Blood, 1972; Mahoney, 1980). As these changes occur, changes within the health professions have occurred and must continue to occur to meet the demands and needs of the health care system (Johnson, G.R., 1974b; Worthingham, 1957).

To insure that the professionals within the health care fields are able to respond to these changes, educators must develop systems to evaluate the credentials of would-be professionals. Capable applicants must be admitted to professional programs, and the professional programs must constantly be updated to stay current with these changes.

Since physical therapy is one of these quickly changing health professions, literature regarding its development and future trends will be reviewed, both in its educational and professional components. Literature regarding the importance of selective admissions amd present tools used in admissions policies in both medical and allied health fields has been reviewed. Specific attention has been given to admissions procedures in physical therapy. Finally, literature regarding the Watson-Glaser Critical Thinking Appraisal and the Grasha-Reichmann Student Learning Style Scales has been reviewed and a summary included.

Physical Therapy as a Health Profession

Evolution of the Profession

Physical therapy, as one of the health professions, has been growing and changing in order to meet the changing needs of society. Physical therapy was born through the responses of physical educators and nurses to the polio epidemics of 1914-1916. Following World War I, programs of intensive training for six weeks began at Walter Reed General Hospital. As the technician-status became recognized, the number of programs increased and the duration of training lengthened. By the 1950's, the need for physical therapists increased due to the return of veterans following World War II, and the "technician" began to be schooled in the rationale behind the procedures. Education moved to the baccalaureate degree level, with programs and content governed by the national association of physical therapists, the American Physical Therapy Association (A.P.T.A.), and in 1958, state licensure laws were enacted (A.P.T.A., 1982; Decker, 1972; Pinkston, 1978).

In the 1960's and early 1970's, the number of physical therapy educational programs continued to grow, with the emphases in breadth and depth of information in content areas also increasing. Master's degree programs were initiated, both for entry-level and for advanced level study for graduated and practicing physical therapists. Education was forced to evolve quickly and to diversify in response to the societal changes (A.P.T.A., 1982; Hogue, 1974).

Projected Changes in the Profession of Physical Therapy

The 1980's and 1990's hold even more changes for the profession of physical therapy. The move toward treatment in ambulatory care settings calls upon greater authority and decision-making ability of the physical therapist (Blood, 1982; Hogshead, 1974). The leadership of the A.P.T.A. has called for the profession to develop greater autonomy and is advocating that physical therapists be able to evaluate and treat patients as a direct portal of entry into the health care system, therefore bypassing the currently mandatory physician referral system (A.P.T.A., 1979). Some states, such as Illinois and Ohio, have begun to support this move toward independent practice by making it legally possible for physical therapists to evaluate patients without physician referral. This, however, is not yet the national norm; although the profession continues to work toward this goal, and the goal of not only evaluation without referral, but for continuing evaluation and treatment without referral.

If independent practice is the goal of the future for the profession of physical therapy, then the educational programs for physical therapists must respond to this need by preparing entry-level therapists to assume this role. The A.P.T.A. has begun further directing the profession toward this goal by advocating more educational preparation for entry-level physical therapists through a master's degree or other post-baccalaureate degree program. The A.P.T.A. has mandated that all baccalaureate degree programs be converted to post-baccalaureate degree programs by 1990 (A.P.T.A., 1979). Leadership in the A.P.T.A. at present is divided between supporting entry-level education at a baccalaureate or post-baccalaureate degree level (Morrison, Lindner, & Aubert, 1982) and supporting entry-level education at the master's degree level (Daniel, 1974; Johnson, G.R., 1974b; Johnson, J.A., 1978).

Such major changes in the profession of physical therapy directly affect the education and future roles of physical therapists in the health care delivery system (Keeping P.T. ... , 1982). As the physical therapist assumes greater professional autonomy, the therapists become more involved in the planning of health care services (Blood, 1972; Worthingham, 1970). This demands a more active role in evaluation, interpretation of evaluation results, and selection of appropriate treatment methods (Daniel, 1974; DiStefano, Johnson, & Pinkston, 1971; Hogshead, 1974; Johnson, G.R., 1974). As the role of advisor and consultant increases, the responsibility and accountability for decisions made in the delivery of health care also increases (Breegle & King, 1982; Johnson, G.R., 1974b).

The Physical Therapist as a Problem-Solver

As the profession of physical therapy moves toward independent practice, the role of the physical therapist involves more decision-making and problem-solving. With the practice of physical therapy moving out of the hospital setting, the principal functions of the therapist will be to evaluate, interpret the findings of the evaluation, and make the decision whether to treat a patient or refer the patient for other care (Johnson, G.R., 1974b; McIntyre, Pinkston, Johnson & Margolis, 1970). The decisions of the therapist directly affect patient care

(Doctor, 1971), so the therapist must be able to use the powers of critical thinking to insure a correct definition of the patient's problem, a good and appropriate evaluation, and the best selection of treatment from all the possible alternatives to provide for optimal patient care (Chidley, 1979; Doctor, 1971; McIntyre, Svetlik, Johnson & Pinkston, 1971). This is the view of the future therapist that is supported by the A.P.T.A. Furthermore, as the profession moves toward greater autonomy, not only is the physical therapist to be active in the decision-making process using judgmental abilities, but the therapist will also be increasingly responsible and accountable for the decisions made (Daniels, 1974; Johnson, G.R., 1974a; Miller, S.A., 1977; Rzonca, 1976). Therefore, the physical therapist must be a problem-solver, and possess those qualities necessary for successful critical thinking (Chidley & Kisner, 1979; Morrow, 1981).

Assuming that problem-solving involves evaluation and decision-making or judgment as major components (Ennis, 1962; Feely, 1976; Kolb) it becomes imperative that the physical therapist develop problem-solving skills in order to meet the changing needs of society and the predicted demands of the profession as described above (Huenecke, 1982; May & Newman, 1980; Morrow, 1981).

Problem-Solving

Definition

It is generally accepted that problem-solving, or critical thinking, involves a great deal of evaluation. In 1962, Ennis defined critical thinking as "the correct assessing of statements" and discussed three dimensions of critical thinking as being (1) the logical dimension, which involves the judging of an alleged relationship between the meanings of words and statements; (2) the criterial dimension, which involves using knowledge of criteria for judging statements; and (3) the pragmatic dimension, which involves using an established background purpose to make decisions regarding such matters as whether or not the given statements are sufficient for the defined purpose. Within these three dimensions, twelve aspects of critical thinking have been clarified; of these twelve, eleven involve the ability to "judge" or evaluate, including in this "judging" the ambiguity, contradiction, conclusions, specificity, applicability, reliability, adequateness, and acceptability of statements.

More recently, this concept of problem-solving as an evaluative and decision-making process has been supported. Kolb, Rubin, and McIntyre (1971) discussed problem-solving as a very active process on the part of the problem-solver, who accepts the responsibility for the problem-solving and can evaluate when the problem is solved. Feeley (1976) cited problem-solving as the ability to think for oneself, or reflective thinking, and called it a mental activity higher on the taxonomy of objectives than comprehension, involving "judging" statements and "being closest in meaning to the evaluation stage of Bloom's taxonomy" (Feeley, 1976, p.2).

Information Processing

Currently, the area which encompasses the preceeding definitions of problem-solving in the field of cognitive psychology is that of information processing. Information processing theorists view the human as a processor of information, and see the subject of problem-solving and how it is accomplished as a primary concern. Information processing attempts to analyze in great detail, the performances which occur due to problem-solving (Greeno, 1978). This is done by following "what happens to the information as it enters the human and is processed by the nervous system" (Norman, 1976, p. 3).

Greeno (1980) states that "there is not a single homogeneous set of skills that we can identify as the important skills of problem-solving . . . - different kinds of problems appear to require rather different kinds of skills." However, Greeno does identify three general types of problems. The first type is problems of inducing structures i.e. of identifying a pattern of relationships among the factors in a specific problem. This type of problem requires the skill of understanding, the ability to apprehend relations and to develop a representation of the situation integrating the relations. The second type is problems of transformation, i.e. of finding a set of operations that will enable the problem-solver to transfer the problem-solving situation into the goal situation. These problems require means-end analysis, and are dependent upon the problem-solver having a plan which will guide the chosen set of operations. The third type is problems of arrangement, i.e. of arranging the components of a situation in order to satisfy a specific criterion. These problems require skills in composition or constructive search (i.e. generating a partial solution and evaluating the aspects generated).

Newell and Simon (1972) considered the essential components of a problem-solving situation to be the task environment and the information processing system, explaining that the problem formulation imposes an overall organization on the problem-solving process. The translation of the problem then produces an internal representation of the problem. Newell and Simon cited lack of information regarding the representation of knowledge as a major difficulty within information processing theory.

Currently, the major foci of investigation in information processing theory include the areas of planning or the organization of knowledge and the representation of knowledge. Greeno identifies these two component skills (i.e. organizing information and representing it) as major aspects in the solution of his three types of problems.

The central concept regarded in the question "How is knowledge organized?" is the concept of brain organization and memory. Norman cited the basic problem as that of determining "how we match the complex sensory waveforms with material stored in memory." (Norman, 1976, p. 40).

Norman (1976) defined processing systems as one of two types, the type determined by the sequence of operations used to process information. Data-driven or bottom-up processing begins with the sensory stimuli (e.g. a visual image) and proceeds through more and more complex analyses of the information until a final stage of input recognition (e.g. a meaningful sentence in a book). Conceptually-driven or top-down processing begins with a concept regarding the input (e.g. this book has sentences in it) to a final refinement of that concept (e.g. this sentence is about conceptually-driven problem-solving). Norman actually states a case not for the competition of these two types of processing systems, but rather for their coexistence and integration in the human problem-solver.

Kirby (1980) supported this integration of processing systems in his discussion of Luria's simultaneous-successive processing model. In a more neuropsychological model, Luria divided the brain into three functional and interrelated systems which are involved in the arousal, coding, and planning of behavior. Kirby integrated Luria's model with information processing concepts and elaborated on the functions of Luria's Block 2, which is involved in the coding or representation of knowledge.

The representation of knowledge is the second major area of focus in current information processing theory. How knowledge is stored in human memory has become the theme of many major investigations. In his review of numerous studies on this subject, Norman (1976) discussed the different forms of the representation of information, and the hierarchy or competition for use. Citing studies by Brooks in 1968 and by Baddely, Grant, Wight and Thomson in 1975, Norman presented the idea that:

> The mental representation of spatial information is in the same form as the information arriving from a spatial task. Thus, if one tries to do a spatial task using information from memory while at the same time doing a spatial task in the world, the two different things interfere with one another. Similarly, verbal information from memory must at some point be in the same form as verbal information coming in through the sensory system. Finally, verbal information and spatial information do not conflict with one another, so they must be represented differently (Norman, 1976, p. 162)

Norman then discussed the example given by Baddeley, Grant, Wight and Thomson regarding the difficulties noted when a football fan is trying to visualize plays being described by a radio announcer while driving a car along a winding road.

Other ways of representing knowledge are also discussed by Norman, including propositional representation, i.e. representation expressed conceptually about the relationships of bits of information to be stored; and analogical representation, i.e. the maintenance of an accurate "picture image" of the information. Episodic memory, i.e. the storage of time-sequence events, semantic memory, i.e. the memory used for words, verbal symbols, and language, and retrieval of information are also discussed by Norman. For a complete review, the reader is referred to Norman (1976).

Finally, Norman concludes that:

> Different forms of information are necessary for different purposes. . . . Humans have great flexibility in the use of information. . . . If several different modes of storage are used in human memory, there must be sufficient interrelationships among the different storage modes to allow access to all modes.
>
> It would appear that people can transform information into the most appropriate form necessary for answering questions. Thus, whatever the storage format of information in memory (and there could be several), when the information is used, it most likely becomes transformed into whatever format is most appropriate (Norman, 1976, p. 195).

Problem-Solving in Education

The need for teaching problem-solving skills is well-supported in the literature (Cyert, 1980; Greeno, 1980; Kozmetsky, 1980; Rubinstein, 1980; Simon, 1980; Tuma & Reif, 1980). Rubinstein and Simon presented cases for teaching problem-solving due to the knowledge explosion and the complex societal changes occurring. Present-day educators are unable to pointedly predict the future needs of today's students and society. Cyert and Kozmetsky stated a specific need for problem-solving being taught in the professions, and linking the academic and practical educational experiences.

Problem-solving courses are presently being taught in general problem-solving skills (Rubinstein, 1980), through computer simulation and computer coaching (Goldstein, 1980), engineering (Norman, 1980) and physics (Larkin, 1980). The development and use of strategies for problem-solving are also being studied and advocated (Pressley & Levin, 1983a, 1983b). It is generally agreed that although a strong knowledge-base is necessary for successful problem-solving, the problem-solving process itself is becoming more and more important in today's education. Furthermore, evidence points to the fact that problem-solving skills can be taught, but it is questionable whether or not this is cost-effective, compared to the teaching of subject-matter itself, that necessary component of the problem-solving process (Simon, 1980). Simon states it well as he writes:

> As a practical teacher, I am satisfied that, as we continue to learn more about the nature of the problem-solving process, we will be able to circumvent the unsolvable problems of coverage and of predicting what specific knowledge our students will need 30 years hence (Simon, 1980, p. 95).

Physical Therapy Education

Physical therapy then, as a profession, is evolving, and as it does, its roles and professional expectations are dictated by this evolution and the societal demands that accompany it. As the profession changes, so also must its educational programs change in order to meet these demands of the profession (A.P.T.A., 1982; Chidley & Kisner, 1979; Keeping P.T. ... , 1982; Morrison, Lindner & Aubert, 1982; Truelove, 1976) and society (Huenecke, 1982; Tyler, 1976). A great deal of the responsibility for preparing entry-level physical therapists to meet these demands lies with educators within the profession of physical therapy. In 1963, Worthingham stated that "the future of physical therapy education will be related of necessity to the role its educators and practitioners elect to play in the development of physical therapy as a profession" (Worthingham, 1963, p. 645). This view continues to be held by present day educators (McBride, 1980; DiStefano et al, 1971). As the profession increases in responsibility and autonomy, it is clear that revisions in the curriculum used to educate physical therapists are necessary. It appears that the inclusion of problem-solving as a process underlying training will be essential.

Developing Critical Thinking Skills Through Education

Since the role of the physical therapist as a problem-solver has been defined, it becomes the task of the educational programs to assist the student in developing problem-solving skills. It has been found that critical thinking can be improved through coursework that stresses this process. In a look at philosophy as related to critical thinking, Annis and Annis (1979) surmised that exposure to critical thinking as used in philosophy could impact on the students further use of critical thinking in the realm of philosophy. On the other hand, Sadler (1982) found that in traditional science education, the inquiry or problem-solving approach did not alter the achievement of students when compared to the conventional teaching approach.

Physical therapy education consists of courses involving both traditional sciences and philosophies regarding planning of treatment and management of patient care. However, such a curriculum, which has emphasis on the integration of basic science with philosophy and prescription, as done in a problem-solving format, has yet to be studied.

Although educators do not seem to totally agree on whether or not critical thinking skills can be improved via coursework which emphasizes critical thinking, educators do seem to feel that the development of critical thinking skills is a worthy goal of education. This is well-supported in the literature (Anderson, 1944; Smith, 1979; Taba & Elzey, 1964).

Problem-Solving Education in Physical Therapy

In recent years, the concept of the problem-solving curriculum has been strongly advocated in physical therapy education (Barr, 1975, 1976, 1977; May, 1977; May & Newman, 1980; Miller, S.A., 1977; Morrow, 1981; Yarbrough, 1976). Miller (1977) especially feels that as an educational tool, problem-solving facilitates and motivates learning, increases the student's involvement in the educational process by promoting self-direction and providing satisfaction, and that the material learned then becomes more relevant and meaningful. It has been shown that the knowledge base in the field of physical therapy has a half-life of 5-20 years (i.e. new information making old information obsolete), and that the amount of information deemed necessary for the entry-level physical therapist continues to grow by leaps and bounds (Ford, P.J., 1976; Hiemstra, 1974; Miller, S.A., 1977; Shepard, 1977). However, it is felt that the problem-solving curriculum assists the student in dealing with this increasing amount of information by helping the student integrate information and use the process of problem-solving (May & Newman, 1980; Miller, S.A., 1977; Shepard, 1977).

Barr, (1975, 1976, 1977) one of the principal exponents of the problem-solving curriculum in physical therapy education, stated a strong case for the advantages of the problem-solving curriculum over the traditional subject-centered curriculum. Barr noted the following disadvantages with the traditional curriculum: focus on the subject matter with little emphasis on the process of learning; knowledge fragmentation due to individual courses in the program, with little integration of course knowledge; and that, with the surge of information being added to the body of knowledge in physical therapy, the curricula are now at a ceiling in regard to the number of courses a student can carry. Among the advantages of the problem-solving curriculum, Barr cited: the facilitation of continued learning, necessary for a professional in such a rapidly evolving profession; providing a process for approaching unfamiliar situations in the future; enhancing the sharing of knowledge among disciplines as the health care delivery system changes; the active involvement of the student in educational experiences through the intellectual, emotional, and activity realms; and the enabling of problem-solving skills being utilized and exercised in both the classroom and clinical settings.

Conrad and Pratt (1983) supported this concept of comprehensive curricular planning to facilitate the integration of theory and practice. Wildman (1980) also supported such a curriculum, which unifies learning theory and instructional design. Finally, there is a strong consensus among physical therapy educators that enhancing problem-solving skills in students through the use of the problem-solving curriculum will better prepare entry-level therapists to meet the changing demands of the profession (Barr, 1976; May & Newman, 1980; Morrow, 1981; Yarbrough, 1976).

Selective Admissions to Educational Programs in Health Care

Need for Selective Admissions Procedures

The importance and concern regarding admissions criteria, standards, and policies for professional educational programs is well-documented in the literature. With the increase in the population, the job security of the professional fields, and the societal demand for professionals, the number of applications for a limited number of positions has greatly increased for educational programs in medicine (Funkenstein, 1970; Garza, Adams & Skinner, 1976; Sarnacki, 1982; Schofield & Garrard, 1975) and allied health fields (El-Din, 1977; French, 1976; Garza, Adams & Skinner, 1978; Morgan, 1974; Rifkin, Maturen, Bradna, Brace & Jacobs, 1981; Thomas, 1977). Especially noted is the increased number of applications in the therapies, including physical therapy (Dietrich & Crowley, 1982; Holmstrom, 1975; Johnson, Pinkston & McIntyre, 1971; Morrow, 1981; Seymour, McDougall, Wadsworth & Saunders, 1982; Trotter & Fordyce, 1975; University of Kentucky, 1981), occupational therapy (Blaisdell & Gordon, 1979; Holmstrom, 1975; Johnson & Arbes, 1974; Lucci & Brockway, 1980), and speech therapy (Holmstrom, 1975).

Several areas of the admissions process in medicine and allied health are currently under scrutiny. The questions most often asked, and the impetus for the scrutiny involve the desire to determine not only which applicants have the abilities necessary to complete the rigorous educational programs, but which of the candidates for admission will prove to be the most successful or capable professionals (Blaisdell & Gordon, 1979; Gough, Hall & Harris, 1963; Johnson, Pinkston & DiStefano, 1971; McBride, 1980; Mehta, 1978; Thomas, 1977) and which qualities can be assessed in making that determination (Dietrich & Crowley, 1982; Swihart, 1974). Many different procedures are in use in the various educational institutions, with the variety of criteria in similar professions attesting to the lack of congruity in naming the desirable qualities of each of the professions (Morgan, 1974; Rhoads, Gallemore, Gianturco & Osterhout, 1974; Rifkin, Trotter & Fordyce, 1975).

It has been seen that most of the present research regarding the admissions procedures has been begun in an effort to objectify admissions criteria (Dietrich & Crowley, 1982; Garrison, 1981). It is felt tha this will not only be fair for the increasing number of applicants, but is important for ethical and legal reasons (Garrison, 1981). This also will provide for more efficient use of time for the faculty members involved in the admissions process, and subsequently be more financially economical for the institutions (James, 1980; Seymour, 1982; Trotter & Fordyce, 1975; Watson, Anthony & Crowder, 1973).

Procedures and Criteria Presently Used

Admissions procedures vary in each institution of higher learning, according to the needs and facilities of each institution. However, some of the criteria used are similar. Most medical schools and programs in physical therapy and occupational therapy employ some means of looking at the undergraduate grade point average (G.P.A.)(Crowder, 1959; Drugo & Martin, 1975; Johnson, Arbes & Thompson, 1974; Rothman, 1974; Tidd & Conine, 1974). Many medical schools and some of the allied health programs separate out the undergraduate science G.P.A. from the overall G.P.A. and use that as a separate criterion (Crowder, 1959; Davis, Martens & Patterson, 1976; Tidd & Conine, 1974). Medical schools generally use the Medical College Admissions Test (M.C.A.T.) scores (Crowder, 1959; Mehta, 1978; Watson, R.I., 1955), with some schools using the M.C.A.T. science subtest score, the M.C.A.T. verbal subtest score, and the M.C.A.T. quantitative subtest score as separate additional criteria. Other tools used include: personal questionnaires and other biographical information, American College Testing (A.C.T.) scores, Scholastic Aptitude Test (S.A.T.) scores, the undergraduate university attended, extracurricular activities of the applicant, personal references or recommendations, personal interviews, and various intelligence and personality test scores (Garza et al, 1976; Morgan, 1974; Swihart, 1974; Weiss, 1970). Each of these commonly used admissions criteria is discussed below.

Grade Point Average

Among the various criteria studied, undergraduate G.P.A. has repeatedly been demonstrated to be the most accurate predictor of academic success (Anderson, Nunn & Sedlacek, 1976; Conger & Fitz, 1963; Drugo & Martin, 1975; French, 1976; Rothman, Byrne, Fruen, Parlow & Steiner, 1974; Thomas, 1977). Taking this one step farther, G.P.A. in science courses has consistently been demonstrated to be an even more reliable predictor of success in both medical school performance (Davis et al, 1976; Hart, 1981; Watson, R.I., 1955) and performance in allied health education programs (Garza et al, 1978; Landen, 1977; Rifkin et al, 1981; Swihart, 1974; Tidd & Conine, 1974). This "performance" which has correlated with the overall G.P.A. or with the science G.P.A., is performance in academic work, however, and not clinical performance, as cited in most studies. Therefore, neither overall G.P.A. nor science G.P.A. has been found to be a conclusive and consistent predictor of clinical performance in either medicine or the allied health fields (Bailey, Jantzen & Dunteman, 1969; Herman & Veloski, 1981; Hobfoll & Benor, 1981; Korman, Stubblefield & Martin, 1968; Murden, Galloway, Reid & Collwill, 1978; Rifkin et al, 1981, Tidd & Conine, 1974).

Concerns regarding the use of G.P.A.

Various concerns have been expressed in the literature regarding the strong influence G.P.A.'s seem to have in student selection procedures. These concerns lie chiefly in the areas of course weighting for selection purposes, undergraduate college selectivity, undergraduate college majors, and differing grading scales in various undergraduate institutions. These concerns seem to be warranted.

Undergraduate G.P.A. and major field of study

Studies have consistently cited undergraduate science G.P.A. as a valuable predictor of success in medical school. However, it has been noted that of the applicants to medical school, over 50% have had an undergraduate science major while only 1 in 17 has majored in the behavioral sciences (Stokes & Martin, 1983). It has been hypothesized that this could be a circular mechanism due to the importance medical schools place on the sciences (Gough, 1978; Zeleznik, Hojat & Veloski, 1983).

However, Yens and Stimmel (1982) found no difference in performance in medical school based on undergraduate science versus non-science majors. It has also been questioned whether some quite capable candidates - candidates who may bring a different kind of variety or talent to the professions, are being "missed" due to the heavy emphasis on science (Dawson-Saunders & Doolen, 1981; Gough, 1978; Herman & Veloski, 1981; Korman et al, 1968; McBride, 1980).

Grading Practices

The question then arises as to whether the heavy emphasis medical schools place on sciences or the grading practices used in the colleges reflect the reason for student choice of undergraduate majors. Hills (1964) hypothesized that grading standards of colleges vary, depending on the academic potential of the presently enrolled student body. A later study confirmed this hypothesis (Hills & Gladney, 1968). More recently, Sarnacki (1982) also raised this question.

Goldman, Schmidt, Hewitt and Fisher (1974) hypothesized that the perception of grading standards in different major fields could influence the student's choice of major field of study. It was felt that adaptation theory might predict that the ability level of the student population at a specific time would determine the grading standards for that group. Their findings indicated that for students at the lower and middle ability levels, adaptation theory held true; it appeared that easier grading standards were used for fields with the students of lowest ability. This relationship, however, did not hold true for students ranking in what was defined as the highest ability level (G.P.A. above

3.30 on a 4.0 scale). Therefore, Goldman, Schmidt, Hewitt and Fisher concluded that: (1) grading standards are not consistently utilized for all ability levels; (2) lower ability students are expected to perform lower, especially in science fields, and (3) that the grades given in different major fields have different values attached to them, which may affect the major field choice or career choice of the student (Goldman & Hewitt, 1976).

It has also been noted that not only do fields of study and student ability levels affect choice of major field of study by students, but course selection by students is affected by the grading standards in those courses. Creditor and Creditor (1982) found that although premedical students, the majority of whom were science majors, enrolled in more science courses than non-science majors, the non-science courses in which they enrolled were more likely to be "easier" non-science courses. They then surmised that the course selection of premedical students seemed to be made on the basis of grading standards and the competition for medical school admission. McCurdy (1982) similarly found an all-too-important emphasis on grades as opposed to substance or content of learning.

Undergraduate G.P.A. and College Selectivity

Another factor which appears to affect undergraduate G.P.A. has been termed the undergraduate "college selectivity" by several authors (Clapp & Reid, 1976; Golmon, 1982; Sarnacki, 1982).

In 1960, Hill and Heck questioned whether or not a better definition of the standards used for grading in undergraduate institutions would assist in more effective selection procedures for medical students. It was felt that the grading scales of the undergraduate institutions could be adjusted based upon the performance of present medical students who had attended each of the various undergraduate colleges. This would allow a reasonably reliable comparison of applicants. It was then concluded that such a system could be utilized in identifying weak students, but cautioned that students from a particular undergraduate school should not be ruled out as potentially successful just because the institution had weaker grading scales than other schools.

More recently, Sarnacki (1982) considered the same question, hypothesizing that the large variations seen in undergraduate college G.P.A.'s could be due to differences in grading standards rather than due to differences in individual academic ability. A comparison was made between M.C.A.T. scores, a reliable predictor of success in medical schools, and an adjusted G.P.A. based on college selectivity as determined through the classifications noted in Barron's College Admissions Selector. (Barron's uses median entrance examination scores of the S.A.T. and A.C.T. to report the status of students to whom the college offered acceptance. Presently, six categories of undergraduate institutions exist.) Sarnacki found that the undergraduate G.P.A. did not significantly correlate with the M.C.A.T. scores, which are considered to be a much more reliable predictor, and thus casting doubt as to the predictive ability of the undergraduate G.P.A. It was therefore recommended that undergraduate G.P.A. not be used in its raw form when considering this as a factor in medical school admissions. Rather, the source, i.e. college selectivity, and the G.P.A. should be weighted and considered together. The concept of either using college selectivity or an adjusted G.P.A. with a weighted system of admissions has been supported by other investigators (Clapp & Reid, 1976; Conger & Fitz, 1963; Garza et al, 1978; Gordon & Lincoln, 1976; McBride, 1980; Rhoads & Gallemore, 1974; Rippey, 1981; Stronck, 1979; Weiss, 1970).

It is seen more and more in the literature and in admissions policies of medical schools and other professional schools that undergraduate college selectivity is being considered as a factor in the evaluation of an applicant's potential for success (Conger & Fitz, 1963; Golmon, 1982; Tucker & McGaghie, 1982; Watson, 1973; Wergin, 1981; Yens & Stimmel, 1982.) For example, Northwestern University revises its rating of undergraduate institutions every two years based upon the performance of the enrolled medical students for the previous two years. A comparison is made considering the rating of the undergraduate institution in Barron's College Admissions Selector and performance scores for classes taken during the first two years of medical school at Northwestern. This is also compared to the student's entering M.C.A.T. scores. Although this information is not a deciding factor in an applicant's medical school acceptance or rejection, it does supply the Admissions Committee with added information about the way students attending Northwestern University Medical School with a background at an applicant's undergraduate institution are performing in the Northwestern setting (Golmon, 1983).

Interviews

Since the goal of admissions procedures is to admit the students who are not only the most capable of completing the selecting program, but to admit the students who will perform capably as professionals and contribute to their respective fields, the personal interview is an often used tool (Blaisdell & Gordon, 1979; Conger & Fitz, 1963; Dube & Johnson, 1975; Gough et al, 1963; Johnson, Pinkston, & DiStefano, 1971; Mehta, 1978; Rippey, 1981; Seymour et al, 1982; Thomas, 1977; University of Kentucky, 1981). The personal interview, however, by its nature poses some very real problems for admissions committees. For one thing, it is very subjective (Blaisdell & Gordon, 1979). Secondly, it becomes quite difficult for an interviewer to "judge" personal qualities, and to later weigh those qualities against academic achievement (James, 1980). It is also time-consuming for faculty involved in the admissions process (Funkenstein, 1970; Swihart, 1974) and can be influenced by halo effects or qualities the individual interviewer prefers (Gordon & Lincoln, 1976). To decrease some of these problems, the Georgia Program in Physical Therapy videotapes all interviews of applicants to the program, and then has the interview scored by more than one faculty member (May, 1982). This has provided more consistency among the interviewers, but again proves to be very time-consuming and expensive (Murden et al, 1978; Schofield & Garrard, 1975).

Personality and Intelligence Tests

Although personality and intellignence test scores have not been used routinely in admissions procedures as a selection tool, such instruments have been widely used in research situations to determine if any correlation exists between the instruments and success in medical school or allied health educational endeavors and subsequent success in clinical or on-the-job endeavors. The Myers-Briggs Type Indicator and the Strong Vocational Interest Blank have been the most widely used tools (Bailey, 1969; Blaisdell & Gordon, 1979; Crowder, 1959; Garza et al, 1976; Johnson, Pinkston & DiStefano, 1971; Rezler & French, 1975; Swihart, 1974). Other tools used include the Bell Adjustment Inventory, the Kuder Preference Record, the Omnibus Personality Scoring, the Sixteen Personality Factor Questionnaire, the California Personality Inventory, the Adjective Check List, the Gordon Personal Inventory and the Edwards Personal Preference Schedule (Drugo & Martin, 1975; Garza et al, 1976; Gough & Hall, 1975; Johnson, Pinkston, & DiStefano, 1971; Johnson, Pinkston & McIntyre, 1971; Morgan, 1974; Swihart, 1974).

Unfortunately, although these have inconsistently been found to correlate with various personality types in different fields, none of the correlations has been very high, and the samples have been small. Furthermore, none has been shown to be as effective as G.P.A. in predicting academic performance (Lander, 1977; Watson, R.I., 1955). The usefulness of instruments such as these needs considerably more study.

Admissions in Programs of Allied Health

Although most of the literature refers to the admissions procedures utilized for selection of medical students, there has been some research done regarding admission to programs in the allied health professions. These have primarily addressed admissions in programs of physical therapy, occupational therapy, and medical technology. The research regarding occupational therapy and physical therapy is addressed.

Occupational Therapy

Undergraduate G.P.A. has been shown to be the most reliable predictor of success in occupational therapy educational programs. However, when clinical competence is used as a variable, the reliability of undergraduate G.P.A. is questionable. In 1965, Anderson and Jantzen found that freshman and sophomore course grades did not predict clinical performance of occupational therapy students even at the 0.05 level of significance. It was suggested that measures other than academic achievement be used to predict clinical performance. Pursuing this further, Bailey, Jantzen and Dunteman (1969) found that not only are academic performance and clinical performance independent of each other and not predictors for each other, but that tests such as the Minnesota Multiphasic Personality Inventory, the Strong Vocational Interest Blank for Women and the Florida Placement Exam were also ineffective predictors of clinical performance.

On the other hand, Holmstrom (1975) found that the majority of students aspiring to careers in therapy performed well in academic achievement variables. In also considering academic achievement, Maynard, Bilkey and Hyre (1972) classified grades as either an aspect of academic grades or practical experience grades. In this regard, job performance for occupational therapy assistants was found to be related to practical experience grades at the 0.01 level of significance and to academic grades at the 0.05 level of significance. However, a high intercorrelation (0.61 at the 0.001 level of significance) was found between academic grades and practical experience grades.

Lind (1970) found almost the opposite results when looking at G.P.A. as related to clinical performance in different specialty areas. Lind found that G.P.A. was the best single predictor of clinical performance success in each of the four clinical areas studied: general medicine and surgery, psychiatry, pediatrics, and physical disabilities. However, recent research by Ford (1979) did not support this. Lind, on the basis of the research, recommended that a grade level higher than that recommended by the entire university be required for acceptance into the occupational therapy program. Lind also called for more research into predictive measures due to the many changes occurring in the allied health fields. Thus, it can be seen that although G.P.A. seems to be a viable predictor for success in occupational therapy educational programs, some controversy exists as to its reliability. Furthermore, its usefulness as a tool in predicting clinical performance is under question. Therefore, further study in this area is indicated.

Physical Therapy

Grade point average

The profession of physical therapy has long been interested in defining and refining admission selection procedures and standards. In 1949, the A.P.T.A. sponsored a three-year research program headed by Gobetz (1954a) to examine and evaluate student selection procedures for physical therapy educational programs. It was felt that the professional status of physical therapy would be upgraded through more scientific selection and admission procedures, thus providing physical therapy educational programs with a high caliber student and subsequently providing health care with more effective physical therapists. Gobetz utilized a battery of tests (specific test names were not revealed) and factors of academic achievement and clinical performance. What Gobetz (1954b) found was a striking difference in the ability level of students in the several physical therapy schools, reflecting the fact that the schools differ widely in the selectivity of their admissions policies." (Gobetz, 1954b, p. 429). Gobetz also found a positive but low relationship between academic and clinical performance. Recommendations made by Gobetz (1954c) were that neither didactic average nor the test battery be used as a single predictor, but that the significance of the didactic average should assume more importance to education in physical therapy.

This has been shown to have occurred, for academic average is used as a factor in the admission procedures for most physical therapy schools (Seymour et al, 1982; Trotter & Fordyce, 1975). Since Gobetz's initial study, physical therapy admissions procedures and predictors of success have been the focus of several research investigations.

In 1959, Stockmeyer studied three aspects of academic and clinical grades in physical therapy. The three relationships investigated were: (1) the relationship between pre-professional studies and academic grades; (2) the relationship between academic grades in physical therapy and grades in physical therapy clinical work; and (3) the relationship between job experience and clinical grades. Stockmeyer found that the coefficients of correlation were actually not high enough to be of value in predicting the success of students. The relationship between pre-professional grades and academic grades in physical therapy was non-significant, although the trend was that parallel performances occurred. Academic grades in physical therapy coursework and clinical grades correlated only in a few specific courses, e.g. therapeutic exercise and clinical performance ($r = .45$), anatomy and clinical performance ($r = .39$) and advanced kinesiology and clinical performance ($r = .30$). Stockmeyer also found no significant relationship between clinical performance and previous job experience, or between any specific pre-professional educational background and performance in physical therapy education. Stockmeyer then recommended use of overall academic achievement regardless of field of study for student selection purposes, and a closer look at non-scholastic abilities and their relationship to professional education and performance.

Dewton (1967) also studied the relationship of academic grades to professional performance, but did not separate pre-professional grades from coursework in the professional curricula. The correlation found was low, but Dewton concluded that G.P.A. did have some predictive value for clinical performance.

Still more recently, it has been demonstrated that entering G.P.A. is the best predictor of professional G.P.A. at the University of Pittsburgh. Findings demonstrated that the entering G.P.A. from the first two years of college coursework correlated (r = .69) with the professional coursework G.P.A. (Drugo & Martin, 1975). Similar findings were reported in 1975 (Trotter & Fordyce), 1977 (Landen), and as recently as 1982 (Peat, Woodbury & Donner).

Science grade point average

Some of the research has separated out the science G.P.A. from the overall G.P.A. In 1962, Everett found a significant relationship between physics and specific physical therapy courses (at the 0.01 and 0.05 levels of significance) and between biology and anatomy/physiology. Tidd and Conine (1974) found that academic achievement was the strongest predictor (r = .88) of academic performance in physical therapy education, but that separating out the biological and physical science sciences G.P.A. was also a strong predictor (r = .84). Tidd and Conine thus surmised that since this is more specific than total academic achievement, the G.P.A. in biological and physical sciences may be the best single predictor of academic success in physical therapy education. However, Trotter and Fordyce (1975), also separated out the prerequisite G.P.A. and did not find this predictive. They suggested reinstating the cumulative G.P.A. as a screening item. Thus, at present, the currently available research appears inconclusive.

Non-academic factors

Although various researchers have begun the task of defining the non-academic areas related to the profession of physical therapy and success in the field of physical therapy, no consistent results have been found. Furthermore, a variety of different instruments have been used, so the results tend to vary depending on the instrument used.

Several sources, however, cite problem-solving as a factor which should be used and evaluated in consideration of physical therapy and the evaluation of physical therapy students (Seymour et al, 1982). Furthermore, as the problem-solving curriculum becomes more strongly advocated and used, evaluation of problem-solving skills becomes even more critical for educational programs in physical therapy. As yet, however, the use of problem-solving skills as a criterion for admission into a physical therapy educational program has not been studied, although its study has been recommended (May & Newman, 1980; Miller, S.A., 1977; Yarbrough, 1976).

Questions for research into this matter have long been posed by a number of educators. Ennis (1962) assumed that critical thinking was teachable, yet questioned how instruction should be used. Feely (1969) asked what aspects of critical thinking are treated in instruction and when that occurs in school curricula. Miller, (1977) more specifically related to physical therapy, asked what the prerequisites for a problem-solving curriculum are, and whether or not a student should be rejected from entry into a physical therapy educational program based on problem-solving skills acquired prior to application.

Presently, both the University of Kentucky and Case Western Reserve University require a test of problem-solving skills, the Watson-Glaser Critical Thinking Appraisal (W.G.C.T.A.), as a factor considered in the admissions process for the educational program in physical therapy (Graham, McIntyre, Johnson & Pinkston, 1971; Jaeger, 1983; Johnson, Pinkston & McIntyre, 1971; Seymour et al, 1982; University of Kentucky, 1981). The impact of this criterion, however, has yet to be studied.

Since this instrument offers both a practical and theoretical rationale for assessing admission potential, it is described in detail in the methodology chapter, and its use in research discussed below.

The Watson-Glaser Critical Thinking Appraisal

Use of the W.G.C.T.A. in Research

The W.G.C.T.A. has been suggested to be "the most widely used measure of critical thinking" (Feely, 1976; Landis, 1981), and thus has often been used in research involving the evaluation of critical thinking skills. Ennis (1958) felt that the W.G.C.T.A. "advanced the frontier in the measure of critical thinking skills" (Ennis, 1958, p. 155). and that consistently the items on the test required students to think and examine evidence carefully. Rust (1960) found that of three tests of critical thinking, reliability was found for the W.G.C.T.A. but not for the other two critical thinking tests used. Miller (1969) felt that intercorrelations significant at the 0.01 level indicated that both the Cornell Critical Thinking Test Form X and the W.G.C.T.A. measured aspects of critical thinking. Landis (1981) demonstrated a small but statistically significant correlation between the W.G.C.T.A. and A Test of Critical Thinking.

In recent years, the W.G.C.T.A. has been used in research regarding specific courses and university majors. Simon and Ward (1974) found that in general, the type of major pursued by college students did not relate significantly to critical thinking skills as measured by the W.G.C.T.A., except in the case of subtest 1, Inference, where science students did perform significantly better (0.001 level of significance). Lehman (1963) suggested that changes in critical thinking skills can occur over time after investigating the differences between freshmen and seniors in critical thinking skills using the W.G.C.T.A. Seniors demonstrated a significant improvement in critical thinking skills, but the greatest change was noted to occur in the freshman and sophomore years of college, with the majority of this occurring between the beginning and end of the freshman year.

Similar findings resulted from a study done by Annis and Annis (1979) of impact of philosophy courses on critical thinking. Annis and Annis suggested that prolonged exposure to critical thinking as used in philosophy courses could result in a greater effect on critical thinking skills. This occurred as students progressed from the freshman through the senior year of college. Of all the subtests, both Simon and Ward and Annis and Annis found Inference to be most related to the criteria studied.

W.G.C.T.A. as a selection instrument

The W.G.C.T.A. has also been supported as an instrument to be used for selection purposes. It has been found useful in business in selection of executives (Rose, 1980) and has been demonstrated to be more effective than the Scholastic Aptitude Test for college courses specifically designed to develop critical thinking skills (Wilson & Wagner, 1981). Furthermore, the W.G.C.T.A. has recently been supported in its use in assessing clinical problem-solving skills in allied health, and recommended for study in admissions processes and student selection procedures (Dietrich, 1981).

Learning Styles

Learning style has been defined as "an attribute of an individual which interacts with instructional circumstances in such a way as to produce differential learning achievement as a function of these circumstances" (Tallmadge & Shearer, 1969, p. 222). As an attribute, learning styles should not change during instruction in a program of study, but should remain somewhat constant. Thus, learning styles can be viewed as classificatory constants in understanding other factors related to academic success.

In studying the interactions of learning styles and instructional circumstances, Tallmadge and Shearer found a significant interaction among learner characteristics, subject matter, and instructional methods. This may be an important component to consider in evaluating the success of the problem-solving curriculum. Student learning style may affect student success in the curriculum. Also, in looking to the future of the profession of physical therapy, learning style may affect independent practice and physical therapy education in preparation for such practice.

Unfortunately, the literature related to this area is somewhat inconclusive. Rezler, Mrtek and Guttman (1975) found that pharmacy students with higher grades tend to be introverts and prefer to learn in orderly, planned ways. In looking at students in six allied health professions, it was found that the students preferred concrete, teacher-structured learning experiences which are practice-oriented and concrete rather than abstract (Rezler & French, 1975). Similarly, Olmstead (1973) had found that the science-oriented individual attracted to medicine tended to prefer a dependent learning style.

Along the same vein, Payton, Hueter and McDonald (1975) found that physical therapy students prefer experience for learning, and are not strongly motivated toward independence in activities. It may be concluded that this introvert, who likes activities planned by another and dislikes independence, will have difficulty providing quality patient care once the profession of physical therapy becomes more autonomous and independent in practice. In contrast, however, Brollier (1970) found that when studying occupational therapists and physical therapists, they were found to be capable of analytical problem-solving and "may be more autonomous than they realize" (Brollier, 1970, p. 69). It is not clear what accounts for these contradictory findings and further investigation is warranted.

Literature relating to instructional methods and learning style creates even a hazier picture. Domino (1971) hypothesized that there is an interaction between student achievement orientation and teaching style, which was found to be true. However, no effect was found of teaching style on independent or original thinking. It was concluded that "in order to elicit original thinking, one must begin with students whose achievement orientation is conducive to independent original thinking" (G. Domino, 1971, p. 430).

Tallmadge (1968), in discussing the negative results of a study testing the interaction between training methods and learner characteristics, concluded that interest in the material learned could affect student achievement. Miller (1977) and Andrews (1981) appear to support this concept. Miller concluded that using problem-solving as an instrument of instruction motivates learners since it increases their involvement in the educational process and makes the material more relevant and meaningful. Andrews agreed and stated "Students should learn more and be more satisfied in settings which enable them to interact smoothly and to satisfy important needs." (Andrews, 1981, p. 162).

Critical Thinking as Related to Learning Styles

The literature regarding critical thinking skills and their relationship to personality variables has been inconclusive. Simon and Ward (1974) concluded that performance on tests of critical thinking did not correlate with personality in a consideration of introversion-extroversion. Garrett and Wurf (1979) also felt that personality was not significantly related to critical thinking. Smith, (1979) however, found a strong relationship between variables of learning and critical thinking behaviors. A perfect correlation of 1.00, significant at the 0.001 level was found; the processes related to critical thinking skills were determined to be student participation, encouragement, and peer-to-peer interaction. The behaviors of analysis and synthesis, important in the problem-solving process, were also related to critical thinking skills. Tobin and Capri (1982) also seem to agree that students who integrate information and use complex process skills will improve and use these skills more than other students not involved in exercising these skills.

Grasha-Reichmann Student Learning Style Scales

In 1972, Grasha identified three response styles of students which were later used to develop the six response syles used in the learning style scales. These learning styles were developed around three dimensions of learning: (1) the student's attitude toward learning; (2) the student's view of the instructor and peers; and (3) the student's reaction to classroom procedures. The six response styles used by Reichmann (1972) in developing the Grasha Reichmann Student Learning Style Scales (G.R.S.L.S.S.) are defined in Appendix A.

Summary

Changes in the health care delivery system have prompted changes in the profession of physical therapy, with the profession moving toward independent practice without physician referral. It has been posited that physical therapists must be astute problem-solvers to meet the demands of the future. The problem-solving curriculum has been advocated as a curricular emphasis to help prepare the physical therapists now graduating from educational programs to meet these needs.

Problem-solving has been cited as a current theme of information processing theorists. Concerned with the organization and representation of knowledge, information processing theorists have studied the storage of information and competition for use. Problem-solving skills have been demonstrated to improve with education, and this need in education is supported. A special need has been cited in professional education.

The importance of selective admissions in medicine and allied health educational programs, specifically physical therapy, has been documented. Present policies and tools used, including G.P.A., undergraduate college major, college selectivity, interviews, and non-academic factors have been reviewed. The needs of the future necessitate revisions in admissions policies to better insure capable professionals.

Finally, learning styles and the two instruments used in this study were reviewed. Both the W.G.C.T.A. and the G.R.S.L.S.S. have been used in research studies in order to evaluate critical thinking skills and learning styles.

CHAPTER III

METHOD

As stated in the introduction, this study was divided into two phases to accomplish its aims. The purposes and procedures for each phase will be discussed separately.

There were four objectives in Phase I: (1) determining if there was a relationship between any of the specific prerequisite courses required for admission to the physical therapy educational program and problem-solving skills as demonstrated on the W.G.C.T.A.; (2) determining if there was a relationship between the college selectivity of the undergraduate institution where the prerequisite courses were taken, and the problem-solving skills as demonstrated on the W.G.C.T.A.; (3) determining if there was a relationship between learning styles as demonstrated on the G.R.S.L.S.S. and the problem-solving skills demonstrated on the W.G.C.T.A.; and (4) examining students' perception of problem-solving skills utilized in prerequisite courses through a questionnaire designed and administered by this investigator.

Changes in problem-solving skills were examined in Phase II. The objectives of this phase included: (1) determining if there was a change in problem-solving skills as demonstrated on the W.G.C.T.A. after exposure to the problem-solving curriculum utilized in the Programs in Physical Therapy at Northwestern University Medical School; (2) determining the point in the curriculum, in relationship to specific quarters of coursework, where the greatest change in problem-solving skills occurred; (3) examining the relationship of problem-solving skills to specific coursework, such as physical therapy treatment courses and science courses (e.g. gross anatomy, neuroanatomy, etc.) using grades earned in courses taken in the physical therapy curriculum; and (4) determining if there was a relationship between G.P.A. and problem-solving skills as demonstrated on the W.G.C.T.A.

Hypotheses

The null hypotheses tested in this investigation were as follows:

Phase I

Hypothesis 1

There is no relationship between grades in any of the prerequisite courses required for admission to the physical therapy educational program and problem-solving skills as demonstrated on the W.G.C.T.A.

Hypothesis 2

There is no relationship between the college selectivity of undergraduate institutions where prerequisite courses were taken and problem-solving skills as demonstrated on the W.G.C.T.A.

Hypothesis 3

There is no relationship between learning styles as demonstrated on the G.R.S.L.S.S. and problem-solving skills as demonstrated on the W.G.C.T.A.

Hypothesis 4

There is no relationship between undergraduate college major and problem-solving skills as demonstrated on the W.G.C.T.A.

Phase II

Hypothesis 5

There is no relationship between problem-solving skills as demonstrated on the W.G.C.T.A. and involvement as a student in the problem-solving curriculum in physical therapy.

Hypothesis 6

There is no relationship between grades in physical therapy coursework and problem-solving skills as demonstrated on the W.G.C.T.A.

Hypothesis 7

There is no relationship between G.P.A. and problem-solving skills as demonstrated on the W.G.C.T.A.

Hypothesis 8

There is no relationship between learning styles as demonstrated on the G.R.S.L.S.S. and success in a problem-solving curriculum as demonstrated by G.P.A.

Instrumentation

The Watson-Glaser Critical Thinking Appraisal

The W.G.C.T.A. defines critical thinking as

> a composite of attitudes, knowledge, and skills.... (which include): (1) attitudes of inquiry that involve an ability to recognize the existence of problems and an acceptance of the general need for evidence in support of what is asserted to be true; (2) knowledge of the nature of valid inferences, abstractions, and generalizations in which the weight or accuracy of different kinds of evidence are logically determined; and (3) skills in employing and applying the above definitions and knowledge. (Watson & Glaser, 1980, p. 1)

Five subtests, each of which tests a different aspect of critical thinking as defined, are used to determine a raw score of critical thinking ability. Each subtest consists of sixteen items, which together give a composite score. This composite score can be compared to the various standards as stated in the manual in order to determine a percentile rank for the subjects. A description of each of the five subtests is included in Appendix B.

The test is easily administered; it can be given in a forty-minute timed period. It can be hand-scored with a scoring key, or machine-scored by The Psychological Corporation (Watson & Glaser, 1980).

Split-half reliability coefficients for Form A for groups of subjects vary from the lowest of 0.69 for ninth-grade students, to a high of 0.85 for third-year medical students at a university in the West. The test-retest reliability measured over three month intervals showed a correlation of 0.73, which the authors feel demonstrates reasonable stability over time.

The validity of the W.G.C.T.A. has been established by a number of investigators since 1966. The instrument has also been shown to correlate with various other measures of intelligence, achievement, and G.P.A.'s, both cumulative and course-specific. For a more in-depth review of the statistical information regarding these studies, reference to the manual would be helpful. The authors do suggest that this instrument is "a potentially useful tool for the selection of candidates for positions where careful, analytical reasoning is an important part of the job." (Watson & Glaser, 1980, p. 9).

Grasha-Reichmann Student Learning Style Scales

In 1972, Grasha identified three response styles of students which were later used to develop the six response sytles used in the learning style scales. These learning styles were developed around three dimensions of learning: (1) the student's attitude toward learning; (2) the student's view of the instructor and peers; and (3) the student's reaction to classroom procedures. The six response styles used by Reichmann (1972) in developing the Grasha-Reichmann Student Learning Style Scales are defined in Appendix B.

Reichmann (1972) found the reliability of the scales too low for the scales to be used as a diagnostic instrument, so suggested the scales be used for research purposes only. A rational process was used and the scales were revised in 1974 (Reichmann).

Presently, (Hruska (Reichmann) & Grasha, 1981) the scales consist of ninety items with each of the six learning styles having a corresponding fifteen items. A five-point scale is used, ranging from "strongly agree" to "strongly disagree" for each statement. Test-retest reliability, with a seven day interval between tests, correlates from a low of 0.76 for the Dependent scale to a high of 0.83 for the Independent scale. The scales have not been found to show any significant correlation to grades, as measures of success in a program. An interesting focus of investigation will be to examine whether or not learning style has any relationship to problem-solving skills or success within a problem-solving curriculum.

Procedures

Subjects

The subjects for this investigation were the entire 1982-1983 class of 81 students enrolled in the baccalaureate Programs in Physical Therapy at Northwestern University Medical School. Although three students withdrew from the program prior to completion of this study, informed consent had been obtained for use of data in Phase I of this investigation.

This population was selected in order to utilize the research findings for changes in admission procedures and curricular evaluation and revision for the Northwestern University Programs in Physical Therapy. The permission of the Program Director and support of the Admissions Committee was obtained.

The population ranged in age from 18 to 52, with 18 males and 63 females. Thirty-four of the students were admitted without having earned a bachelors degree from previously attended institutions. Forty-three had earned a bachelors degree, and four were admitted with a master's degree.

Gender, age and other biographical information regarding each subject was not obtained. It was felt that this information would assist in the identification of individual subjects, and therefore violate the right to confidentiality. In addition, none of these variables can be legally used for admission criteria and therefore are of no substative interest in this investigation.

Setting

Data was collected at the Northwestern University Programs in Physical Therapy on the thirteenth floor of the Rehabilitation Institute of Chicago., where the subjects were enrolled during the time of this investigation. The entire sample of subjects were involved in the problem-solving curriculum and all took the same courses at the same time with the same instructors. Only practical experience laboratory sessions were scheduled at differing times to accomodate all students in small groups; content was the same for all laboratory groups.

Phase I

The study was explained to the 1982-1983 class of physical therapy students as potential subjects. Informed consent and permission to use academic records was obtained at that time. The chairperson of the Programs in Physical Therapy Research Committee was present for the explanation of the research, and served as witness for the informed consent. A copy of the informed consent was given to each subject. (See Appendix C.) In addition, the chairperson of the Research Committee assigned random numbers and maintained the identifying list until completion of the study.

The W.G.C.T.A. was administered to the subjects on the first day of classes in the Programs in Physical Therapy, prior to the initiation of classwork in the problem-solving curriculum. Form A of the W.G.C.T.A. was used for both Phase I and Phase II of this investigation. The test was administered by this investigator. A timed administration of forty minutes was used to facilitate ease of scheduling for the Programs in Physical Therapy, i.e. one class period was used. Exact scheduling times during the day were not determined by this investigator, but were determined by the scheduling coordinator to fit in with the physical therapy class schedule. The test was given during the first or second day of the first week of each quarter for Phase II of the study (e.g. Fall, Winter, and Spring Quarters). That week follows a break between quarters, and was used to evaluate the changes in problem-solving skills which may have occurred in the previous quarter. Following administration, the W.G.C.T.A. was hand-scored by this investigator.

Transcripts of prerequisite coursework from each subject's entering academic records were systematically evaluated by this investigator. Prerequisite coursework utilized in this investigation were only those courses presently required for admission to the Northwestern University Programs in Physical Therapy, as defined by the Admissions Committee. These prerequisites include: Physiology, Biology, Chemistry, English, Physics, and Psychology.

Prerequisite course grades were taken from the entering transcripts included with other application materials and used for admissions selection purposes. Coursework data was selected in sequential (i.e. chronological) order as the coursework was undertaken by the students, regardless of the institution or time when the coursework was done. Only the coursework necessary to complete the minimum academic requirements was used, so that all subjects had equal numbers of credit hours and courses used. This also insured objectivity in data collection. Course grades were recorded and utilized on the following scale: A = 4 points; B = 3 points; C = 2 points; D = 1 point, and F = 0 points. All plus (+) or minus (-) grades were excluded; only the letter grade was recorded. Laboratory grades were not recorded separately, but were included with lecture credit hours, and the lecture grade was utilized to represent both.

College selectivity for each course taken was based on selectivity as recorded in Barron's College Guide, from the institutions listed as most competitive being ranked as "1" to the institutions listed as least competitive being ranked as "6". The college selectivity of Junior Colleges was ranked as "7".

A questionnaire designed by this investigator was distributed to the subjects to ascertain the subjects' perception of problem-solving skills required or used in prerequisite courses, and the relationship to the grades received in those courses. (See Appendix D for details.) This assisted in determining if there was any correlation between the students perception of the problem-solving skills in the prerequisite courses, the grades received in those courses, and problem-solving skills as demonstrated on the W.G.C.T.A., although this was not one of the major intents of this investigation. This correlation was made with the W.G.C.T.A. baseline established at the beginning of coursework in the Programs in Physical Therapy, prior to involvement in the problem-solving curriculum used for the professional education.

Finally, results of the Grasha-Reichmann Student Learning Style Scales were obtained. This had been administered to the subjects at the beginning of their studies in the Programs in Physical Therapy by another faculty member. Permission was obtained to utilize that data so the subjects would not have to complete another instrument. The chairperson of the Programs in Physical Therapy Research Committee had replaced the student names with the random numbers which were assigned for the purposes of this investigation. This insured the confidentiality of the subjects involved in this study.

Phase II

The subjects were divided into stratified random samples, N1, N2, and N3, based upon the baseline scores established for each subject on the W.G.C.T.A. taken during Phase I upon entrance to the Programs in Physical Therapy. The W.G.C.T.A. was then administered at the beginning of successive quarters to each subsample. The first subsample, N1, was tested at the beginning of Quarter 2 (Fall Quarter) to evaluate Quarter 1 (Summer Quarter); the second subsample, N2, was tested at the beginning of Quarter 3 (Winter Quarter) to assess Quarter 2; the third subsample, N3, was tested at the beginning of Quarter 4 (Spring Quarter) to assess Quarter 3.

Course grades and corresponding quarterly G.P.A. for each subsample N (e.g. N1, Fall Quarter) were obtained. Grades in the coursework undertaken during the professional education program in the Programs in Physical Therapy were obtained from the subject's academic records at Northwestern University Medical School. A scale equal to that used for recording grades in prerequisite coursework (e.g. A = 4, etc.) was used.

Design and Statistical Analysis

Multivariate statistical analyses with a 0.05 level of significance were used to analyze the data. Multiple regression procedures, both stepwise forward and backward elimination, were used to analyze prerequisite course grades and college selectivities in regard to problem-solving skills and changes in problem-solving skills. Regression procedures were also used to determine relationships between grades obtained in courses in the physical therapy educational program and both problem-solving skills and the changes in problem-solving skills. The relationships between undergraduate college majors and learning styles with problem-solving skills and changes in problem-solving skills were analyzed with multiple regression techniques, as were the relationships between course grades and learning styles.

Canonical correlation was used to determine the relationships between sets of variables. These included W.G.C.T.A. subtests and prerequisite courses; W.G.C.T.A. subtests and quarter courses, and W.G.C.T.A. subtests and learning styles. Also determined were relationships between prerequisite course grades/college selectivities and undergraduate majors and learning styles.

CHAPTER IV

RESULTS

Results Pertaining to Entering Characteristics

Grades, Colleges and Entering Problem-Solving Skills

Multiple regression analyses between prerequisite course grades and problem-solving skills revealed that none of the prerequisite courses (i.e. Physiology, Biology, Chemistry, English, Physics, Psychology) was a significant contributor to the variability of problem-solving skills found in the prediction equation. The prediction equation was not found to be significant in either the stepwise forward or backward elimination regression analyses. When all the prerequisite course grades were entered into the prediction equation for the backward elimination analysis, only 2.32% of the 15.2% variability of the prediction equation was accounted for, and this finding was non-significant, at the 0.47 level (Table 1).[1] Furthermore, the Beta weights demonstrate the importance of each prerequisite course grade as fairly equal in contribution to the prediction equation. None appears very important to the prediction equation, although the Beta weight for Physics shows it to be slightly more important in the prediction equation.

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[1]Note: Abbreviations are used in all Tables. A glossary of abbreviations appears in Appendix F.

When the prerequisite course college selectivity and the prerequisite course grade were combined as equal variables, multiple regression results still did not show this score to be related to problem-solving skills scores on the W.G.C.T.A. Backward elimination (Table 20*)[2] found that the prediction equation accounted for only 15.4% of the variability in problem-solving skills scores, and only 2.37% was accounted for by the combination of all the prerequisite courses and their corresponding college selectivity. This finding was non-significant, at the 0.46 level. Again, the Beta weights were close for each grade/college selectivity variable, although the Chemistry grade/college selectivity Beta weight was the greatest, followed by English. When the backward elimination was completed (Table 21*) neither of these course grade/college selectivity variables was removed from the equation.

Canonical correlation procedures between the prerequisite course grades and corresponding college selectivity and the five subtests of the W.G.C.T.A. showed no canonical correlation at the 0.05 level of significance. The first non-significant canonical correlation found the Chemistry grade/college selectivity and subtest 2, of the W.G.C.T.A. as playing important roles in the variate (Table 22*).

Pearson correlation coefficients did not show any of the prerequisite course grades or the grade/college selectivity combinations as being related to entering problem-solving skills at the 0.05 level of significance (Table 2). The most significant correlations were the

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[2]Note: Due to the number of Tables included in this manuscript, tables noted by an "*" can be found in Appendix G.

Physics grade/college selectivity combination, significant at the 0.068 level, and the Chemistry grade/college selectivity combination, found to be significant at the 0.069 level.

Grades, Colleges and Changes in Problem-Solving Skills

Multiple regression analyses were then used to evaluate prerequisite course grades and college selectivity with the changes in problem-solving skills which occurred during the subjects' involvement in the problem-solving curriculum. Stepwise forward regression analysis between the prerequisite course grades alone and the changes in problem-solving skills found no one course grade as being significantly related to the changes in problem-solving skills. Furthermore, a non-significant finding in the backward elimination analysis (0.86 level of significance) found the combination of all the prerequisite course grades accounting for only 1% of the 10.2% variability in problem-solving skills change scores explained by the prediction equation (Table 23*). In addition, the Beta weights show the consistent lack of importance of these variables to the prediction equation.

When the corresponding college selectivity was entered into the equation, however, significant results were seen (Tables 3 and 4). Stepwise forward regression analysis found the prediction equation to account for 26.5% of the variability in the problem-solving skills change scores, and that the Physics grade/college selectivity combination accounted for 7.0% of this explained variance. This finding was significant at the 0.016 level.

Backward elimination regression supported this finding. Although not significant (0.146 level), the results of the backward elimination analysis indicated that the grades and corresponding college selectivity of the six prerequisite course areas accounted for approximately one-third (11.7%) of the 34.3% variability explained by the prediction equation (Table 5). The Beta weights for this equation indicate the Physics grade/college selectivity combination to be considerably more important to the prediction equation than any of the other course areas and corresponding college selectivities.

It was not until Step 8 of the backward elimination regression that significant results were seen (Table 6). It was found that the combination of Chemistry and Psychology grades and corresponding college selectivity accounted for only 0.1% of the variability of the prediction equation, significant at the 0.049 level. The Beta weight for the Physics grade/college selectivity variable (Beta = -0.42116) demonstrated the importance of this variable to the prediction equation.

Step 9 (Table 24*) demonstrated that the addition of the English grade/college selectivity only accounted for less than an additional 0.1% of the variability of the prediction equation. Step 10 (Tables 25* and 26*) showed that the combination of all the prerequisite course grades/college selectivities except Physics and Physiology accounted for only 1.3% of the variability of the prediction equation explained when all six of the course grades/college selectivities were entered into the prediction equation. The Beta weights consistently demonstrated importance of the Physics and Physiology grades/college selectivities. These two course grade/college selectivity combinations were not removed from the prediction equation in the backward elimination regression.

Canonical correlation analysis between prerequisite course grades and undergraduate college major showed no significant relationship between these sets of variables. No significant canonical correlation was found at the 0.05 level of significance. The first non-significant canonical correlation at the 0.163 level of significance (Table 27*), demonstrated Physiology and Natural Science Major as relatively important contributors to the variate.

Undergraduate College Majors

Multiple regression procedures between undergraduate college majors and entering problem-solving skills scores on the W.G.C.T.A. showed no significant relationship between major and problem-solving skills. Backward elimination regression (Table 28*) analysis, in a non-significant prediction equation (0.809 level) found that college majors contributed, at most, only 2% to the variability of the prediction equation. Beta weights for each major showed that undergraduate college major was a relatively unimportant factor in the prediction equation. Pearson correlation coefficients (Table 29*) supported the lack of relationship between college major and problem-solving skills scores.

Multiple regression analyses between undergraduate college major and the changes in problem-solving skills scores on the W.G.C.T.A. similarly did not find any significant relationships. Backward elimination regression found the prediction equation to account for 30.2% of the variability of the changes in problem-solving skills scores (Table 30*). Significant at the 0.117 level, the combination of the types of undergraduate majors accounted for 9.1% of the variability of the prediction equation. The Beta weights, although not high, demonstrated that undergraduate majors in Education and Science contributed the most to this prediction equation.

Step 5 of the backward elimination regression analysis presented an illustration of the relative importance of Natural Science majors and Other majors to the prediction equation (Table 31*). When these variables were removed from the prediction equation, it was found that the combination of majors in Education, the Social Sciences, and Physical Therapy or Pre-Physical Therapy accounted for only 0.2% of the 30.2% variability explained by the prediction equation, significant at the 0.066 level. Pearson correlation coefficients (Table 32*) supported this finding. The most significantly related majors to problem-solving skills change scores on the W.G.C.T.A. were Other majors (0.043 level of significance) and Natural Science majors (0.073 level of significance). However, Pearson correlation coefficients also demonstrated a lack of relationship between undergraduate college major and success in the problem-solving curriculum as measured by quarterly G.P.A.'s.

Learning Styles

Multiple regression was then done to determine if a relationship exists between entering problem-solving skills and learning styles. Backward elimination regression (Table 33*) revealed that in effect, no relationship existed between problem-solving skills and learning styles (significance of F = 0.9799). Supporting this finding, no significant canonical correlation was found between learning styles and problem-solving skills. The first non-significant canonical correlation, at the 0.292 level of significance, demonstrated important roles in the variate to be played by the Collaborative learning style and W.G.C.T.A. subtest 1 (Table 34*).

Results of canonical correlation did indicate, however, that a significant relationship did exist between undergraduate college major and type of learning style. Two canonical correlations were found below the 0.05 level of significance (Table 7). The first canonical variate was significant at the 0.000 level, and demonstrated the Competitive learning style and Natural Science majors to play important roles in the variate. The second significant canonical variate indicated that the Independent learning style and Physical Therapy majors played important roles in the variate. This canonical correlation was significant at the 0.028 level of significance.

TABLE 1

PROBLEM-SOLVING SKILLS AND PREREQUISITE GRADES

BACKWARD ELIMINATION REGRESSION

Dependent Variable: WGCTA BTOT

Variables Entered on Step Number 1: PSYCH G
2: PHYSIO G
3: BIO G
4: CHEM G
5: ENG G
6: PHCS G

REGRESSION COEFFICIENTS

Multiple R 0.15236 R Square 0.02321

ANALYSIS OF VARIANCE

	DF	Sum of Squares	Mean Square
Regression	6	4051.47503	675.24584
Residual	236	70476.52497	722.35816

F = 0.93478 Significance of F = 0.4707

VARIABLES IN THE EQUATION

Variable	Beta	SE Beta	T	Sig T
PSYCH G/CS	-0.14464	0.11426	-1.266	0.2068
PHYSIO G/CS	0.06023	0.06467	0.931	0.3526
BIO G/CS	0.04396	0.08432	0.521	0.6027
CHEM G/CS	-0.09376	0.09484	-0.989	0.3239
ENG G/CS	0.10342	0.10250	1.009	0.3140
PHCS G/CS	0.15550	0.10430	1.491	0.1373
(Constant)			3.918	0.0001

TABLE 2

PREREQUISITE GRADES, COLLEGES AND PROBLEM-SOLVING SKILLS

PEARSON CORRELATION COEFFICIENTS

Variable Pair	Correlation Coefficient	Significance
PHYSIO; WGCTA BTOT	0.0595	0.299
BIO; WGCTA BTOT	0.0994	0.189
CHEM; WGCTA BTOT	-0.0741	0.255
ENG; WGCTA BTOT	0.0883	0.217
PHCS; WGCTA BTOT	0.0718	0.262
PSYCH; WGCTA BTOT	0.1064	0.172
PHYSIO G/CS; WGCTA BTOT	0.0634	0.287
BIO G/CS; WGCTA BTOT	-0.0798	0.239
CHEM G/CS; WGCTA BTOT	-0.1665	0.069
ENG G/CS; WGCTA BTOT	0.0412	0.357
PHCS G/CS; WGCTA BTOT	-0.1669	0.068
PSYCH G/CS; WGCTA BTOT	0.0585	0.302

TABLE 3

PROBLEM-SOLVING SKILLS CHANGES AND GRADES, COLLEGES

STEPWISE FORWARD REGRESSION

Dependent Variable: WGCTA CHNG

Variable Entered on Step Number 1: PHCS G/CS

REGRESSION COEFFICIENTS

Multiple R 0.26590 R Square 0.07070

ANALYSIS OF VARIANCE

	DF	Sum of Squares	Mean Square
Regression	1	3494.36990	3494.36990
Residual	79	45930.76590	581.40210

F = 6.01025 Significance of F = 0.0164

VARIABLES IN THE EQUATION

Variable	Beta	SE Beta	T	Sig T
PHCS G/CS	-0.26590	0.10846	-2.452	0.0164
(Constant)			0.167	0.8677

TABLE 4

PROBLEM-SOLVING SKILLS CHANGES AND GRADES, COLLEGES

STEPWISE FORWARD REGRESSION

Dependent Variable: WGCTA CHNG

VARIABLES NOT IN THE EQUATION

Variable	T	Sig T
PHYSIO G/CS	1.797	0.0762
BIO G/CS	1.695	0.0940
CHEM G/CS	0.645	0.5208
ENG G/CS	1.413	0.1617
PSYCH G/CS	1.207	0.2310

TABLE 5

PROBLEM-SOLVING SKILLS CHANGES AND GRADES, COLLEGES

BACKWARD ELIMINATION REGRESSION

Dependent Variable: WGCTA CHNG

Variables Entered on Step
1: PSYCH G/CS
2: CHEM G/CS
3: PHCS G/CS
4: ENG G/CS
5: BIO G/CS
6: PHYSIO G/CS

REGRESSION COEFFICIENTS

Multiple R 0.34316 R Square 0.11776

ANALYSIS OF VARIANCE

	DF	Sum of Squares	Mean Square
Regression	6	5820.32260	970.05377
Residual	74	43604.81320	589.25423

F = 1.64624 Significance of F = 0.1465

VARIABLES IN THE EQUATION

Variable	Beta	SE Beta	T	Sig T
PSYCH G/CS	-0.06578	0.20064	-0.328	0.7439
CHEM G/CS	0.02562	0.13733	0.187	0.8525
PHCS G/CS	-0.42107	0.15020	-2.803	0.0065
ENG G/CS	0.05731	0.16576	0.346	0.7305
BIO G/CS	0.12191	0.17926	0.680	0.4986
PHYSIO G/CS	0.16256	0.19463	0.835	0.4063
(Constant)			-0.933	0.3540

TABLE 6

PROBLEM-SOLVING SKILLS CHANGES AND GRADES, COLLEGES

BACKWARD ELIMINATION REGRESSION: STEP 8

Dependent Variable: WGCTA CHNG

Variable Removed on Step Number 8: PSYCH G/CS

REGRESSION COEFFICIENTS

Multiple R 0.34101 R Square 0.11628

ANALYSIS OF VARIANCE

	DF	Sum of Squares	Mean Square
Regression	4	43677.38276	1436.84569
Residual	76	43677.75304	574.70728

F = 2.50013 Significance of F = 0 0494

VARIABLES IN THE EQUATION

Variable	Beta	SE Beta	T	Sig T
PHCS G/CS	-0.42116	0.13978	-3.013	0.0035
ENG G/CS	0.03813	0.15226	0.250	0.8029
BIO G/CS	0.12884	0.17396	0.741	0.4612
PHYSIO G/CS	0.12913	0.16190	0.798	0.4276
(Constant)			-1.037	0.3032

VARIABLES NOT IN THE EQUATION

Variable	T	Sig T
CHEM G/CS	0.128	0.8982
PSYCH G/CS	-0.300	0.7648

TABLE 7

LEARNING STYLES AND MAJORS

CANONICAL CORRELATION

Number	Eigenvalue	Canonical Correlation	DF	Significance
1	7.16106	0.40132	30	0.000
2	0.07075	0.16598	20	0.028
3	0.05787	0.24056	12	0.171
4	0.01014	0.10070	6	0.879
5	0.0	0.0	2	1.000

Coefficients for Canonical Variables
First Significant Canonical Correlation

First Set Variables			Second Set Variables		
Variable	Canonical Variate 1	Canonical Variate 2	Variable	Canonical Variate 1	Canonical Variate 2
INDEP	-0.00010	-0.66801	OTHER	1.04309	0.42801
AVOID	0.36348	0.00053	PT	0.67200	-0.73764
COLLAB	-0.44564	-0.21369	NSCI	1.04581	-0.22558
DEPEND	-0.11260	0.55421	SSCI	1.28110	0.58457
COMPET	-0.83743	0.11045	EDUC	0.0	0.0
PARTIC	-0.25762	-0.20230			

Results Pertaining to Summer Quarter: Quarter 1

Statistical analysis of data pertinent to N1 (first quarter of classes, the Summer Quarter) demonstrated a high interrelatedness of courses. Of the four courses undertaken by the subjects that quarter, the grade in one course, Patient Assessment, was consistently related to problem-solving skills scores on the W.G.C.T.A. None of the course grades was related to learning style.

Descriptive Statistics

Descriptive statistics indicated problem-solving skills to be fairly well distributed in the normal distribution. The W.G.C.T.A. scores ranged from a minimum of the first percentile to a maximum of the 99th percentile. The mean was 69.6; the median was 73.0; and the mode was 75.0. However, in this distribution, only 7.4% of the scores were below the 40th percentile ranking, and an equal 7.4% were in the 99th percentile; the other 85.2% ranged between the 40th and the 99th percentiles, presenting a curve skewed to the right. If the outliers (i.e. those below the 40th percentile) are not considered, then the range becomes the 40th to the 99th percentiles; the mean becomes 80.0; the median becomes 80.0; and the mode becomes 85.0 (Table 35*).

The course grades, however, were not all as fairly well-distributed, as can be seen in Tables 36*, 37*, 38*, 39*. The anatomy courses, Gross Anatomy and Functional Anatomy, had grades which ranged from 1 to 4 (D to A) with Gross Anatomy skewed to the right and Functional Anatomy in a fairly normal distribution. The grades in the other quarter 1 courses, the patient care courses, were less distributed, ranging from 2 to 4 (C to A) with a fairly normal distribution within these grades. The means of all the courses, except Functional Anatomy, were 3.0; the mean of Functional Anatomy was 2.5. The modes of all four courses were 3.00.

Problem-Solving Skills and Grades: Quarter 1

Using the total problem-solving skills score for the first quarter as the dependent variable, a multiple regression analysis was conducted to determine the contribution each course taken during the quarter had to the variability in the problem-solving skills scores on the W.G.C.T.A. Through a stepwise procedure (Table 8), Patient Assessment was found to contribute more to the variability of the prediction equation than any of the other courses taken that quarter. The prediction equation accounted for 54.1% of the variability in the problem-solving skills scores. Of this 54.1%, Patient Assessment was found to contribute 29.3%. Analysis of variance showed this to be significant at the 0.004 level. The Beta weights showed Patient Assessment to contribute heavily to the prediction equation. None of the other three courses appeared to significantly contribute to the variability of the regression prediction equation.

This was also borne out through the backward elimination technique of multiple regression (Tables 9, 40*, 41*, 42*). In backward elimination analyses it was determined that all four Quarter 1 courses together account for only 32.61% of the 57.1% variability accounted for by the prediction equation, as seen in Table 9. The Beta weights show that at this point in the regression procedure, the variable contributing the least to the prediction equation is Functional Anatomy (Beta = -0.4462) and the variable most important in the prediction equation is Patient Assessment (Beta = 0.54312).

This was found to be true, for the first variable removed from the prediction equation on Step 2 of the backward elimination regression was Functional Anatomy. Functional Anatomy was determined to contribute only 0.11% to the variability of the prediction equation. Analysis of variance showed this to be significant at the 0.031 level (Table 40*).

In Table 40*, it can be seen that the equation Beta weights at this point still signified that Patient Assessment continued to be very important in the prediction equation (Beta = 0.52492). The least important variable was Gross Anatomy (Beta = -0.13674), the next variable to be removed from the prediction equation.

Significant at the 0.014 level, Gross Anatomy was then removed from the prediction equation (Table 41*). The combination of Functional Anatomy and Gross Anatomy contributed only 1.6% to the variability of the prediction equation. Once again, the Beta weights supported Patient Assessment as important in the prediction equation (Beta = 0.48926), and Basic Patient Care Skills as much less important to the equation (Beta = 0.13820).

Finally, the Basic Patient Care Skills variable was removed from the prediction equation, this significant at the 0.004 level (Table 42*). Though contributing more to the variability of the prediction equation than either Functional Anatomy or Gross Anatomy, the combination of these three courses accounted for only 3.27% of the variability in the prediction equation.

The variable Patient Assessment was not removed from the prediction equation in the backward elimination regression. As the Beta weights consistently demonstrated, Patient Assessment appeared to be important in this prediction equation and supported its inclusion as the only significant variable in the stepwise regression procedure.

Canonical correlations between the Summer Quarter course grades and the five subtest scores of the W.G.C.T.A. did not reveal a canonical correlation at the 0.050 level of significance (Table 43*). The first non-significant canonical correlation, however, did show that of the set of subtests of the W.G.C.T.A., subtests 2 and 5 were important as non-significant variates. Of the four courses taken that quarter, Patient Assessment appeared to play an important role in that variate also.

Changes in Problem-Solving Skills

Multiple regression between the score difference in problem-solving skills and the Quarter 1 course grades did not reveal any specific course to be related to the problem-solving skill score differences. Moreover, backward elimination showed that the four courses together explained only 4.7% of the 21.7% variability accounted for by the prediction equation. This finding appeared to be essentially a chance occurrence, however, since the analysis of variance revealed the level of significance to be 0.899 (Table 44*). The Beta weights at this point showed Basic Patient Care Skills (Beta = 0.21969) to be the most important of the four courses in the equation, although the equation itself is non-significant.

Course-Course Relationships

Pearson correlation coefficients revealed a strong interrelatedness of courses (Table 10). These demonstrated that Patient Assessment, the course found to be significant in the multiple regression analyses with the problem-solving skills scores correlated with the problem-solving skills score at the 0.002 level of significance. A second course, Basic Patient Care Skills, was also related to problem-solving skills scores at the 0.053 level of significance. It is interesting to see that not only was Patient Assessment also significantly related to each of the other three courses, Gross Anatomy (at the 0.037 level of significance); Functional Anatomy (at the 0.002 level of significance); and Basic Patient Care Skills (at the 0.028 level of significance), but that the two courses with significant Pearson correlation coefficients were patient care courses. The other two courses were anatomy courses. These two anatomy courses, as would be expected, were also significantly related, at the 0.002 level of significance.

Learning Styles

Results of the multiple regression analyses between each of the Summer Quarter courses and the learning styles as defined in the G.R.S.L.S.S., indicated that none of the learning styles was found to be significantly related to any one of the courses (Tables 45*, 46*, 47*, 48*). However, it was interesting to note that in each procedure, the

Participative learning syle was demonstrated as contributing very little to the prediction equation. It was either the first or second of the six learning styles to be eliminated from the prediction equation. For three of the four courses, the Independent learning style was eliminated early with the Participative learning style, and the Avoidant learning style was the last eliminated from the prediction equation.

TABLE 8

PROBLEM-SOLVING SKILLS AND GRADES: QUARTER 1

STEPWISE FORWARD REGRESSION

Dependent Variable: WGCTA 1TOT

Variable Entered on Step Number 1: PTAS

REGRESSION COEFFICIENTS

Multiple R 0.54164 R Square 0.29337

ANALYSIS OF VARIANCE

	DF	Sum of Squares	Mean Square
Regression	1	4370.21356	4370.21356
Residual	24	10526.13260	438.58886

F = 9.96426 Significance of F = 0.0043

VARIABLES IN THE EQUATION

Variable	Beta	SE Beta	T	Sig T
PTAS	0.54164	0.17159	3.157	0.0043
(Constant)			-0.309	0.7602

VARIABLES NOT IN THE EQUATION

Variable	T	Sig T
GANAT	-0.501	0.6213
FANAT	-0.440	0.6639
BPCS	0.738	0.4678

TABLE 9

PROBLEM-SOLVING SKILLS AND GRADES: QUARTER 1

BACKWARD ELIMINATION REGRESSION

Dependent Variable: WGCTA 1TOT

Variables Entered on Step Number 1: BPCS
2: FANAT
3: PTAS
4: GANAT

REGRESSION COEFFICIENTS

Multiple R 0.57105 R Square 0.32610

ANALYSIS OF VARIANCE

	DF	Sum of Squares	Mean Square
Regression	4	48576.85750	1214.42144
Residual	21	10038.66041	478.03145

F = 2.54046 Significance of F = 0.0702

VARIABLES IN THE EQUATION

Variable	Beta	SE Beta	T	Sig T
BPCS	0.17113	0.20032	0.854	0.4026
FANAT	-0.04462	0.24135	-0.185	0.8551
PTAS	0.54312	0.22324	2.433	0.0240
GANAT	-0.11768	0.22343	-0.527	0.6039
(Constant)			-0.706	0.4882

TABLE 10

PEARSON CORRELATIONS: QUARTER 1

Variable Pair	Correlation Coefficient	Significance
GANAT, WGCTA 1TOT	0.1120	0.293
FANAT, WGCTA 1TOT	0.1918	0.169
PTAS, WGCTA 1TOT	0.5240	0.002
BPCS, WGCTA 1TOT	0.3236	0.053
PTAS, GANAT	0.3573	0.037
PTAS, FANAT	0.5411	0.002
PTAS, BPCS	0.3790	0.028
GANAT, FANAT	0.5578	0.002

Results Pertaining to Fall Quarter: Quarter 2

Statistical analysis of data pertinent to the second subsample, the Second Quarter of courses in the curriculum, again showed that only one course grade was significantly related to problem-solving skills. This course, Physiology, was also the only course from which the grades could be plotted on a normal curve.

Descriptive Statistics

Descriptive statistics showed that problem-solving skills for the W.G.C.T.A. were skewed to the right (Table 49*). For this sample, 22% fell below the 40th percentile, with one third of those below the 25th percentile. The range was 1 to 99, the mean was 66.29, the median 71 and the mode was 75. If the outliers (i.e. those below the 25th percentile) are removed, the mean becomes 68.8, with the median and mode remaining the same.

The descriptive statistics for the grades of the six courses taken for this sample and quarter demonstrated no consistency or pattern (Tables 50*, 51*, 52*, 53*, 54*, 55*). Four of the courses had curves very skewed to the right (high grades) (Tables 50*-54*) and four of the course grades (Tables 51*-54*) ranged from 2 to 4 (C to A). Only one course, Physiology (Table 55*) could be plotted on a fairly normal curve.

Grades and Problem-Solving Skills

Using the total problem-solving skill score as the dependent variable, a multiple regression analysis was done with all the courses taken in the second quarter. Stepwise forward regression showed that the regression prediction equation accounted for 53.9% of the variability found in the problem-solving skills scores. Of this 53.9%, 29.1% could be accounted for by grades in Physiology; this was significant at the 0.006 level (Table 11). The Beta weight (0.53959) for this variable in the equation signified its importance to the prediction equation. No other course was determined to be significant in contributing to the variability of the problem-solving skills scores.

Backward elimination regression supported this finding. The prediction equation accounted for 58.6% of the variability of the problem-solving skills scores, and the combination of all the course grades accounted for 34.37% of this variability (Table 12). This was found to be significant at only the 0.242 level, however. In the regression analyses, none of the courses alone was found to be highly significant in its contribution to the variability of the problem-solving skills scores. Not until Step 9 of the elimination procedure (Table 56*) was the combination of Exercise Physiology, Research, and Developmental Basis of Human Performance together found to be significant at the 0.05 level, and accounting for 3.2% of the prediction equation. When the other courses were also removed from the prediction equation, at significant levels: Foundations of the Musculoskeletal System, significant at the 0.023 level (Table 57*) and Pathophysiology, significant at the

0.006 level (Table 58*), it was found that the combination of these courses only accounted for 5.2% of the 58.6% of the explained variance, significant at the 0.006 level.

Canonical correlations between the course grades and the W.G.C.T.A. subtest scores showed that no canonical correlation was found to be significant at the 0.05 level of significance. However, in the first non-significant canonical correlation, at the 0.387 level, Physiology was found to contribute more to the correlation than any of the other five courses. W.G.C.T.A. subtest 2 was found to be significantly more important in the variate than the other four subtests (Table 59*).

Pearson correlation coefficients supported Physiology as related to problem-solving skills scores on the W.G.C.T.A. Physiology was the only course significantly related to the problem-solving skills scores (Table 13).

Pearson correlation coefficients also demonstrated that again the courses taken during the quarter were fairly closely related, centered around two courses. Foundations of the Musculoskeletal System was significantly related to four courses below the 0.05 level of significance: Physiology ($r = 0.022$); Pathophysiology ($r = 0.009$); Developmental Basis of Human Performance ($r = 0.003$); and Research ($r = 0.020$). Physiology was related to Foundations of the Musculoskeletal System, Pathophysiology ($r = 0.000$) and Developmental Basis of Human Performance ($r = 0.022$). Only one course, Exercise Physiology, was found to be not related to any other course.

Changes in Problem-Solving Skills

Multiple regression procedures did not reveal any of the six courses taken during the second quarter to be significantly related to the changes seen in problem-solving skills scores on the W.G.C.T.A. for that quarter. In a highly non-significant prediction equation (0.777 level), it was seen that the prediction equation accounted for 39.7% of the variability of the problem-solving skills difference scores, with the combination of all six courses accounting for 15.7% of this (Table 60*). The Beta weights for this equation showed the fairly equal contribution of each of the six variables to this non-significant prediction equation. Furthermore, at no step in the regression procedure was a significant finding seen (Table 61*), thus demonstrating the lack of relationship between any one of the six courses taken during that quarter and problem-solving skills difference scores.

Learning Styles

Multiple regression procedures done with learning styles and each individual course taken during the second quarter showed only one course to have any significant relationship with learning style. This was Pathophysiology (Table 62*). In stepwise forward regression, the prediction equation accounted for 40.8% of the variability of the grades, and the Participative learning style explained 16.7% of this variability, significant at the 0.034 level. In backward elimination regression analysis (Table 63*), it was found that the combination of all the learning styles was not highly significant (0.318 level). The prediction equation accounted for 52.4% of the variability in the Pathophysiology grades, and the combination of all six learning styles explained only 27.5% of this variability.

Stepwise forward regression analyses with each of the courses taken during this quarter found no significant relationship to learning styles as defined by the G.R.S.L.S.S. Backward elimination regression analyses revealed no specific pattern of learning styles as related to the course grades (Tables 64* 65*, 66*, 67*, 68*, 69*). Each of the six learning styles, except the Avoidant learning style, was seen as the least significant learning style for a different course. The only pattern that could be delineated was that the Participative and the Competitive learning styles were most often (for four courses) seen as neither the least significant nor the most significant learning style, except in the case of Pathophysiology, where the Participative learning style was significant. The other four learning styles were found to be equally distributed at the beginning and the end of the spectrum. In no case except Pathophysiology, however, were any of the learning styles found to be significant.

Canonical correlation supported this lack of pattern of the learning styles. No significant canonical correlation was found at the 0.05 level of significance. The first non-significant canonical correlation, at the 0.978 level, showed the Dependent learning style and the Foundations of the Musculoskeletal System to play the greatest roles in the variate (Table 70*).

TABLE 11

PROBLEM-SOLVING SKILLS AND GRADES: QUARTER 2

STEPWISE FORWARD REGRESSION

Dependent Variable: WGCTA 2TOT

Variable Entered on Step Number 1: PHYSIO

REGRESSION COEFFICIENTS

Multiple R 0.53959 R Square 0.29116

ANALYSIS OF VARIANCE

	DF	Sum of Squares	Mean Square
Regression	1	4569.48986	4569.48986
Residual	22	11124.46847	505.65766

F = 9.03673 Significance of F = 0.0065

VARIABLES IN THE EQUATION

Variable	Beta	SE Beta	T	Sig T
PHYSIO	0.53959	0.17950	3.006	0.0065
(Constant)			1.540	0.1379

VARIABLES NOT IN THE EQUATION

Variable	T	Sig T
PHYSIO	-0.524	0.6061
FMS	0.404	0.6904
EXPHYS	0.266	0.7931
DBHP	-0.369	0.7160
RES	-0.038	0.9701

TABLE 12

PROBLEM-SOLVING SKILLS AND GRADES: QUARTER 2

BACKWARD ELIMINATION REGRESSION

Dependent Variable: WGCTA 2TOT

Variables Entered on Step Number 1: RES
2: DBHP
3: EXPHYS
4: PPHYS
5: PHYSIO
6: FMS

REGRESSION COEFFICIENTS

Multiple R 0.58632 R Square 0.34377

ANALYSIS OF VARIANCE

	DF	Sum of Squares	Mean Square
Regression	6	5395.13194	899.18866
Residual	17	10298.82639	605.81332

F = 1.48427 Significance of F = 0.2422

VARIABLES IN THE EQUATION

Variable	Beta	SE Beta	T	Sig T
RES	-0.09130	0.22250	-0.410	0.6867
DBHP	-0.18378	0.26457	-0.695	0.4967
EXPHYS	0.07618	0.22318	0.341	0.7370
PPHYS	-0.26635	0.30472	-0.874	0.3943
PHYSIO	0.68290	0.28849	2.367	0.0301
FMS	0.27393	0.29030	0.944	0.3586
(Constant)			0.520	0.6100

TABLE 13

PEARSON CORRELATIONS: QUARTER 2

Variable Pair	Correlation Coefficient	Significance
PHYSIO; WGCTA 2TOT	0.5429	0.002
PPHYS; WGCTA 2TOT	0.2957	0.067
FMS; WGCTA 2TOT	0.2909	0.084
EXPHYS; WGCTA 2TOT	-0.0771	0.351
DBHP; WGCTA 2TOT	0.1566	0.218
RES; WGCTA 2TOT	0.0610	0.381
FMS; PHYSIO	0.4144	0.022
FMS; PPHYS	0.4753	0.009
FMS; EXPHYS	0.0000	0.500
FMS; DBHP	0.5500	0.003
FMS; RES	0.4201	0.020
PHYSIO; PPHYS	0.6607	0.000
PHYSIO; EXPHYS	0.0384	0.425
PHYSIO; DBHP	0.3921	0.022
PHYSIO; RES	0.1064	0.306
PPHYS; EXPHYS	0.1702	0.198
PPHYS; DBHP	0.2599	0.095
PPHYS; RES	0.1888	0.173
EXPHYS; DBHP	-0.2107	0.146
EXPHYS; RES	0.1251	0.167
DBHP; RES	0.0668	0.370

Results Pertaining to Winter Quarter: Quarter 3

Statistical analysis of data pertinent to the third subsample (i.e the courses taken during the third quarter in the curriculum) demonstrated no real consistency or pattern in the relationship to problem-solving skills or learning styles. One course was significantly related to problem-solving skills; another course was significantly related to the changes in problem-solving skills; and three different courses were related to learning styles.

Descriptive Statistics

Descriptively, once again, problem-solving skills were distributed in a curve skewed to the right. As seen in Table 71*, the range was from 1 to 99; the mean was 70.69; the median was 74.0; and the mode was a high of 90.0. Only 3.8% of the sample (one subject) was below the 25th percentile and only 7.7% below the 40th percentile. If the one extreme outlier is removed, the mean is raised to 73.5, but the median and mode remain the same.

There were eight courses graded during Quarter 3. Of these eight courses, only three courses had grades ranging from 1 to 4 (D to A). Two of these, Neurophysiology (Table 72*) and Prosthetics-Orthotics (Table 73*) had fairly normal distributions, but skewed to the right. The third course, Medical Lectures (Table 74*), although also skewed to the right, had almost equal distributions for three of the four course grades. Of the remaining five courses, four had grades ranging from 2 to 4 (C to A). Two courses, Neuroanatomy (Table 75*) and Clinical Orthopedics (Table 76*) presented normal distributions, and two courses, Cardiopulmonary Physical Therapy (Table 77*) and Psychology of Disability (Table 78*) presented curves skewed to the right. The last course taken that quarter, Principles of Therapeutic Exercise (Table 79*), had grades equally distributed between B's and A's.

Problem-Solving Skills and Grades

Multiple regression analyses revealed only one of the eight courses as being significantly related to problem-solving skills for Quarter 3. The stepwise regression prediction equation presented in Table 14 accounted for 41.0% of the variability of the problem-solving skills scores. Of this 41%, Neurophysiology accounted for 16.8% of the variability of the scores; significant at the 0.041 level.

Backward elimination regression did not support this finding as it had for Quarter 1 and Quarter 2 courses. In this regression, when all eight courses were entered into the prediction equation (Table 80*), the equation was significant at only the 0.347 level. The prediction equation, although not statistically significant, accounted for 61.6% of the variability of the problem-solving skills scores, with the combination of all eight courses accounting for 37.9% of this 61.6%. The Beta weights at this point indicated that Neurophysiology (Beta = 0.42081) was a significant contributor to the prediction equation, followed in importance by Clinical Orthopedics (Beta = 0.35991).

It was not until Step 15 of the regression procedure was reached that a result significant at the 0.05 level of significance was found (Table 81*). At this point, the combination of all seven courses only accounted for 21.6% of the variability of the prediction equation. At that time, however, the course remaining in the prediction equation was not Neurophysiology as in the forward inclusion regression, but Clinical Orthopedics, which was not found to be significant in the stepwise forward procedure.

Canonical correlation between the course grades and the subtests on the W.G.C.T.A. revealed that no significant canonical correlation was found at the 0.05 level of significance. The first non-significant canonical correlation revealed that of the eight courses taken during Quarter 3, Neurophysiology and subtest 5, were the most important contributors to the variate (Table 82*).

Changes in Problem-Solving Skills

Multiple regression procedures between the changes in problem-solving skills scores with regard to the course grades earned during this quarter revealed only one course to be related to the changes in problem-solving skills. The stepwise forward regression analysis (Table 15) showed that the regression prediction equation accounted for 40.4% of the variability of the change scores, significant at the 0.044 level. Of this 40.4%, Psychology of Disability was determined to account for 16.3% of the variability. The Beta weight for Psychology of Disability in this regression prediction equation was -0.40490, demonstrating the importance of this variable to the prediction equation.

This finding was supported by the backward elimination regression. In this regression, when all the course grades were entered into the prediction equation, the prediction equation accounted for 58.7% of the variability of the problem-solving skills difference scores (Table 83*).

Of this 58.7%, the combination of all eight of the courses taken during Quarter 3 accounted for 34.5%. This finding, however, was non-significant (0.438 level). The Beta weights for this prediction equation illustrated the importance of Psychology of Disability (Beta = -0.55910) to this prediction equation.

It was not until Step 15 (Table 84*) of the backward elimination regression procedure when all the course grades except Psychology of Disability were removed from the prediction equation, that a significant result was seen. The prediction equation at this point, with only Psychology of Disability in the equation, accounted for 16.39% of the explained variance. Therefore, the combination of all the courses except Psychology of Disability accounted for 18.1% of the variability of the prediction equation. The Beta weight (Beta = -0.40490) again illustrated the importance of Psychology of Disability to this prediction equation, significant at the 0.044 levle. Psychology of Disability was not removed from the prediction equation in the backward elimination regression.

Pearson correlation coefficients showed only one course, Clinical Orthopedics, to be related to problem-solving skills scores for the third quarter (Table 85*) Clinical Orthopedics was related to the W.G.C.T.A. score, significant at the 0.043 level. Neurophysiology was less significant, at the 0.60 level. Furthermore, once again a close interrelatedness of courses was demonstrated by the correlation coefficients (Table 86*), but chiefly in two cases. Neuroanatomy was related to Neurophysiology (r = 0.000) and Clinical Orthopedics (r = 0.053), and

Prosthetics-Orthotics (r = 0.000). Neurophysiology was related to Neuroanatomy, Clinical Orthopedics (r = 0.008) and Prosthetics-Orthotics (r = 0.000). Clinical Orthopedics and Prosthetics-Orthotics were only related to Neuroanatomy and Neurophysiology; and Cardiopulmonary Physical Therapy was related to Psychology of Disability (r = 0.026). Neurophysiology again dominated as highly important in this quarter.

Learning Styles

Multiple regression procedures between learning styles and each individual course grade revealed that although each of three courses was related to the learning styles, each course was significantly related to a different learning style. Furthermore, backward elimination revealed no consistent pattern in which the individual learning styles were removed from the prediction equation (Tables 87*, 88*, 89*, 90*, 91*, 92*, 93*, 94*).

Medical Lectures and Learning Style

Stepwise forward regression analysis between Medical Lectures and the six learning styles of the G.R.S.L.S.S. showed that of the variability seen in the grades, 53.2% could be accounted for by the prediction equation. Of this, 28.2% could be accounted for by the Collaborative learning style, significant at the 0.006 level (Table 95*). From the Beta weight (Beta = 0.53186) it can be seen that the Collaborative learning style contributes significantly to this prediction equation.

Backward elimination regression (Table 96*) revealed that the prediction equation accounted for 63.4% of the variability of the Medical

Lectures grades. Of this, the combination of all six learning styles of the G.R.S.L.S.S. accounted for only 40.2% of the variability of the prediction equation. This, however, was not a significant finding; the significance was at the 0.115 level. The Beta weights for the variables in this equation, the learning styles, illustrated the relative evenness of the contributions of each of the learning styles except the Collaborative learning style (Beta = 0.55940).

When the contribution of the Participative and Avoidant learning styles was removed from the prediction equation on Step 8 (Table 97*), it was seen that the combination of these two types of learning styles accounted for only 2.4% of the explained variance. Analysis of variance showed this to be significant at the 0.041 level. When the Dependent learning style was added to these in Step 9 (Table 98*), 5.2% of the variability in the equation was explained, significant at the 0.025 level. The addition of the Competitive learning style in Step 10 (Table 99*) brought the explained variance only up to 8.7%, significant at the 0.01 level. Finally, when the Independent learning style was removed from the prediction equation on Step 11 (Table 100*) it was found that the combination of all the learning styles except the Collaborative learning style accounted for only 11.9% of the variability of the prediction equation, significant at the 0.006 level.

Principles of Therapeutic Exercise and Learning Style

Stepwise forward regression analysis between Principles of Therapeutic exercise and the six learning styles of the G.R.S.L.S.S. showed that the Participative learning style was a major contributor in explaining the variability of the prediction equation (Table 101*). The prediction equation accounted for 46.8% of the variability; the Participative learning style accounted for 21.9% of this 46.8%, significant at the 0.015 level. This was the only learning style found significant in the stepwise forward regression analysis.

The prediction equation of the backward elimination procedure for Principles of Therapeutic Exercise and learning styles accounted for 58.8% of the variability, with 34.5% accounted for by the combination of all six learning styles (Table 102*). This was, however, non-significant at the 0.181 level. The Beta weights at this point, clearly demonstrated the significance of the Participative learning style over the other five learning styles (Beta = 0.65519).

The first significant finding in the backward elimination regression did not occur until Step 9 when the combination of the Competitive, Collaborative, and Avoidant learning styles was determined to account for 2.2% of the explained variance of the prediction equation (Table 103*). Adding the Independent learning style on Step 10 (Table 104*) accounted for 5.6% of the 58.8% of the explained variability, significant at the 0.01 level. Finally, in Step 11, when the combination of all the learning styles except the Participative learning style (i.e Competitive, Collaborative, Avoidant, Independent, and Dependent) accounted for only 12.7% of the variability of the prediction equation, significant at the 0.015 level (Table 105*).

The lack of elimination of the Participative learning style in the backward elimination regression, and the consistently high Beta weights attributed to the Participative learning style (Table 102*: Beta = -0.65519 Table 103*: Beta = -0.52276 Table 104*: Beta = -0.53090 Table 105*: Beta = -0.46853) in each step of the regression analysis supported the importance of the Participative learning style in Principles of Therapeutic Exercise. This also supported the forward inclusion prediction equation, leaving 21.9% of the explained variance accounted for by the Participative learning style.

Cardiopulmonary P.T. and Learning Style

Findings of multiple regression analyses between Cardiopulmonary Physical Therapy and the G.R.S.L.S.S. learning styles indicated that for this course, the Independent learning style was significant. In the stepwise forward regression analysis (Table 106*), 49.6% of the variability in the course grades was accounted for by the prediction equation. Significant at the 0.01 level, 24.6% of this was accounted for by the Independent learning style, with a Beta weight of -0.49613. No other learning style was found to be significant in the stepwise forward procedure.

The backward elimination procedure revealed that the combination of all six learning styles accounted for 37.4% of the 61.1% variance explained by the prediction equation (Table 107*). However, this was significant at only the 0.13 level. Not until the contribution of both the Competitive and Participative learning styles was removed from the prediction equation on Step 8 (Table 108*) was a significant result found, and this at the 0.037 level. The combination of these two learning styles accounted for only 0.2% of the variability of the prediction equation. Adding the Avoidant learning style to these two on Step 9 (Table 109*) significant at the 0.015 level, accounted for less than an additional 0.1%. Finally, the combination of the Competitive, Participative, Avoidant, and Dependent learning styles on Step 10 (Table 110*) accounted for only 1.2% of the explained variance of the prediction equation.

The final of the six learning styles, the Collaborative learning style, was neither included in the stepwise forward regression analysis nor eliminated in the backward elimination analysis. The Beta weights in the backward elimination regression indicated that this learning style was second in importance to the Independent learning style for Cardiopulmonary Physical Therapy (Table 107*: Independent, Beta = -0.43127 Collaborative, Beta = -0.33591; Table 108*: Independent, Beta = -0.44362 Collaborative, Beta = -0.34497; Table 109*: Independent, Beta = -0.44490 Collaborative, Beta = -0.34721; Table 110*: Independent, Beta = -0.45751 Collaborative, Beta = -0.34133).

Canonical correlation analyses between the course grades for the third quarter and the G.R.S.L.S.S. revealed no canonical correlation at the 0.05 level of significance. The first non-significant canonical correlation, at the 0.141 level (Table 111*) found the Independent learning style and Neurophysiology as important elements in the variate. This supported the lack of pattern for the learning styles in Quarter 3.

Changes in Problem-Solving Skills

Statistical analysis between the course grades for all three groups (i.e. all of the first three quarters of courses in the curriculum) and the changes in problem-solving skills scores indicated that only one course, Patient Assessment, was consistently related to the changes in problem-solving skills scores.

Stepwise forward regression analysis (Table 16) found the prediction equation accounted for 75.18% of the variability of the problem-solving skills change scores. Of this 75%, Patient Assessment was determined to account for 56.53%, highly significant at the 0.00 level. The Beta weight (Beta = 0.75186) supported this finding. Patient Assessment was the only course removed from the equation in the stepwise forward regression analysis.

Backward elimination regression analyses (Table 112*) revealed that the combination of all the graded courses taken during the first three quarters of the curriculum, accounted for 66.68% of the 81.66% variability of the changes in problem-solving skills accounted for by the prediction equation. This was significant at the 0.000 level. The Beta weights (Table 113*) illustrated Clinical Orthopedics as important to the equation at this point.

Each step or combination of courses removed from the prediction equation remained significant at the 0.000 level until Step 31 of the backward elimination regression (Tables 114*, 115*, 116*). At this

TABLE 14

PROBLEM-SOLVING SKILLS AND GRADES: QUARTER 3

BACKWARD ELIMINATION REGRESSION

Dependent Variable: WGCTA 3TOT

REGRESSION COEFFICIENTS

Multiple R 0.41023 R Square 0.16829

ANALYSIS OF VARIANCE

	DF	Sum of Squares	Mean Square
Regression	1	1728.05510	1728.05510
Residual	23	8540.18490	371.31239

F = 4.65391 Significance of F = 0.0417

VARIABLES IN THE EQUATION

Variable	Beta	SE Beta	T	Sig T
NPHYS	0.41023	0.19016	2.157	0.0417
(Constant)			2.993	0.0065

VARIABLES NOT IN THE EQUATION

Variable	T	Sig T
NANAT	-0.666	0.5124
MLEC	-0.946	0.3545
CLORTH	1.281	0.2135
PRTE	-0.602	0.5531
CPPT	-0.951	0.3521
PO	-0.152	0.8808
PSYD	0.225	0.8239

TABLE 15

PROBLEM-SOLVING SKILLS CHANGES AND GRADES: QUARTER 3

STEPWISE FORWARD REGRESSION

Dependent Variable: WGCTA 3DIFF

Variables Entered on Step Number 1: PSYD

REGRESSION COEFFICIENTS

Multiple R 0.40490 R Square 0.16395

ANALYSIS OF VARIANCE

	DF	Sum of Squares	Mean Square
Regression	1	2269.65789	2269.65789
Residual	23	11574.34211	503.23227

F = 4.51016 Significance of F = 0.0447

VARIABLES IN THE EQUATION

Variable	Beta	SE Beta	T	Sig T
PSYD	-0.40490	0.19066	-2.124	0.0447
(Constant)			-0.713	0.4830

VARIABLES NOT IN THE EQUATION

Variable	T	Sig T
NANAT	-0.973	0.3410
NPHYS	-0.374	0.7121
MLEC	0.557	0.5832
CLORTH	-1.121	0.2744
PRTE	0.042	0.9666
CPPT	0.725	0.4763
PO	0.744	0.4645

point, the combination of all the courses except Medical Lectures, Research, and Clinical Orthopedics accounted for 3.58% of the prediction equation. Medical Lectures, Research, and Clinical orthopedics were not removed from the prediction equation (Table 116). The Beta weights showed Clinical Orthopedics to be the most significant variable in the equation.

Patient Care/Lecture Courses and Problem-Solving Skills

All the courses were then classified as either primarily lecture courses or primarily patient care with practical experience courses for each quarter (Appendix E). The grades for each group of courses were then averaged, yielding one patient care course variable and one lecture course variable for each quarter. Multiple regression analyses were then done to determine if any relationship existed between patient care or lecture courses and the changes in problem-solving skills scores. Both stepwise forward and backward elimination regression analyses demonstrated that the combination of patient care courses for the first quarter of classes, which were Patient Assessment and Basic Patient Care Skills, was the only set of courses significantly related to the changes in problem-solving skills scores.

Stepwise forward regression analysis (Table 17) demonstrated the prediction equation to account for 92.7% of the variability of the changes in problem-solving skills scores. Of this 92.7%, the first quarter patient care courses were found to contribute 85.94%, significant at the 0.000 level. This was the only set of courses entered in the stepwise forward procedure.

Backward elimination regression analysis found (Table 18) that the combination of the lecture and patient care course sets accounted for 86.54% of the 93.0% variability accounted for by the prediction equation, significant at the 0.000 level. The Beta weights illustrated how important the contribution of the patient care courses of the first quarter was (Beta = 0.96209), compared to the contribution of the other sets of courses (Betas = 0.04386; -0.00617; -0.17792; -0.13157; -0.19923).

The combinations of courses continued to be significant at the 0.000 level (Table 117*) until Step 11 of the backward elimination regression analysis (Table 19). At this point it was seen that all the courses together accounted for only 6.76% of the variability of the prediction equation, significant at the 0.000 level. The set of patient care courses for the first quarter was not removed from the prediction equation, and remained important to the prediction equation, as demonstrated by the Beta weight (Beta = 0.92705).

G.P.A., Learning Style and Problem-Solving Skills

Multiple regression analyses did not find either G.P.A. or learning style to be significantly related to changes in problem-solving skills scores. Backward elimination regression analysis between G.P.A. and changes in problem-solving skills scores (Table 118*) showed that the prediction equation accounted for only 24.66% of the variability of the problem-solving skills scores. The combination of the G.P.A.'s for each quarter, non-significant at the 0.182 level, accounted for only 6.08% of this 24.66%. The Beta weights, by their similarity (Betas = -0.54946; -0.59947; -0.56363), also demonstrated the equal contribution of these three variables to the prediction equation.

Similarly, no significant relationship was found between the changes in problem-solving skills and the learning styles as defined by the G.R.S.L.S.S. (Table 119*). At the 0.329 level of significance, backward elimination regression analysis found the prediction equation to account for 29.5% of the variability of the problem-solving skills change scores. All six learning styles together accounted for only 8.69% of this 29.5%. This, however, was not significant (0.329 level). Furthermore, the Beta weights illustrated the lack of importance of each of the learning styles to the prediction equation. All the Beta weights are low, although the Beta weights for the Participative learning style and the Avoidant learning style are greater than those for the other learning styles.

Canonical correlation showed that learning styles were also unrelated to success in the problem-solving curriculum, with success measured by G.P.A. (Table 120*). No canonical correlation was found at the 0.05 level of significance. The first non-significant canonical correlation, non-significant at the 0.804 level, showed the Independent and the Avoidant learning styles to be inversely important to the variate. All three of the quarterly G.P.A.'s were found to be fairly equal contributors to the variate, although the second quarter G.P.A. canonical variate coefficient was less than the other two G.P.A. coefficients.

Questionnaire

The questionnaire designed to correlate students' opinions of problem-solving skill use in a course reflected a relatively accurate perception on the parts of subjects. In using Pearson correlation coefficients, it was found that subtests 2 and 5 most often correlated at less than the 0.05 level of significance with the subjects opinions regarding whether or not a course utilized a problem-solving approach. Thus, perhaps the subjects who recognized the use of a problem-solving approach in a course were also able to perform well on those subtests (Table 121*).

This was the only pattern that seemed obvious in looking at the subjects' responses to the questionnaire regarding the use of problem-solving skills. There were significant correlations between subjects' opinions regarding the appropriateness of grades and the grades actually received for all the prerequisite courses, except Psychology. These ranged from 0.000 to 0.091 (Table 122*). The correlation for Psychology was significant at the 0.246 level. It is not surprising, however, to find students' opinions of grades related to the grade itself; high grades are usually approved while lower grades are not.

TABLE 16

PROBLEM-SOLVING SKILLS CHANGES AND GRADES: ALL QUARTERS

STEPWISE FORWARD REGRESSION

Dependent Variable: WGCTA DIFF

Variables Entered on Step Number 1: PTAS

REGRESSION COEFFICIENTS

Multiple R 0.75186 R Square 0.56529

ANALYSIS OF VARIANCE

	DF	Sum of Squares	Mean Square
Regression	1	78006.16430	78006.16430
Residual	79	59987.71225	759.33813

F = 102.72915 Significance of F = 0.0000

VARIABLES IN THE EQUATION

Variable	Beta	SE Beta	T	Sig T
PTAS	0.75186	0.07418	10.136	0.000
(Constant)			-14.479	0.000

TABLE 17

PROBLEM-SOLVING SKILLS CHANGES AND PATIENT CARE COURSES

STEPWISE FORWARD REGRESSION

Dependent Variable: WGCTA CHNG

Variable Entered on Step Number 1: PTCR1

REGRESSION COEFFICIENTS

Multiple R 0.92705 R Square 0.85942

ANALYSIS OF VARIANCE

	DF	Sum of Squares	Mean Square
Regression	1	775351.56395	775351.56395
Residual	79	126831.99160	1605.46825

F = 482.94419 Significance of F = 0.0000

VARIABLES IN THE EQUATION

Variable	Beta	SE Beta	T	Sig T
PTCR1	0.92705	0.04218	21.976	0.0000
(Constant)			-9.731	0.0000

VARIABLES NOT IN THE EQUATION

Variable	T	Sig T
LEC1	-0.997	0.3220
PTCR2	0.057	0.9551
LEC2	0.106	0.9159
PTCR3	-1.748	0.4567
LEC3	-0.521	0.6038

TABLE 18

PROBLEM-SOLVING SKILLS CHANGES AND PATIENT CARE COURSES

BACKWARD ELIMINATION REGRESSION

Dependent Variable: WGCTA BTOT

Variables Entered on Step Number
1: LEC3
2: PTCR2
3: LEC1
4: LEC2
5: PTCR3
6: PTCR1

REGRESSION COEFFICIENTS

Multiple R 0.93024 R Square 0.86535

ANALYSIS OF VARIANCE

	DF	Sum of Squares	Mean Square
Regression	6	780702.34379	130117.05730
Residual	74	121481.21176	1641.63800

F = 79.26051 Significance of F = 0.0000

VARIABLES IN THE EQUATION

Variable	Beta	SE Beta	T	Sig T
LEC3	0.04386	0.15258	0.287	0.7746
PTCR2	-0.00617	0.07014	-0.088	0.9302
LEC1	-0.17792	0.18305	-0.972	0.3342
LEC2	-0.13157	0.12572	-1.046	0.2987
PTCR3	-0.19923	0.16472	-1.210	0.2303
PTCR1	0.96209	0.21233	4.531	0.0000
(Constant)			-0.865	0.3901

TABLE 19

PROBLEM-SOLVING SKILLS CHANGES AND PATIENT CARE COURSES

BACKWARD ELIMINATION REGRESSION: STEP 11

Dependent Variable: WGCTA CHNG

Variable Entered on Step Number 11: PTCR3

REGRESSION COEFFICIENTS

Multiple R 0.92705 R Square 0.85942

ANALYSIS OF VARIANCE

	DF	Sum of Squares	Mean Square
Regression	1	775351.56395	775351.56395
Residual	79	126831.99160	1605.46825

F = 482.94419 Significance of F = 0.0000

VARIABLES IN THE EQUATION

Variable	Beta	SE Beta	T	Sig T
PTCR1	0.92705	0.04218	21.976	0.0000
(Constant)			-9.731	0.0000

VARIABLES NOT IN THE EQUATION

Variable	T	Sig T
LEC1	-0.997	0.3220
PTCR2	0.057	0.9551
LEC2	0.106	0.9159
PTCR3	-1.748	0.4567
LEC3	-0.521	0.6038

CHAPTER V

DISCUSSION

Discussion Related to Null Hypothesis 1

There is no relationship between grades in any of the prerequisite courses and problem-solving skills.

This investigation failed to conclusively demonstrate a relationship between any of the specific prerequisite coursework subject areas used in this study, i.e. Physiology, Biology, Chemistry, English, Physics and Psychology, and problem-solving skills upon entrance into a professional educational program in physical therapy. Multiple regression analyses showed that prerequisite course grades actually contributed very little (2.32%) to the variability of problem-solving skills scores. Although Physics was seen to contribute slightly more to the problem-solving skills scores, Beta weights illustrated the fairly equal contribution of the six prerequisite course areas to the variability of problem-solving skills scores.

Similarly, no relationship was seen between prerequisite course grades and the changes seen in problem-solving skills during involvement in the problem-solving curriculum at Northwestern University Medical School Programs in Physical Therapy. A non-significant prediction equation and Beta weights demonstrated the lack of contribution of any one specific area of coursework to the changes in problem-solving skills.

Therefore, Null Hypothesis 1 was not rejected, indicating that there was no relationship between prerequisite course grades and problem-solving skills. However, this finding may be based on the low variability in prerequisite course grades.

Discussion Related to Null Hypothesis 2

> There is no relationship between college selectivity and problem-solving skills.

Although the findings of this study did not demonstrate a relationship between course grades and problem-solving skills, when the contributing factor of college selectivity was considered, significant results were found. Findings of multiple regression analyses between course grades with their corresponding college selectivity did not show a relationship when analyzed with respect to entering problem-solving skills. However, when the grade with its corresponding college selectivity was analyzed with respect to changes in problem-solving skills, significant results manifested themselves.

Multiple regression techniques showed that the Physics grade/college selectivity accounted for more than one quarter of the variability of the prediction equation. Beta weights and Pearson correlation coefficients supported this. The contribution of the other course grades and respective college selectivities was not found to be significant. Their contribution to changes in problem-solving skills was minimal, although the significance of the Pearson correlation coefficient for the Chemistry grade/college selectivity and changes in problem-solving skills was 0.069. However, this significant relationship was not supported in any other statistical procedures.

Thus, Null Hypothesis 2 was not rejected. It appears that when the difficulty rating of the institution where coursework is taken is a considered factor, a relationship does exist between the grades earned and problem-solving skills.

Discussion Related to Null Hypothesis 3

> There is no relationship between undergraduate college majors and problem-solving skills.

None of the statistical procedures indicated a clear relationship between undergraduate college major and problem-solving skills. Results of multiple regression procedures, Beta weights, canonical correlation and Pearson correlation coefficients point not only to the lack of relationships but to the lack of importance of undergraduate college major to prerequisite course grades, problem-solving skills, or changes in problem-solving skills.

Of the classification of majors used in this investigation, the Natural Science major and Other majors were consistently seen as the most related to problem-solving skills change scores, through the Pearson correlation coefficients. This finding, however, was not supported by any other statistical analyses. Finally, undergraduate college major was not found to be related to success in a problem-solving curriculum as measured by quarterly G.P.A.'s.

Therefore, Null Hypothesis 3 was not rejected. The results of this study indicate that there is no relationship between undergraduate college major and problem-solving skills. Furthermore, undergraduate college major appears to be an unimportant factor in relationship to changes in problem-solving skills and academic success in a professional educational program as measured by G.P.A.

Discussion Related to Null Hypothesis 4

> There is no relationship between learning styles and problem-solving skills.

None of the statistical findings demonstrated a significant relationship between problem-solving skills and learning styles. Learning styles were found to not be related to entering problem-solving skills, changes in problem-solving skills, or the subtests of the W.G.C.T.A. Learning styles were also found not to be related to prerequisite course grades.

Learning styles were found to be related to undergraduate college majors and to grades received in several courses in the physical therapy educational program. Since learning styles are actually considered to be a personality characteristic, these findings seem quite understandable. College majors are usually chosen to assist a student in meeting a particular professional or vocational goal. These goals are chosen to suit personal or "personality" characteristics. Thus, it follows that certain college majors attract students with specific personality styles or learning styles.

In a related finding, learning styles were found to be related to certain specific courses in the curriculum. It should be considered, however, that since grades were used to signify success in coursework, the relationship between the grades and learning styles may indicate the learning style preferred by a specific instructor. Unknowingly, an instructor may teach more successfully to a specific learning style. Furthermore, a teacher may design a course to facilitate more learning within a particular style. For example, a therapeutic exercise course may be designed with a goal to help students learn to work together, so the participative or collaborative learning style may be statistically significant. In contrast, an instructor may want students to work on their own, and design a course to assist the student in self-instruction or independent learning.

Although related to certain specific courses, learning styles were not found to be strong contributors to problem-solving skills, changes in problem-solving skills, or success in the problem-solving curriculum as measured by G.P.A. Therefore, it must be stated that the null hypothesis regarding a relationship between learning styles and problem-solving skills was not rejected. Further investigation of the relationship of learning styles to other aspects of higher education appears warranted.

Discussion Related to Null Hypothesis 5

There is no relationship between problem-solving skills and involvement in a problem-solving curriculum.

Statistical analyses of data from each quarter in the curriculum found only one course each quarter significantly related to problem-solving skills: Patient Assessment in Quarter 1; Physiology in Quarter 2; and Neurophysiology in Quarter 3. When considering characteristics of these three courses, no clear pattern exists regarding these findings. Each course was taught by a different instructor or group of instructors; none of the instructors participated in two of these three courses. Furthermore, only one of these three courses, Patient Assessment, was a patient care oriented course, although application of subject matter to patient care situations was an essential element of each course in the curriculum.

In addition, when each quarter of the curriculum was examined independently, it was seen that none of these three courses was found to be related to the difference scores in problem-solving skills for that particular quarter. Only Quarter 3 showed any course as related to the differences in problem-solving skills. This course, Psychology of Disability, was not graded in the same manner as other courses in the curriculum. In this course students signed a contract for a specific grade, and prepared specific assignments in order to keep the contract and receive the goal grade. Perhaps this course was not significantly related to the changes in problem-solving skills, but related to each student's perception of his/her own ability level. Thus, it would appear that no one course was significant in accounting for changes seen in problem-solving skills for one quarter.

However, when the total changes in problem-solving skills were examined and all the courses in the curriculum considered together, one of the three courses related to problem-solving skills for one quarter was found to be significantly related to the total changes in problem-solving skills. This course, Patient Assessment, was taken in Quarter 1 and found to be significant at the 0.000 level. Moreover, when the courses were divided into either primarily patient care or primarily lecture, and then used in this classification to determine a relationship with the changes in problem-solving skills, only Patient Care 1 was found to be significant. Patient Care 1 was the combination of Patient Assessment and Basic Patient Care Skills, the patient care courses taken during Quarter 1. Pearson correlation coefficients also showed these two courses to be significantly related.

The strength of the relationship between Patient Assessment and problem-solving skills was clearly demonstrated by the multiple regression analyses. Moreover, due to the fact that course grades demonstrated low variability, this relationship could be considered strong. Therefore, although Null Hypothesis 5 was not rejected, these results do support the assumption that problem-solving skills can be taught. Patient Assessment was a newly designed course for the Class of 1983. The charge from the Programs in Physical Therapy Curriculum Committee to the coordinator of that course (the present investigator) was to introduce the students to the problem-solving process and to teach the students how to implement these problem-solving skills in the discipline of physical therapy. Thus, problem-solving was a major focus of the Patient Assessment course. Following this, the faculty of the Programs in Physical Therapy was charged to implement the problem-solving process as established in Patient Assessment in other patient care courses. It appeared that this was done.

However, it must be noted that the instructor for the Physiology course, significantly related to problem-solving skills in Quarter 2, was not a member of the faculty of the Programs in Physical Therapy, but rather, a member of the medical school faculty who carried teaching responsibilities in each department. It is, therefore, questionable as to whether or not he was charged with implementing the problem-solving process.

Cursory examination of the changes in problem-solving skills scores did indicate that gains had been made in problem-solving skills. However, based on the statistical analyses these apparent gains or improvement in problem-solving skills were not statistically significant. It is possible that these gains were related to normal maturation processes, although this position can not be supported from the findings from the present investigation. In fact, it is unlikely that given the age and prerequisite screening of the students involved that such developmental change would have accounted for these differences. Although it must be concluded from the findings of this investigation that involvement in a problem-solving curriculum does not have any relationship to changes in problem-solving skills, this hypothesis clearly warrants further study.

Discussion Related to Null Hypothesis 6

There is no relationship between grades in physical therapy coursework and problem-solving skills.

The findings from stepwise forward and backward elimination regression analyses indicated that when all the courses in the first three quarters were considered as a group, only Patient Assessment was related to the changes in problem-solving skills. Following this finding, each course was classified as either a patient care course or a lecture course, and a patient care course variable and a lecture course variable were created. When these variables were used in multiple regression procedures with the changes in problem-solving skills, only the patient care courses from Quarter 1 were demonstrated to be significantly related to the changes in problem-solving skills.

The courses averaged to become the Patient Care 1 variable were Patient Assessment and Basic Patient Care Skills. Patient Assessment was consistently found to be related to problem-solving skills and changes in problem-solving skills. Pearson correlation coefficients (r = 0.028) illustrated the significant relationship between these two courses. Furthermore, the courses were designed to complement each other.

Thus, again it can be seen that the Patient Assessment course, specifically oriented toward problem-solving skills, was an important factor when the courses were classified as primarily patient care or lecture. Therefore, it does not appear that physical therapy coursework in general is related to problem-solving skills, since no other quarter's patient care courses were found to be significantly related to changes in problem-solving skills in the regression procedures. Null Hypothesis 6 was not rejected.

Discussion Related to Null Hypothesis 7

> There is no relationship between grade point average and problem-solving skills.

Null Hypothesis 7 was also not rejected. Pearson correlation coefficients and grades in both prerequisite coursework and courses taken while a student in the Programs in Physical Therapy showed no significant relationship between grades and problem-solving skills. Entering problem-solving skills scores on the W.G.C.T.A. approximated a normal distribution, ranging from the first to the 99th percentile. However, the average entering G.P.A. for the students entering the Northwestern University Programs in Physical Therapy was above 3.25 on a 4.0 scale. Thus, there was little, if any, variability in prerequisite course grades.

The results of this investigation would support the concept that G.P.A. is not a reliable predictor of problem-solving skills. However, G.P.A. is an often-used tool in admission policies, and considered to be a good tool due to its reported objectivity. As the profession of physical therapy continues to move toward independent practice, educators within the profession continue to urge the use of problem-solving skills and the problem-solving curriculum. Therefore, another mechanism besides G.P.A. must be found to assess applicant performance in problem-solving skills.

Discussion Related to Null Hypothesis 8

> There is no relationship between learning styles and success in a problem-solving curriculum.

Canonical correlation procedures between learning styles and grades for courses taken, both prerequisite coursework and courses taken while a student in the problem-solving curriculum of the Programs in Physical Therapy, showed no relationship between learning styles and grades. Furthermore, Pearson correlation coefficients showed no relationship between learning styles and G.P.A. Therefore, Null Hypothesis 8 was not rejected; there does not appear to be a relationship between learning styles and success in a problem-solving curriculum. There does, however, appear to be a course specific relationship between grades and learning styles. It is possible that this relationship was due to instructor preference for a specific learning style or due to the teaching style of each specific instructor.

Limitations of the Study

This was a quasi-experimental study, utilizing an already existing, and as such, a preselected group of subjects. There was no control group. By using a sample such as this, no information regarding problem-solving skills was available regarding applicants not accepted into the physical therapy educational program, or students receiving their professional education in a traditional curriculum rather than a problem-solving curriculum as implemented by the Programs in Physical Therapy. Furthermore, the obtained results are specific to the unique program of physical therapy education as offered by Northwestern University.

Another limitation concerns the lack of uniformity regarding the time of day the W.G.C.T.A. was administered. Since the class period was selected by the scheduling coordinator, the time of day was variable. Thus, some subjects may have been more well-rested, if administered in the morning, or more fatigued, if administered in the afternoon, etc. The test was administered on either the first or second day of each quarter, during the first week following the quarter break. However, since the subjects were adult college students, time of test administration should have minor, if any, effect.

The last major limitation of the study concerns the use of pre-test and post-test with the same instrument. Although the W.G.C.T.A. has been shown to have test-retest reliability when given at three-month intervals, it is possible that the group of subjects in the first subsample, N1, may have recalled the test items, and responded more from memory than the last subsample, N3, who did not retake the W.G.C.T.A. until almost nine months later. It is also possible that as the study progressed or as the students neared completion of their educational program, the subjects may have experienced "burnout" and not taken the testing as seriously as earlier in the program or study. It is assumed that these limitations served to balance each other and did not have any significant effect on the findings.

Suggestions for Future Research

Grades and Problem-Solving Skills

This investigation did not conclusively demonstrate relationships between grades and problem-solving skills. However, a possible major hindrance to this could be the relatively high caliber students (and therefore low variance among their G.P.A.'s) enrolled in the Northwestern University Programs in Physical Therapy. Of the over 400 applications submitted yearly, the Programs in Physical Therapy admits only 80 students. In a highly competitive field such as this one, G.P.A. becomes a major contributing factor in admissions decisions. Furthermore, because the program is highly concentrated and demanding, it is advisable that applicants present evidence of ability to withstand a rigorous academic schedule. G.P.A. can be considered illustrative of actual student performance. Thus, the students in the Northwestern University Programs in Physical Therapy, (i.e. the subjects in this investigation) had fairly high grades which were used in Phase I of this study.

It is possible that although the entering problem-solving skills scores were distributed, somewhat, (i.e. ranged from the first to the 99th percentile) the concentration of high grades made analysis of the relationship of grades to entering problem-solving skills difficult. Moreover, not only were prerequisite course grades high, but admitted students, as might be expected, performed well in the curriculum, and the distribution of grades received in the Programs in Physical Therapy were skewed toward high grades. It is also possible that the lack of variability in the grades received during enrollment in the problem-solving curriculum presented a problem in statistical analyses of the relationships among problem-solving skills, grades received while enrolled in the physical therapy educational program, and success in the curriculum as measured by G.P.A.

Since G.P.A. is a major factor in many graduate and professional programs, however, this question does warrant further investigation. Although it would be a major and cumbersome investigation, it might prove worthwhile to study this question on a larger scale. If problem-solving skills could be assessed for an entire entering freshman class at a university, the grades received in courses would encompass the entire spectrum. Furthermore, along with highly successful students, (i.e. those receiving high grades) there would also be those students who fail a course, withdraw from the course, or do not complete the course. With these data there would be additional data regarding undergraduate majors of the students. Perhaps then, with a larger sample and additional data, more significant differences would be found.

Similarly, no significant relationships were found between the perceptions of students regarding problem-solving skills and the relationships of problem-solving skills to prerequisite coursework or grades. Although this was not a major focus of this investigation, the perceptions of the subjects would have been interesting to investigate if significant results had been seen. However, since this was not a major focus of this investigation, the questionnaire used was fairly vague and did not delve deeply into the students' perceptions and opinions. If this should become the major intent of a further study, a much more thorough instrument should be designed and used.

Colleges, Grades and Problem-Solving Skills

This investigation demonstrated a relationship between the Physics grade/college selectivity variable and problem-solving skills. Although no relationship between the grade alone and problem-solving skills was seen, the factor of college selectivity deserves further research attention.

Realizing that college selectivity would be a difficult factor to investigate, it could be an important consideration for admissions decisions. The mathematical contributions of grades and college selectivity were not investigated in this study. Since the Physics grade/college selectivity variable was found to be related to the changes in problem-solving skills, the contribution of college selectivity in differing mathematical equations could be investigated. This study considered the grade and the college selectivity as equal contributors to the created variable grade/college selectivity; it is possible that if the college selectivity is weighted more, significant differences would be found. This possibility requires further investigation for use in admissions decisions. Furthermore, the possibility of success in the curriculum being related to performance at undergraduate institutions of different qualities is also a subject of interest for further study.

Degree and Problem-Solving Skills

As the profession of physical therapy moves toward independent practice and post-baccalaureate educational programs, the relationship of degree and problem-solving skills or success in the professional phase of the educational preparation for physical therapists should be carefully investigated. It is possible that the degree status of a student prior to entering a physical therapy educational program is related to problem-solving skills or success in the professional curriculum. Furthermore, this is an area where the college selectivity of the institution granting the earlier degrees may be a significant factor. This is another area which would be important not only for admissions policy-makers, but for the development of the post-baccalaureate professional educational programs in physical therapy mandated by the A.P.T.A. by 1990. It is possible that this type of information could assist the profession in decision-making regarding the degree status of the post-baccalaureate educational programs. Perhaps this information would influence the decision to adopt a certificate program, a master's degree program, or a doctorate in physical therapy.

Learning Styles

No conclusive evidence was found regarding the contribution learning styles might make to problem-solving skills, the changes in problem-solving skills, or success in a problem-solving curriculum. It was found, however, that learning styles were significantly related to undergraduate college major. This is an area that warrants further investigation regarding the field of physical therapy.

Literature regarding the personality characteristics of persons entering the profession of physical therapy is minimal. No conclusive evidence has been found defining the personality attributes which contribute to an individual becoming an effective or ineffective clinical therapist or professional educator. This area should be more closely investigated as the competition for admittance into physical therapy educational programs continues to be a matter of concern and as the interview continues to be used as an admissions tool.

If the desirable characteristics for a physical therapist could be defined, admissions tools could be selected to evaluate those qualities. However, it is important to note that too much concentration on variables such as personality characteristics could lead to a narrow spectrum of physical therapists. This could lead to stereotypic treatment and a lack of innovation in what is now considered to be a dynamic and creative field.

Significant results were found between learning styles and success within several specific courses in the problem-solving curriculum in the Programs in Physical Therapy. However, it was not possible to delineate any specific pattern of learning styles which led to success in these courses. It is probable that the learning style of the student is not what leads to success in a specific course, but rather that the instructor, perhaps unknowingly, teaches in a style that facilitates success by a student with a particular type of learning style. It could not be suggested that a particular learning style actually learns more; rather, it could be suggested that a particular learning style is thus facilitated to perform better on the evaluative measures for the course, since grades were used as measures of success in this investigation.

Investigations of learning styles could provide significant information to professional educators in the educational programs in the field of physical therapy. If the profession desires to teach in preparation for independent practice, then the instructors who have been considered to facilitate that type of student may have a contribution to make to other educators. Although this would be a difficult area to investigate, the information gained would be of benefit to instructors who desired to alter their teaching style or improve their teaching skills. For example, an instructor may desire to facilitate students to develop some independent learning techniques where previously the instructor facilitated dependency in learning; and this kind of information could assist that instructor.

The G.R.S.L.S.S. was a difficult instrument to use. It did not actually identify students as primarily one type of learner but scored each subject on each style of learning. Many subjects scored closely in several of the learning styles, which was a hindrance in establishing statistical relationships and conclusions. This instrument should be refined before being adopted for use as a tool in further research.

Teaching Problem-Solving Skills

Although this investigation was not designed to determine if problem-solving skills could be taught, the results support this concept. The only course consistently found to be related to problem-solving skills scores or to total changes in problem-solving skills was a course designed specifically with the objective of assisting students in developing their problem-solving skills. This is an important point to consider if the profession of physical therapy seeks to improve the problem-solving skills of the therapists entering the profession.

This investigation did not demonstrate that a problem-solving curriculum improves problem-solving skills, for the gains in problem-solving skills were not significant. Before the profession of physical therapy places emphasis on problem-solving skills and advocates the problem-solving curriculum, further investigation in this area is needed. If the curricular emphasis on problem-solving skills does lead to an improvement in problem-solving skills, this information should be shared with educators in other disciplines. The knowledge explosion is not restricted to the field of physical therapy and the subject of problem-solving is of interest to many educators.

Conclusions

This investigation did not offer conclusive evidence that problem-solving skills are related to prerequisite course grades, undergraduate major, or course grades received while enrolled in a problem-solving curriculum. A significant relationship was seen between the variable of grade/college selectivity and changes in problem-solving skills. This relationship should be investigated further.

Undergraduate college major was not found to be significantly related to grades, problem-solving skills, or changes in problem-solving skills. Student perception of the use and facilitation of problem-solving skills was also not found to be accurate. Similarly, learning styles were not found to be related to problem-solving skills, changes in problem-solving skills, course grades or G.P.A. Learning styles were, however, significantly related to undergraduate college majors.

No relationship was found among improvement in problem-solving skills, enrollment in a problem-solving curriculum in physical therapy, grades earned in physical therapy coursework and G.P.A. It does appear that problem-solving skills can be improved through coursework specifically designed for that purpose. However, since only one course demonstrated this finding, further investigation is warranted.

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APPENDIX A

SUBTESTS OF THE WATSON-GLASER CRITICAL THINKING APPRAISAL

Test 1: Inference
Discriminating among degrees of truth or falsity of inferences drawn from data.

Test 2: Recognition of Assumptions
Recognizing unstated assumptions or presuppositions in given statements or premises.

Test 3: Deduction
Determining whether certain conclusions necessarily follow from information in given statements or premises.

Test 4: Interpretation
Weighing evidence and deciding if generalizations or conclusions based on the given data are warranted.

Test 5: Evaluation of Arguments
Distinguishing between arguments that are strong and relevant and those that are weak or irrelevant to a particular question or issues.

(Source: _Watson-Glaser Critical Thinking Appraisal Manual_, p. 2).

APPENDIX B

G.R.S.L.S.S LEARNING STYLES

Independent:

The student who prefers to think for himself and work on his own, but will listen to the ideas of others in the classroom; this student decides what content is important, learns that content, and has confidence in his learning abilities.

Dependent:

The student who demonstrates little intellectual curiosity and learns only required content; this student desires structure and support from teachers and peers, wanting to be told what to do and desiring guidelines from authority figures.

Collaborative:

The student who is cooperative with teachers and peers, and likes to work with others, feeling that the most can be learned by sharing ideas and talents; the classroom is viewed as a place for social interaction plus content learning.

Competitive:

The student who learns content in order to outperform others in the class, feeling he must compete for grades and teacher attention, which are considered to be rewards in the classroom; the classroom is seen as a win-lose situation, and winning is important.

Participant:

The student who desires to learn course content and enjoys going to class, taking responsibility for learning and participating with others when told to do so; the student feels it important to take part in as much class related activity as is possible and does little that is not part of the course outline.

Avoidant:

The student who is not interested in learning course content in the traditional classroom, not participating with students or teachers in that setting and appearing uninterested and overwhelmed by what occurs there.

(Source: Reichmann, 1972)

APPENDIX C

QUESTIONNAIRE

Project Title: An investigation into Problem-Solving in Physical Therapy Education: Prerequisites and Curriculum

Random Number ____

In reference to my prerequisite courses:

Physiology
Utilized a critical thinking and problem solving format:
___ yes ___ no
Grading reflected my use of critical thinking and problem solving:
___yes ___no
My grade was:
appropriate___ lower than I deserved___ higher than I deserved___

Biology
Utilized a critical thinking and problem solving format:
___ yes ___ no
Grading reflected my use of critical thinking and problem solving:
___yes ___no
My grade was:
appropriate___ lower than I deserved___ higher than I deserved___

Chemistry
Utilized a critical thinking and problem solving format:
___ yes ___ no
Grading reflected my use of critical thinking and problem solving:
___yes ___no
My grade was:
appropriate___ lower than I deserved___ higher than I deserved___

English
Utilized a critical thinking and problem solving format:
___ yes ___ no
Grading reflected my use of critical thinking and problem solving:
___yes ___no
My grade was:
appropriate___ lower than I deserved___ higher than I deserved___

Physics
Utilized a critical thinking and problem solving format:
___ yes ___ no
Grading reflected my use of critical thinking and problem solving:
___yes ___no
My grade was:
appropriate___ lower than I deserved___ higher than I deserved___

Psychology

Utilized a critical thinking and problem solving format:

___ yes ___ no

Grading reflected my use of critical thinking and problem solving:

___yes ___no

My grade was:

appropriate___ lower than I deserved___ higher than I deserved___

APPENDIX D

CONSENT FORM

Project Title: An investigation into Problem-Solving in Physical Therapy Education: Prerequisites and Curriculum

I, ________________ (Volunteer), state that I am over 18 years of age and that I wish to participate in a program of research being conducted by JUDITH UTZ ARAND, M.S., R.P.T. (Investigator), who has fully explained to me the procedures, risks, benefits, and alternatives involved and the need for the research; has informed me that I may withdraw from participation at any time without prejudice; has offered to answer any inquiries which I may make concerning the procedures to be followed; and has informed me that I will be given a copy of this consent form.

I give permission for my academic records to be provided to this researcher for use within this research project.

I freely and voluntarily consent to my participation in the research project.

______________________________	______________________________
(Signature of Investigator)	(Signature of Volunteer)
______________________________	______________________________
Date	(Signature of Witness)
	______________________________
	Date

APPENDIX E

PATIENT CARE COURSES AND LECTURE COURSES

Patient Care Courses	Lecture Courses
Quarter 1	
Patient Assessment	Gross Anatomy
Basic Patient Care Skills	Functional Anatomy
Quarter 2	
Foundations of the Musculoskeletal System	Exercise Physiology
	Developmental Basis of Human Performance
	Physiology
	Pathophysiology
	Research
Quarter 3	
Cardiopulmonary Physical Therapy	Neuroanatomy
	Neurophysiology
Clinical Orthopedics	Medical Lectures
Principles of Therapeutic Exercise	Prosthetics-Orthotics
	Psychology of Disability

APPENDIX F

LIST OF ABBREVIATIONS

AVOID	Avoidant Learning Style
BIO	Biology Grade
BIO G/CS	Biology Grade and College Selectivity
BPCS	Basic Patient Care Skills
CHEM	Chemistry Grade
CHEM G/CS	Chemistry Grade and College Selectivity
CLORTH	Clinical Orthopedics
COLLAB	Collaborative Learning Style
COMPET	Competitive Learning Style
CPPT	Cardiopulmonary Physical Therapy
DBHP	Developmental Basis of Human Performance
DEPEND	Dependent Learning Style
EDUC	Undergraduate majors in Education
ENG	English Grade
ENG G/CS	English Grade and College Selectivity
EXPHYS	Exercise Physiology
FANAT	Functional Anatomy
FMS	Foundations of the Musculoskeletal System
GANAT	Gross Anatomy
GPA1	G.P.A., Quarter 1
GPA2	G.P.A., Quarter 2
GPA3	G.P.A., Quarter 3
INDEP	Independent Learning Style

LEC1	Lecture Courses, Quarter 1
LEC2	Lecture Courses, Quarter 2
LEC3	Lecture Courses, Quarter 3
MLEC	Medical Lectures
NANAT	Neuroanatomy
NPHYS	Neurophysiology
NSCI	Undergraduate majors in Natural Sciences, e.g. Biology, Chemistry
OTR	Undergraduate majors that are unusual, e. g. Speech Pathology
PART	Participative Learning Style
PHCS	Physics Grade
PHCS G/CS	Physics Grade and College Selectivity
PHYSIO	Physiology Grade
PHYSIO G/CS	Physiology Grade and College Selectivity
PO	Prosthetics-Orthotics
PPHYS	Pathophysiology
PRTE	Principles of Therapeutic Exercise
PSYCH	Psychology Grade
PSYCH G/CS	Psychology Grade and College Selectivity
PSYD	Psychology of Disability
PT	Undergraduate majors in Physical Therapy or Pre-Physical Therapy
PTAS	Patient Assessment
PTCR1	Patient Care Courses, Quarter 1
PTCR2	Patient Care Courses, Quarter 2
PTCR3	Patient Care Courses, Quarter 3

RES	Research
SSCI	Undergraduate majors in Social Sciences, e.g. Psychology
WGCTA B1	W.G.C.T.A. Baseline Score, Subtest 1
WGCTA B2	W.G.C.T.A. Baseline Score, Subtest 2
WGCTA B3	W.G.C.T.A. Baseline Score, Subtest 3
WGCTA B4	W.G.C.T.A. Baseline Score, Subtest 4
WGCTA B5	W.G.C.T.A. Baseline Score, Subtest 5
WGCTA BTOT	W.G.C.T.A. Total Baseline Score
WGCTA CHNG	W.G.C.T.A. Change Score, All Groups
WGCTA DIFF	W.G.C.T.A. Difference Score, All Groups
WGCTA 11	W.G.C.T.A. Quarter 1, Subtest 1
WGCTA 12	W.G.C.T.A. Quarter 1, Subtest 2
WGCTA 13	W.G.C.T.A. Quarter 1, Subtest 3
WGCTA 14	W.G.C.T.A. Quarter 1, Subtest 4
WGCTA 15	W.G.C.T.A. Quarter 1, Subtest 5
WGCTA 1DIFF	W.G.C.T.A. Difference Score, Quarter 1
WGCTA 1TOT	W.G.C.T.A. Total Score, Quarter 1
WGCTA 21	W.G.C.T.A. Quarter 2, Subtest 1
WGCTA 22	W.G.C.T.A. Quarter 2, Subtest 2
WGCTA 23	W.G.C.T.A. Quarter 2, Subtest 3
WGCTA 24	W.G.C.T.A. Quarter 2, Subtest 4
WGCTA 25	W.G.C.T.A. Quarter 2, Subtest 5
WGCTA 2DIFF	W.G.C.T.A. Difference Score, Quarter 2
WGCTA 2TOT	W.G.C.T.A. Total Score, Quarter 2
WGCTA 31	W.G.C.T.A. Quarter 3, Subtest 1

WGCTA 32	W.G.C.T.A. Quarter 3, Subtest 2
WGCTA 33	W.G.C.T.A. Quarter 3, Subtest 3
WGCTA 34	W.G.C.T.A. Quarter 3, Subtest 4
WGCTA 35	W.G.C.T.A. Quarter 3, Subtest 5
WGCTA 3DIFF	W.G.C.T.A. Difference Score, Quarter 3
WGCTA 3TOT	W.G.C.T.A. Total Score, Quarter 3

APPENDIX G

TABLE 20

PROBLEM-SOLVING SKILLS AND GRADES, COLLEGES

BACKWARD ELIMINATION REGRESSION

Dependent Variable: WGCTA BTOT

Variables Entered on Step Number 1: PSYCH G/CS
2: BIO G/CS
3: CHEM G/CS
4: PHCS G/CS
5: ENG G/CS
6: PHYSIO G/CS

REGRESSION COEFFICIENTS

Multiple R 0.15402 R Square 0.02372

ANALYSIS OF VARIANCE

	DF	Sum of Squares	Mean Square
Regression	6	4140.15059	690.02510
Residual	236	170387.84941	721.98241

F = 0.95574 Significance of F = 0.4560

VARIABLES IN THE EQUATION

Variable	Beta	SE Beta	T	Sig T
PSYCH G/CS	0.01882	0.18182	0.103	0.9177
BIO G/CS	-0.01511	0.08746	-0.173	0.8630
CHEM G/CS	0.14238	0.09684	-1.470	0.1428
PHCS G/CS	-0.06952	0.10346	-0.672	0.5023
ENG G/CS	0.14118	0.10662	1.324	0.1868
Phys G/CS	0.01410	0.18044	0.078	0.9378
(Constant)			17.739	0.0000

TABLE 21

PROBLEM-SOLVING SKILLS AND GRADES, COLLEGES

BACKWARD ELIMINATION REGRESSION: SUMMARY

Step	Mult R	R Sq	F	Sig F	Status	Variable
1					In:	PSYCH G/CS
2					In:	BIO G/CS
3					In:	CHEM G/CS
4					In:	PHCS G/CS
5					In:	ENG G/CS
6	0.1540	0.0237	0.956	0.456	In:	PHYSIO G/CS
7	0.1539	0.0237	1.150	0.334	Out:	PHYSIO G/CS
8	0.1535	0.0236	1.437	0.223	Out:	BIO G/CS
9	0.1527	0.0233	1.903	0.130	Out:	PSYCH G/CS
10	0.1463	0.0214	2.625	0.074	Out:	Phys G/CS

TABLE 22

PREREQUISITE GRADES AND W.G.C.T.A. SUBTESTS

CANONICAL CORRELATION

Number	Eigenvalue	Canonical Correlation	DF	Significance
1	0.18196	0.42657	30	0.422
2	0.11186	0.33446	20	0.716
3	0.05877	0.24243	12	0.842
4	0.03296	0.18155	6	o.841
5	0.00353	0.05938	2	0.877

Coefficients for Canonical Variables
First Non-Significant Canonical Correlation

First Set Variables		Second Set Variables	
Variable	Canonical Variate 1	Variable	Canonical Variate 1
PHYSIO G/CS	0.24704	WGCTA B1	-0.54762
BIO G/CS	0.25104	WGCTA B2	0.92629
CHEM G/CS	-0.95838	WGCTA B3	0.07598
ENG G/CS	-0.61561	WGCTA B4	0.08018
PHCS G/CS	0.50156	WGCTA B5	0.13300
PSYCH G/CS	0.24523		

TABLE 23

PROBLEM-SOLVING SKILLS CHANGES AND PREREQUISITE GRADES

BACKWARD ELIMINATION REGRESSION

Dependent Variable: WGCTA CHNG

Variables Entered on Step Number 1: PSYCH G
2: PHYSIO G
3: BIO G
4: CHEM G
5: ENG G
6: PHCS G

REGRESSION COEFFICIENTS

Multiple R 0.10247 R Square 0.01050

ANALYSIS OF VARIANCE

	DF	Sum of Squares	Mean Square
Regression	6	1556.98250	259.49708
Residual	236	146718.42490	621.68824

F = 0.41741 Significance of F = 0.8971

VARIABLES IN THE EQUATION

Variable	Beta	SE Beta	T	Sig T
PSYCH G	-0.01361	0.11500	-0.118	0.9059
PHYSIO G	-0.03253	0.06509	-0.500	0.6177
BIO G	0.09205	0.08487	1.085	0.2792
CHEM G	-0.04974	0.09545	-0.521	0.6028
ENG G	0.07132	0.10317	0.691	0.4900
PHCS G	-0.07825	0.10497	-0.745	0.4568
(Constant)			-0.955	0.3407

TABLE 24

PROBLEM-SOLVING SKILLS CHANGES AND GRADES, COLLEGES

BACKWARD ELIMINATION REGRESSION: STEP 9

Dependent Variable: WGCTA CHNG

Variable Removed on Step Number 9: ENG G/CS

REGRESSION COEFFICIENTS

Multiple R 0.33993 R Square 0.11556

ANALYSIS OF VARIANCE

	DF	Sum of Squares	Mean Square
Regression	3	5711.34476	1903.78159
Residual	77	43713.79104	567.71157

F = 3.35343 Significance of F = 0.0232

VARIABLES IN THE EQUATION

Variable	Beta	SE Beta	T	Sig T
PHCS G/CS	-0.41956	0.13878	-3.023	0.0034
BIO G/CS	0.13935	0.16779	0.830	0.4088
PHYSIO G/CS	0.14687	0.14468	1.015	0.3132
(Constant)			-1.013	0.3142

VARIABLES NOT IN THE EQUATION

Variable	T	Sig T
CHEM G/CS	0.138	0.8906
ENG G/CS	0.250	0.8029
PSYCH G/CS	-0.190	0.8502

TABLE 25

PROBLEM-SOLVING SKILLS CHANGES AND GRADES, COLLEGES

BACKWARD ELIMINATION REGRESSION: STEP 10

Dependent Variable: WGCTA CHNG

Variable Removed on Step Number 10: BIO G/CS

REGRESSION COEFFICIENTS

Multiple R 0.32808 R Square 0.10763

ANALYSIS OF VARIANCE

	DF	Sum of Squares	Mean Square
Regression	2	5319.79563	2659.89781
Residual	78	44105.34018	565.45308

F = 4.70401 Significance of F = 0.0118

VARIABLES IN THE EQUATION

Variable	Beta	SE Beta	T	Sig T
PHCS G/CS	-0.36111	0.11937	-3.025	0.0034
PHYSIO G/CS	0.21447	0.11937	1.797	0.0762
(Constant)			-0.864	0.3903

TABLE 26

PROBLEM-SOLVING SKILLS CHANGES AND GRADES, COLLEGES

BACKWARD ELIMINATION REGRESSION: STEP 10

Dependent Variable: WGCTA CHNG

VARIABLES NOT IN THE EQUATION

Variable	T	Sig T
BIO G/CS	0.830	0.4088
CHEM G/CS	0.295	0.7685
ENG G/CS	0.443	0.6587
PSYCH G/CS	-0.125	0.9005

TABLE 27

GRADES AND MAJORS

CANONICAL CORRELATION

Number	Eigenvalue	Canonical Correlation	DF	Significance
1	0.08775	0.29622	30	0.163
2	0.03987	0.19967	20	0.726
3	0.02178	0.14759	12	0.903
4	0.00442	0.06649	6	0.984
5	0.0	0.0	2	1.000

Coefficients for Canonical Variables
First Non-Significant Canonical Correlation

First Set Variables		Second Set Variables	
Variable	Canonical Variate 1	Variable	Canonical Variate 1
PHYSIO	-0.79511	OTR	-0.82080
BIO	-0.05421	PT	0.67695
CHEM	-0.30735	NSCI	0.52569
ENG	0.66211	SSCI	1.31740
PHCS	-0.52167	EDUC	0.0

TABLE 28

PROBLEM-SOLVING SKILLS AND MAJORS

BACKWARD ELIMINATION REGRESSION

Dependent Variable: WGCTA BTOT

Variables Entered on Step Number 1: EDUC
2: OTR
3: SSCI
4: PT

REGRESSION COEFFICIENTS

Multiple R 0.14330 R Square 0.02054

ANALYSIS OF VARIANCE

	DF	Sum of Squares	Mean Square
Regression	4	1194.67426	298.66856
Residual	76	56981.32574	749.75429

F = 0.39836 Significance of F = 0.8092

VARIABLES IN THE EQUATION

Variable	Beta	SE Beta	T	Sig T
EDUC	0.05191	0.13027	0.398	0.6914
OTR	0.11519	0.13235	0.870	0.3869
SSCI	0.15880	0.13574	1.170	0.2457
PT	0.09847	0.13708	0.718	0.4747
(Constant)			8.647	0.0000

VARIABLES NOT IN THE EQUATION

Variable	T	Sig T
NSCI	-0.000	1.0000

TABLE 29

PROBLEM-SOLVING SKILLS AND MAJORS

PEARSON CORRELATIONS

Variable Pair	Correlation Coefficient	Significance
OTR, WGCTA BTOT	0.0466	0.340
PT, WGCTA BTOT	0.0139	0.451
NSCI, WGCTA BTOT	-0.1226	0.138
SSCI, WGCTA BTOT	0.0941	0.202
EDUC, WGCTA BTOT	-0.1495	0.091

TABLE 30

PROBLEM-SOLVING SKILLS CHANGES AND MAJORS

BACKWARD ELIMINATION REGRESSION

Dependent Variable: WGCTA DIFF

Variables Entered on Step Number 1: EDUC
2: OTR
3: SSCI
4: PT

REGRESSION COEFFICIENTS

Multiple R 0.30212 R Square 0.09128

ANALYSIS OF VARIANCE

	DF	Sum of Squares	Mean Square
Regression	4	12595.46762	31482.86691
Residual	76	125398.40892	1649.97906

F = 0.90843 Significance of F = 0.1176

VARIABLES IN THE EQUATION

Variable	Beta	SE Beta	T	Sig T
EDUC	-0.22370	0.12548	-1.783	0.0786
OTR	0.05994	0.12748	0.470	0.6396
SSCI	-0.22935	0.13075	-1.754	0.0834
PT	-0.17187	0.13203	-1.302	0.1969
(Constant)			-2.375	0.0201

VARIABLES NOT IN THE EQUATION

Variable	T	Sig T
NSCI	-0.000	1.0000

TABLE 31

PROBLEM-SOLVING SKILLS CHANGES AND MAJORS

BACKWARD ELIMINATION REGRESSION: STEP 5

Dependent Variable: WGCTA DIFF

Variable Removed on Step Number 5: OTR

REGRESSION COEFFICIENTS

Multiple R 0.29771 R Square 0.08863

ANALYSIS OF VARIANCE

	DF	Sum of Squares	Mean Square
Regression	3	12230.71865	4076.90622
Residual	77	125763.15789	1633.28776

F = 2.49613 Significance of F = 0.0660

VARIABLES IN THE EQUATION

Variable	Beta	SE Beta	T	Sig T
EDUC	-0.24509	0.11635	-2.106	0.0384
SSCI	-0.25478	0.11844	-2.151	0.0346
PT	-0.19833	0.11884	-1.669	0.0992
(Constant)			-2.665	0.0094

VARIABLES NOT IN THE EQUATION

Variable	T	Sig T
OTR	0.470	0.6396
NSCI	-0.470	0.6396

TABLE 32

MAJORS, PROBLEM-SOLVING SKILLS CHANGES AND G.P.A.

PEARSON CORRELATION COEFFICIENTS

Variable Pair	Correlation Coefficient	Significance
OTR; WGTD	0.1920	0.043
PT; WGTD	-0.0719	0.262
NSCI; WGTD	0.1632	0.073
SSCI; WGTD	-0.1481	0.093
EDUC; WGTD	-0.1495	0.091
OTR; GPA1	-0.1433	0.238
OTR; GPA2	0.0970	0.315
OTR; GPA3	-0.0800	0.349
PT; GPA1	0.0138	0.473
PT; GPA2	0.2580	0.097
PT; GPA3	0.2868	0.078
NSCI; GPA1	0.0265	0.448
NSCI; GPA2	-0.3251	0.049
NSCI; GPA3	0.1884	0.178
SSCI; GPA1	0.0219	0.070
SSCI; GPA2	-0.0432	0.415
SSCI; GPA3	0.0617	0.382
EDUC; GPA1	-0.0257	0.067
EDUC; GPA2	0.1031	0.304
EDUC; GPA3	-0.4470	0.011

TABLE 33

PROBLEM-SOLVING SKILLS AND LEARNING STYLES

BACKWARD ELIMINATION REGRESSION

Dependent Variable: WGCTA BTOT

Variables Entered on Step Number
1: PARTIC
2: INDEP
3: COLLAB
4: DEPEND
5: COMPET
6: AVOID

REGRESSION COEFFICIENTS

Multiple R 0.12191 R Square 0.01486

ANALYSIS OF VARIANCE

	DF	Sum of Squares	Mean Square
Regression	6	864.58950	144.09825
Residual	74	57311.41050	774.47852

F = 0.18606 Significance of F = 0.9799

VARIABLES IN THE EQUATION

Variable	Beta	SE Beta	T	Sig T
PARTIC	-0.05681	0.15463	-0.367	0.7144
INDEP	-0.02326	0.12127	-0.192	0.8484
COLLAB	-0.03598	0.11888	-0.303	0.7630
DEPEND	-0.03132	0.13449	-0.233	0.8165
COMPET	-0.05680	0.13312	-0.427	0.6708
AVOID	0.05822	0.15167	0.384	0.7022
(Constant)			1.273	0.2070

TABLE 34

LEARNING STYLES AND W.G.C.T.A. SUBTESTS

CANNONICAL CORRELATION

Number	Eigenvalue	Canonical Correlation	DF	Significance
1	0.18773	0.43328	30	0.292
2	0.11570	0.34014	20	0.565
3	0.09188	0.30312	12	0.683
4	0.02295	0.15149	6	0.910
5	0.00518	0.07197	2	0.825

Coefficients for Canonical Variables
First Non-Significant Canonical Correlation

First Set Variables		Second Set Variables	
Variable	Canonical Variate 1	Variable	Canonical Variate 1
INDEP	0.06738	WGCTA B1	0.72883
AVOID	-0.26899	WGCTA B2	-0.47511
COLLAB	-0.77755	WGCTA B3	0.56227
DEPEND	0.28729	WGCTA B4	-0.66263
COMPET	-0.47503	WGCTA B5	0.39973
PARTIC	-0.62281		

TABLE 35

PROBLEM-SOLVING SKILLS: QUARTER 1 DESCRIPTIVE STATISTICS

Percentile Ranking	Absolute Freq	Relative Freq (Pct)	Cumulative Freq (Pct)
1	2	7.4	7.4
40	1	3.7	11.1
50	1	3.7	14.8
55	1	3.7	18.5
59	1	3.7	22.2
65	1	3.7	25.9
68	2	7.4	33.3
70	1	3.7	37.0
71	3	11.1	48.1
73	1	3.7	51.9
75	4	14.8	66.7
80	2	7.4	74.1
85	1	3.7	77.8
90	2	7.4	85.2
97	2	7.4	92.6
99	2	7.4	100.0
Total	27	100.0	

Mean	69.630	Std Err	4.725	Median	73.000
Mode	75.000	Std Dev	24.553	Variance	602.856
Kurtosis	3.072	Skewness	-1.598	Range	98.000
Minimum	1.000	Maximum	99.000		

TABLE 36

GROSS ANATOMY: DESCRIPTIVE STATISTICS

Grade	Code	Absolute Freq	Relative Freq (Pct)	Adjusted Freq (Pct)	Cumulative Freq (Pct)
D	1	2	7.4	7.7	7.7
C	2	3	11.1	11.5	19.2
B	3	14	51.9	53.9	73.1
A	4	7	25.9	26.9	100.0
Tested Out		1	3.7	None	100.0
Total		27	100.0		

Mean	3.000	Std Err	0.166	Median	3.071
Mode	3.000	Std Dev	0.849	Variance	0.720
Kurtosis	0.725	Skewness	-0.851	Range	3.000
Minimum	1.000	Maximum	4.000		

TABLE 37

FUNCTIONAL ANATOMY: DESCRIPTIVE STATISTICS

Grade	Code	Absolute Freq	Relative Freq (Pct)	Cumulative Freq (Pct)
D	1	2	7.4	7.4
C	2	11	40.7	48.1
B	3	12	44.4	92.6
A	4	2	7.4	100.0
Total		27	100.0	

Mean	2.519	Std Err	0.145	Median	2.542
Mode	3.000	Std Dev	0.753	Variance	0.567
Kurtosis	-0.107	Skewness	-0.068	Range	3.000
Minimum	1.000	Maximum	4.000		

TABLE 38

PATIENT ASSESSMENT: DESCRIPTIVE STATISTICS

Grade	Code	Absolute Freq	Relative Freq (Pct)	Cumulative Freq (Pct)
C	2	3	11.1	11.1
B	3	20	74.1	85.2
A	4	4	14.8	100.0
Total		27	100.0	

Mean	3.037	Std Err	0.100	Median	3.025
Mode	3.000	Std Dev	0.517	Variance	0.268
Kurtosis	1.289	Skewness	0.067	Range	2.000
Minimum	2.000	Maximum	4.000		

TABLE 39

BASIC PATIENT CARE SKILLS: DESCRIPTIVE STATISTICS

Grade	Code	Absolute Freq	Relative Freq (Pct)	Adjusted Freq (Pct)	Cumulative Freq (Pct)
C	2	3	7.4	7.7	7.7
B	3	22	81.5	84.6	92.3
A	4	2	7.4	100.0	100.0
Tested Out		1	3.7	None	100.0
Total		27	100.0		

Mean	3.000	Std Err	0.078	Median	3.000
Mode	3.000	Std Dev	0.400	Variance	0.160
Kurtosis	4.552	Skewness	0.0	Range	2.000
Minimum	2.000	Maximum	4.000		

TABLE 40

PROBLEM-SOLVING SKILLS AND GRADES: QUARTER 1

BACKWARD ELIMINATION REGRESSION: STEP 5

Dependent Variable: WGCTA 1TOT

Variable Removed on Step Number 5: FANAT

REGRESSION COEFFICIENTS

Multiple R 0.57009 R Square 0.32500

ANALYSIS OF VARIANCE

	DF	Sum of Squares	Mean Square
Regression	3	4841.34802	1613.78267
Residual	22	10054.99813	457.04537

F = 3.53090 Significance of F = 0.0316

VARIABLES IN THE EQUATION

Variable	Beta	SE Beta	T	Sig T
BPCS	0.17303	0.19562	0.885	0.3860
PTAS	0.52492	0.19592	2.679	0.0137
GANAT	-0.13674	0.19382	-0.705	0.4879
(Constant)			-0.716	0.4817

VARIABLES NOT IN THE EQUATION

Variable	T	Sig T
FANAT	-0.185	0.8551

TABLE 41

PROBLEM-SOLVING SKILLS AND GRADES: QUARTER 1

BACKWARD ELIMINATION REGRESSION: STEP 6

Dependent Variable: WGCTA 1TOT

Variable Removed on Step Number 6: GANAT

REGRESSION COEFFICIENTS

Multiple R 0.55654 R Square 0.30973

ANALYSIS OF VARIANCE

	DF	Sum of Squares	Mean Square
Regression	2	4613.86390	2306.93195
Residual	23	10282.48226	447.06445

F = 5.16018 Significance of F = 0.0141

VARIABLES IN THE EQUATION

Variable	Beta	SE Beta	T	Sig T
BPCS	0.13820	0.18721	0.738	0.4678
PTAS	0.48926	0.18721	2.613	0.0155
(Constant)			-0.736	0.4693

VARIABLES NOT IN THE EQUATION

Variable	T	Sig T
GANAT	-0.705	0.4879
FANAT	-0.490	0.6287

TABLE 42

PROBLEM-SOLVING SKILLS AND GRADES: QUARTER 1

BACKWARD ELIMINATION REGRESSION: STEP 7

Dependent Variable: WGCTA 1TOT

Variable Removed on Step Number 6: BPCS

REGRESSION COEFFICIENTS

Multiple R 0.54164 R Square 0.29337

ANALYSIS OF VARIANCE

	DF	Sum of Squares	Mean Square
Regression	1	4370.21356	4370.21356
Residual	24	10526.13260	438.58886

F = 9.96426 Significance of F = 0.0043

VARIABLES IN THE EQUATION

Variable	Beta	SE Beta	T	Sig T
PTAS	0.54164	0.17159	3.157	0.0043
(Constant)			-0.309	0.7602

VARIABLES NOT IN THE EQUATION

Variable	T	Sig T
GANAT	-0.501	0.6213
FANAT	-0.440	0.6639
BPCS	0.738	0.4678

TABLE 43

GRADES AND W.G.C.T.A. SUBTESTS: QUARTER 1

CANONICAL CORRELATION

Number	Eigenvalue	Canonical Correlation	DF	Significance
1	0.54131	0.73574	20	0.177
2	0.29904	0.54685	12	0.608
3	0.09431	0.30711	6	0.810
4	0.04913	0.22165	2	0.604

Coefficients for Canonical Variables
First Non-Significant Canonical Correlation

First Set Variables		Second Set Variables	
Variable	Canonical Variate 1	Variable	Canonical Variate 1
WG11	-0.29409	GANAT	-0.06353
WG12	0.13844	FANAT	-0.41834
WG13	-0.77089	PTAS	0.29722
WG14	-0.7474	BPCS	-0.90289
WG15	0.42662		

TABLE 44

PROBLEM-SOLVING SKILLS CHANGES AND GRADES: QUARTER 1

BACKWARD ELIMINATION REGRESSION

Dependent Variable: WGCTA Difference Score, N1

Variable entered on Step Number 1: BPCS
2: FANAT
3: PTAS
4: GANAT

REGRESSION COEFFICIENTS

Multiple R 0.21792 R Square 0.04749

ANALYSIS OF VARIANCE

	DF	Sum of Squares	Mean Square
Regression	4	621.89934	155.47484
Residual	21	12473.63912	593.98282

F = 0.26175 Significance of F = 0.8991

VARIABLES IN THE EQUATION

Variable	Beta	SE Beta	T	Sig T
BPCS	0.21969	0.23816	0.922	0.3668
FANAT	-0.10485	0.28693	-0.365	0.7184
PTAS	-0.30286	0.26540	-0.114	0.9103
GANAT	-0.04132	0.26562	-0.156	0.8779
(Constant)			-0.267	0.7920

TABLE 45

GROSS ANATOMY AND LEARNING STYLES

BACKWARD ELIMINATION REGRESSION: SUMMARY

Dependent Variable: GANAT

Step	Mult R	R Sq	F	Sig F	Status	Variable
1					In:	PARTIC
2					In:	INDEP
3					In:	COLLAB
4					In:	DEPEND
5					In:	COMPET
6	0.2230	0.0497	0.645	0.694	In:	AVOID
7	0.2211	0.0489	0.771	0.574	Out:	PARTIC
8	0.2190	0.0480	0.957	0.436	Out:	INDEP
9	0.1919	0.0368	0.981	0.406	Out:	COLLAB
10	0.1478	0.0219	0.871	0.422	Out:	DEPEND
11	0.1154	0.0133	1.067	0.305	Out:	COMPET
12	0.0000	0.0000	0.000	1.000	Out:	AVOID

TABLE 46

FUNCTIONAL ANATOMY AND LEARNING STYLES

BACKWARD ELIMINATION REGRESSION: SUMMARY

Dependent Variable: FANAT

Step	Mult R	R Sq	F	Sig F	Status	Variable
1					In:	PARTIC
2					In:	INDEP
3					In:	COLLAB
4					In:	DEPEND
5					In:	COMPET
6	0.1886	0.0356	0.455	0.839	In:	AVOID
7	0.1886	0.0356	0.553	0.735	Out:	PARTIC
8	0.1805	0.0326	0.640	0.635	Out:	AVOID
9	0.1733	0.0300	0.795	0.501	Out:	COLLAB
10	0.1506	0.0227	0.905	0.409	Out:	INDEP
11	0.0992	0.0098	0.785	0.378	Out:	COMPET
12	0.0000	0.0000	0.000	1.000	Out:	DEPEND

TABLE 47

PATIENT ASSESSMENT AND LEARNING STYLES

BACKWARD ELIMINATION REGRESSION: SUMMARY

Dependent Variable: PTAS

Step	Mult R	R Sq	F	Sig F	Status	Variable
1					In:	PARTIC
2					In:	INDEP
3					In:	COLLAB
4					In:	COMPET
5					In:	AVOID
6	0.4234	0.1793	0.728	0.632	In:	DEPEND
7	0.4227	0.1787	0.914	0.491	Out:	INDEP
8	0.4198	0.1763	1.177	0.348	Out:	PARTIC
9	0.4112	0.1691	1.560	0.226	Out:	COMPET
10	0.3973	0.1579	2.249	0.127	Out:	COLLAB
11	0.3181	0.1012	2.815	0.106	Out:	DEPEND
12	0.0000	0.0000	0.000	1.000	Out:	AVOID

TABLE 48

BASIC PATIENT CARE SKILLS AND LEARNING STYLES

BACKWARD ELIMINATION REGRESSION: SUMMARY

Dependent Variable: BPCS

Step	Mult R	R Sq	F	Sig F	Status	Variable
1					In:	PARTIC
2					In:	INDEP
3					In:	COLLAB
4					In:	COMPET
5					In:	AVOID
6	0.3347	0.1120	0.399	0.870	In:	DEPEND
7	0.3345	0.1119	0.504	0.770	Out:	INDEP
8	0.3299	0.1089	0.641	0.639	Out:	PARTIC
9	0.3247	0.1054	0.864	0.474	Out:	DEPEND
10	0.3203	0.0269	1.315	0.288	Out:	COMPET
11	0.2800	0.0784	2.042	0.166	Out:	COLLAB
12	0.0000	0.0000	0.000	1.000	Out:	AVOID

TABLE 49

PROBLEM-SOLVING SKILLS: QUARTER 2 DESCRIPTIVE STATISTICS

Percentile Ranking	Absolute Freq (Pct)	Relative Freq (Pct)	Cumulative Freq (Pct)
1	1	3.7	3.7
25	1	3.7	7.4
30	1	3.7	11.1
35	1	3.7	14.8
40	1	3.7	18.5
46	1	3.7	22.2
59	1	3.7	25.9
60	1	3.7	29.6
65	1	3.7	33.3
68	2	7.4	40.7
70	2	7.4	48.1
73	2	7.4	59.3
75	4	14.8	74.1
80	2	7.4	81.5
90	1	3.7	85.2
95	1	3.7	88.9
97	3	11.1	100.0
Total	27	100.0	

Mean	66.296	Std Err	4.545	Median	71.000
Mode	75.000	Std Dev	23.617	Variance	557.754
Kurtosis	1.012	Skewness	-1.016	Range	96.000
Minimum	1.000	Maximum	97.000		

TABLE 50

DEVELOPMENTAL BASIS OF HUMAN PERFORMANCE

DESCRIPTIVE STATISTICS

Grade	Code	Absolute Freq (Pct)	Relative Freq (Pct)	Cumulative Freq (Pct)
D	1	1	3.7	3.7
B	3	16	59.3	63.0
A	4	10	37.0	100.0
Total		27	100.0	

Mean	3.296	Std Err	0.129	Median	3.281
Mode	3.000	Std Dev	0.669	Variance	0.447
Kurtosis	3.979	Skewness	-1.255	Range	3.000
Minimum	1.000	Maximum	4.000		

TABLE 51

EXERCISE PHYSIOLOGY: DESCRIPTIVE STATISTICS

Grade	Code	Absolute Freq (Pct)	Relative Freq (Pct)	Cumulative Freq (Pct)
C	2	1	3.7	3.7
B	3	5	18.5	22.2
A	4	21	77.8	100.0
Total		27	100.0	

Mean	3.741	Std Err	0.101	Median	3.857
Mode	4.000	Std Dev	0.526	Variance	0.276
Kurtosis	3.462	Skewness	-1.985	Range	2.000
Minimum	2.000	Maximum	4.000		

TABLE 52

RESEARCH: DESCRIPTIVE STATISTICS

Grade	Code	Absolute Freq (Pct)	Relative Freq (Pct)	Cumulative Freq (Pct)
C	2	1	3.7	3.7
B	3	6	22.2	25.9
A	4	20	74.1	100.0
Total		27	100.0	

Mean	3.704	Std Err	0.104	Median	3.825
Mode	4.000	Std Dev	0.542	Variance	0.293
Kurtosis	2.276	Skewness	-1.703	Range	2.000
Minimum	2.000	Maximum	4.000		

TABLE 53

PATHOPHYSIOLOGY: DESCRIPTIVE STATISTICS

Grade	Code	Absolute Freq (Pct)	Relative Freq (Pct)	Cumulative Freq (Pct)
C	2	2	7.4	7.4
B	3	18	66.7	74.1
A	4	7	25.9	100.0
Total		27	100.0	

Mean	3.185	Std Err	0.107	Median	3.139
Mode	3.000	Std Dev	0.557	Variance	0.311
Kurtosis	0.164	Skewness	0.082	Range	2.000
Minimum	2.000	Maximum	4.000		

TABLE 54

FOUNDATIONS OF THE MUSCULOSKELETAL SYSTEM

DESCRIPTIVE STATISTICS

Grade	Code	Absolute Freq (Pct)	Relative Freq (Pct)	Adjusted Freq (Pct)	Cumulative Freq (Pct)
C	2	11	40.7	45.8	45.8
B	3	10	37.0	41.7	87.5
A	4	3	11.1	12.5	100.0
Missing	9	1	11.1	None	100.0
Total		27	100.0		

Mean	2.667	Std Err	0.143	Median	2.600
Mode	2.000	Std Dev	0.702	Variance	0.493
Kurtosis	-0.696	Skewness	0.579	Range	2.000
Minimum	2.000	Maximum	4.000		

TABLE 55

PHYSIOLOGY: DESCRIPTIVE STATISTICS

Grade	Code	Absolute Freq (Pct)	Relative Freq (Pct)	Cumulative Freq (Pct)
D	1	2	7.4	7.4
C	2	7	25.9	33.3
B	3	13	48.1	81.5
A	4	5	18.5	100.0
Total		27	100.0	

Mean	2.778	Std Err	0.163	Median	2.846
Mode	3.000	Std Dev	0.847	Variance	0.718
Kurtosis	-0.209	Skewness	-0.359	Range	3.000
Minimum	1.000	Maximum	4.000		

TABLE 56

PROBLEM-SOLVING SKILLS AND GRADES: QUARTER 2

BACKWARD ELIMINATION REGRESSION: STEP 9

Dependent Variable: WGCTA 2TOT

Variable Entered on Step Number 9: DBHP

REGRESSION COEFFICIENTS

Multiple R 0.55814 R Square 0.31152

ANALYSIS OF VARIANCE

	DF	Sum of Squares	Mean Square
Regression	3	4889.03574	1629.67858
Residual	20	10804.92259	540.24613

F = 3.01655 Significance of F = 0.0540

VARIABLES IN THE EQUATION

Variable	Beta	SE Beta	T	Sig T
PPHYS	-0.17538	0.26660	-0.658	0.5181
PHYSIO	0.60967	0.25772	2.366	0.0282
FMS	0.12160	0.21290	0.571	0.5743
(Constant)			1.080	0.2932

VARIABLES NOT IN THE EQUATION

Variable	T	Sig T
EXPHYS	0.549	0.5896
PHYSIO	-0.786	0.4418
RES	-0.226	0.8238

TABLE 57

PROBLEM-SOLVING SKILLS AND GRADES: QUARTER 2

BACKWARD ELIMINATION REGRESSION: STEP 10

Dependent Variable: WGCTA 2TOT

Variables Entered on Step Number 10: FMS

REGRESSION COEFFICIENTS

Multiple R 0.54799 R Square 0.30029

ANALYSIS OF VARIANCE

	DF	Sum of Squares	Mean Square
Regression	2	4712.81357	2356.40678
Residual	21	10981.14477	522.91166

F = 4.50632 Significance of F = 0.0235

VARIABLES IN THE EQUATION

Variable	Beta	SE Beta	T	Sig T
PPHYS	-0.13148	0.25115	-0.524	0.6061
PHYSIO	0.62990	0.25115	2.508	0.0204
(Constant)			1.276	0.2157

VARIABLES NOT IN THE EQUATION

Variable	T	Sig T
FMS	0.571	0.5743
EXPHYS	0.440	0.6648
DBHP	-0.396	0.6960
RES	0.006	0.9950

TABLE 58

PROBLEM-SOLVING SKILLS AND GRADES: QUARTER 2

BACKWARD ELIMINATION REGRESSION: STEP 11

Dependent Variable: WGCTA 2TOT

Variables Entered on Step Number 11: PPHYS

REGRESSION COEFFICIENTS

Multiple R 0.53959 R Square 0.29116

ANALYSIS OF VARIANCE

	DF	Sum of Squares	Mean Square
Regression	1	4569.48986	4569.48986
Residual	22	11124.46847	505.65766

F = 9.03673 Significance of F = 0.0065

VARIABLES IN THE EQUATION

Variable	Beta	SE Beta	T	Sig T
PHYSIO	0.53959	0.17950	3.006	0.0065
(Constant)			1.540	0.1379

VARIABLES NOT IN THE EQUATION

Variable	T	Sig T
PPHYS	-0.524	0.6061
FMS	0.404	0.6904
EXPHYS	0.266	0.7931
DBHP	-0.369	0.7160
RES	-0.038	0.9701

TABLE 59

GRADES AND W.G.C.T.A. SUBTESTS: QUARTER 2

CANONICAL CORRELATION

Number	Eigenvalue	Canonical Correlation	DF	Significance
1	0.63370	0.79606	30	0.387
2	0.44174	0.66463	20	0.804
3	0.14495	0.38072	12	0.970
4	0.07830	0.27983	6	0.925
5	0.03213	0.17926	2	0.758

Coefficients for Canonical Variables
First Non-Significant Canonical Correlation

First Set Variables		Second Set Variables	
Variable	Canonical Variate 1	Variable	Canonical Variate 1
PHYSIO	-0.82615	WG21	-0.11303
PPHYS	0.20229	WG22	0.64109
FMS	-0.71480	WG23	-0.08859
EXPHYS	-0.13338	WG24	-1.15481
DBHP	0.30076	WG25	0.21800
RES	0.62204		

TABLE 60

PROBLEM-SOLVING SKILLS CHANGES AND GRADES: QUARTER 2

BACKWARD ELIMINATION REGRESSION

Dependent Variable: WGCTA 2DIFF

Variables Entered on Step Number
1: RES
2: DBHP
3: EXPHYS
4: PPHYS
5: PHYSIO
6: FMS

REGRESSION COEFFICIENTS

Multiple R 0.39712 R Square 0.15770

ANALYSIS OF VARIANCE

	DF	Sum of Squares	Mean Square
Regression	6	3352.42545	558.73774
Residual	17	17905.40688	1053.25923

F = 0.53048 Significance of F = 0.7777

VARIABLES IN THE EQUATION

Variable	Beta	SE Beta	T	Sig T
RES	-0.18048	0.25208	-0.716	0.4837
DBHP	0.14482	0.29974	0.483	0.6352
EXPHYS	-0.09211	0.25284	-0.364	0.7201
PPHYS	0.16008	0.34523	0.464	0.6488
PHYSIO	-0.19290	0.32684	-0.590	0.5628
FMS	-0.28998	0.32890	-0.882	0.3903
(Constant)			0.252	0.8038

TABLE 61

PROBLEM-SOLVING SKILLS CHANGES AND GRADES: QUARTER 2

BACKWARD ELIMINATION REGRESSION: SUMMARY

Step	Mult R	R Sq	F	Sig F	Status	Variable
1					In:	RES
2					In:	DBHP
3					In:	EXPHYS
4					In:	PPHYS
5					In:	PHYSIO
6	0.3971	0.1577	0.530	0.778	In:	FMS
7	0.3888	0.1511	0.641	0.672	Out:	EXPHYS
8	0.3798	0.1442	0.801	0.540	Out:	PPHYS
9	0.3648	0.1331	1.023	0.403	Out:	PHYSIO
10	0.3516	0.1236	1.481	0.250	Out:	DBHP
11	0.3023	0.0914	2.213	0.151	Out:	FMS
12	0.0000	0.0000	0.0	1.0000	Out:	RES

TABLE 62

PATHOPHYSIOLOGY AND LEARNING STYLES

STEPWISE FORWARD REGRESSION

Dependent Variable: PPHYS

Variables Entered on Step Number 1: PARTIC

REGRESSION COEFFICIENTS

Multiple R 0.40870 R Square 0.16703

ANALYSIS OF VARIANCE

	DF	Sum of Squares	Mean Square
Regression	1	1.34864	1.34864
Residual	25	6.72544	0.26902

F = 5.01320 Significance of F = 0.0343

VARIABLES IN THE EQUATION

Variable	Beta	SE Beta	T	Sig T
PARTIC	0.40870	0.18253	2.239	0.0343
(Constant)			0.797	0.4327

VARIABLES NOT IN THE EQUATION

Variable	T	Sig T
INDEP	0.016	0.9876
AVOID	-0.048	0.9619
COLLAB	-0.639	0.5286
DEPEND	1.187	0.2469
COMPET	-0.082	0.9350

TABLE 63

PATHOPHYSIOLOGY AND LEARNING STYLES

BACKWARD ELIMINATION REGRESSION

Dependent Variable: PPHYS

Variables Entered on Step Number 1: PARTIC
2: DEPEND
3: INDEP
4: COLLAB
5: COMPET
6: AVOID

REGRESSION COEFFICIENTS

Multiple R 0.52412 R Square 0.27470

ANALYSIS OF VARIANCE

	DF	Sum of Squares	Mean Square
Regression	6	2.21797	0.36966
Residual	20	5.85610	0.29281

F = 1.26248 Significance of F = 0.3182

VARIABLES IN THE EQUATION

Variable	Beta	SE Beta	T	Sig T
PARTIC	0.18486	0.29059	0.636	0.5319
DEPEND	0.43326	0.27278	1.588	0.1279
INDEP	0.00195	0.20886	0.009	0.9926
COLLAB	-0.08380	0.21136	-0.396	0.6960
COMPET	-0.24370	0.26176	-0.931	0.3629
AVOID	-0.22974	0.29614	-0.776	0.4470
(Constant)			0.521	0.6079

TABLE 64

PATHOPHYSIOLOGY AND LEARNING STYLES

BACKWARD ELIMINATION REGRESSION: SUMMARY

Dependent Variable: PPHYS

Step	Mult R	R Sq	F	Sig F	Status	Variable
1					In:	PARTIC
2					In:	DEPEND
3					In:	INDEP
4					In:	COLLAB
5					In:	COMPET
6	0.5241	0.2747	1.262	0.318	In:	AVOID
7	0.5241	0.2747	1.591	0.206	Out:	INDEP
8	0.5186	0.2689	2.023	0.126	Out:	COLLAB
9	0.5051	0.2552	2.626	0.075	Out:	PARTIC
10	0.4342	0.1885	2.788	0.082	Out:	COMPET

TABLE 65

PHYSIOLOGY AND LEARNING STYLES

BACKWARD ELIMINATION REGRESSION: SUMMARY

Dependent Variable: PHYSIO

Step	Mult R	R Sq	F	Sig F	Status	Variable
1					In:	PARTIC
2					In:	DEPEND
3					In:	INDEP
4					In:	COLLAB
5					In:	COMPET
6	0.4788	0.2293	0.991	0.457	In:	AVOID
7	0.4761	0.2266	1.231	0.330	Out:	INDEP
8	0.4719	0.2227	1.576	0.216	Out:	COLLAB
9	0.4596	0.2113	2.053	0.134	Out:	PARTIC
10	0.3969	0.1576	2.144	0.128	Out:	COMPET

TABLE 66

RESEARCH AND LEARNING STYLES

BACKWARD ELIMINATION REGRESSION: SUMMARY

Dependent Variable: RES

Step	Mult R	R Sq	F	Sig F	Status	Variable
1					In:	PARTIC
2					In:	DEPEND
3					In:	INDEP
4					In:	COLLAB
5					In:	COMPET
6	0.3548	0.1259	0.480	0.815	In:	AVOID
7	0.3479	0.1210	0.578	0.716	Out:	DEPEND
8	0.3437	0.1181	0.737	0.577	Out:	AVOID
9	0.3313	0.1098	0.945	0.435	Out:	PARTIC
10	0.2940	0.0864	1.135	0.338	Out:	COMPET
11	0.2564	0.0657	1.759	0.197	Out:	COLLAB
12	0.0000	0.000	0.0	1.000	Out:	INDEP

TABLE 67

DEVELOPMENTAL BASIS AND LEARNING STYLE

BACKWARD ELIMINATION REGRESSION: SUMMARY

Dependent Variable: DBHP

Step	Mult R	R Sq	F	Sig F	Status	Variable
1					In:	PARTIC
2					In:	DEPEND
3					In:	INDEP
4					In:	COLLAB
5					In:	COMPET
6	0.4271	0.1824	0.744	0.621	In:	AVOID
7	0.4263	0.1817	0.933	0.480	Out:	PARTIC
8	0.4245	0.1802	1.209	0.335	Out:	COLLAB
9	0.4128	0.1704	1.575	0.223	Out:	DEPEND
10	0.3650	0.1332	1.845	0.180	Out:	COMPET
11	0.2979	0.0888	2.435	0.131	Out:	INDEP
12	0.0000	0.0000	0.0	1.000	Out:	AVOID

TABLE 68

EXERCISE PHYSIOLOGY AND LEARNING STYLE

BACKWARD ELIMINATION REGRESSION: SUMMARY

Dependent Variable: EXPHYS

Step	Mult R	R Sq	F	Sig F	Status	Variable
1					In:	PARTIC
2					In:	DEPEND
3					In:	INDEP
4					In:	COLLAB
5					In:	COMPET
6	0.4052	0.1642	0.655	0.686	In:	AVOID
7	0.4038	0.1631	0.818	0.550	Out:	COMPET
8	0.3949	0.1560	1.016	0.421	Out:	DEPEND
9	0.3849	0.1481	1.333	0.288	Out:	PARTIC
10	0.3811	0.1452	2.038	0.152	Out:	AVOID
11	0.3133	0.0982	2.721	0.112	Out:	INDEP
12	0.0000	0.0000	0.0	1.000	Out:	COLLAB

TABLE 69

MUSCULOSKELETAL SYSTEM FOUNDATIONS AND LEARNING STYLE

BACKWARD ELIMINATION REGRESSION: SUMMARY

Dependent Variable: FMS

Step	Mult R	R Sq	F	Sig F	Status	Variable
1					In:	PARTIC
2					In:	COLLAB
3					In:	DEPEND
4					In:	INDEP
5					In:	COMPET
6	0.5867	0.3442	1.487	0.241	In:	AVOID
7	0.5866	0.3441	1.889	0.146	Out:	COLLAB
8	0.5845	0.3417	2.465	0.080	Out:	PARTIC
9	0.5430	0.2949	2.788	0.067	Out:	COMPET
10	0.4834	0.2337	3.202	0.061	Out:	DEPEND
11	0.3818	0.1458	3.754	0.066	Out:	AVOID

TABLE 70

GRADES AND LEARNING STYLES: QUARTER 2

CANONICAL CORRELATION

Number	Eigenvalue	Canonical Correlation	DF	Significance
1	0.43287	0.65793	36	0.978
2	0.29689	0.54488	25	0.989
3	0.17951	0.42369	16	0.990
4	0.10038	0.31683	9	0.979
5	0.04725	0.21737	4	0.937
6	0.00090	0.03006	1	0.903

Coefficients for Canonical Variables
First Non-Significant Canonical Correlation

First Set Variables		Second Set Variables	
Variable	Canonical Variate 1	Variable	Canonical Variate 1
INDEP	0.25265	PHYSIO	-0.25078
AVOID	0.43870	PPHYS	-0.30804
COLLAB	0.27786	FMS	-0.91082
DEPEND	-0.87782	EXPHYS	0.13962
COMPET	0.66981	DBHP	0.38194
PARTIC	-0.11305	RES	0.20414

TABLE 71

PROBLEM-SOLVING SKILLS: QUARTER 3 DESCRIPTIVE STATISTICS

Percentile Ranking	Absolute Freq	Relative Freq (Pct)	Cumulative Freq (Pct)
1	1	3.8	3.8
25	1	3.8	7.7
40	1	3.8	11.5
45	2	7.7	19.2
50	1	3.8	23.1
55	1	3.8	26.9
60	1	3.8	30.8
65	1	3.8	34.6
68	1	3.8	38.5
71	1	3.8	42.3
73	2	7.7	50.0
80	2	7.7	57.7
85	3	11.5	69.2
90	4	15.4	84.6
95	1	3.8	88.5
99	3	11.5	100.0
Total	26	100.0	

Mean	70.692	Std Err	4.855	Median	74.000
Mode	90.000	Std Dev	24.754	Variance	612.780
Kurtosis	1.065	Skewness	-1.112	Range	98.000
Minimum	1.000	Maximum	99.000		

TABLE 72

NEUROPHYSIOLOGY: DESCRIPTIVE STATISTICS

Grade	Code	Absolute Freq	Relative Freq (Pct)	Cumulative Freq (Pct)
D	1	1	3.8	3.8
C	2	7	26.9	30.8
B	3	13	50.0	80.8
A	4	5	19.2	100.0
Total		26	100.0	

Mean	2.846	Std Err	0.154	Median	2.885
Mode	3.000	Std Dev	0.784	Variance	0.615
Kurtosis	-0.163	Skewness	-0.252	Range	3.000
Minimum	1.000	Maximum	4.000		

TABLE 73

PROSTHETICS-ORTHOTICS: DESCRIPTIVE STATISTICS

Grade	Code	Absolute Freq	Relative Freq (Pct)	Cumulative Freq (Pct)
D	1	1	3.8	3.8
C	2	7	26.9	30.8
B	3	17	65.4	96.2
A	1	1	3.8	100.0
Total		26	100.0	

Mean	2.692	Std Err	0.121	Median	2.794
Mode	3.000	Std Dev	0.618	Variance	0.382
Kurtosis	1.106	Skewness	-0.816	Range	3.000
Minimum	1.000	Maximum	4.000		

TABLE 74

MEDICAL LECTURES: DESCRIPTIVE STATISTICS

Grade	Code	Absolute Freq	Relative Freq (Pct)	Adjusted Freq (Pct)	Cumulative Freq (Pct)
D	1	1	3.8	4.0	4.0
C	2	9	34.6	36.0	40.0
B	3	7	26.9	28.0	68.0
A	4	8	30.8	32.0	100.0
Tested Out		1	3.8	None	100.0
Total		26	100.0		

Mean	2.880	Std Err	0.185	Median	2.857
Mode	2.000	Std Dev	0.927	Variance	0.860
Kurtosis	-1.209	Skewness	-0.087	Range	3.000
Minimum	1.000	Maximum	4.000		

TABLE 75

NEUROANATOMY: DESCRIPTIVE STATISTICS

Grade	Code	Absolute Freq	Relative Freq (Pct)	Cumulative Freq (Pct)
C	2	8	30.8	30.8
B	3	12	46.2	76.9
A	4	6	23.1	100.0
Total		26	100.0	

Mean	2.923	Std Err	0.146	Median	2.917
Mode	3.000	Std Dev	0.744	Variance	0.554
Kurtosis	-1.095	Skewness	0.127	Range	2.000
Minimum	2.000	Maximum	4.000		

TABLE 76

CLINICAL ORTHOPEDICS: DESCRIPTIVE STATISTICS

Grade	Code	Absolute Freq	Relative Freq (Pct)	Cumulative Freq (Pct)
C	2	1	3.8	3.8
B	3	23	88.5	92.3
A	4	2	7.7	100.0
Total		26	100.0	

Mean	3.038	Std Err	0.067	Median	3.022
Mode	3.000	Std Dev	0.344	Variance	0.118
Kurtosis	7.016	Skewness	0.698	Range	2.000
Minimum	2.000	Maximum	4.000		

TABLE 77

CARDIOPULMONARY P.T.: DESCRIPTIVE STATISTICS

Grade	Code	Absolute Freq	Relative Freq (Pct)	Cumulative Freq (Pct)
C	2	1	11.5	11.5
B	3	17	65.4	76.9
A	4	6	23.1	100.0
Total		26	100.0	

Mean	3.115	Std Err	0.115	Median	3.088
Mode	3.000	Std Dev	0.588	Variance	0.346
Kurtosis	0.136	Skewness	-0.008	Range	2.000
Minimum	2.000	Maximum	4.000		

TABLE 78

PSYCHOLOGY OF DISABILITY: DESCRIPTIVE STATISTICS

Grade	Code	Absolute Freq	Relative Freq (Pct)	Adjusted Freq (Pct)	Cumulative Freq (Pct)
C	2	4	15.4	16.0	16.0
B	3	14	53.8	56.0	72.0
A	4	7	26.9	28.0	100.0
Tested Out		1	3.8	None	100.0
Total		26	100.0		

Mean	3.120	Std Err	0.133	Median	3.107
Mode	3.000	Std Dev	0.666	Variance	0.443
Kurtosis	-0.557	Skewness	-0.134	Range	2.000
Minimum	1.000	Maximum	4.000		

TABLE 79

THERAPEUTIC EXERCISE: DESCRIPTIVE STATISTICS

Grade	Code	Absolute Freq	Relative Freq (Pct)	Cumulative Freq (Pct)
B	3	13	50.0	50.0
A	4	13	50.0	100.0
Total		26	100.0	

Mean	3.500	Std Err	0.100	Median	3.500
Mode	3.000	Std Dev	0.510	Variance	0.260
Kurtosis	-2.174	Skewness	0.0	Range	1.000
Minimum	1.000	Maximum	4.000		

TABLE 80

PROBLEM-SOLVING SKILLS AND GRADES: QUARTER 3

BACKWARD ELIMINATION REGRESSION

Dependent Variable: WGCTA 3TOT

Variables Entered on Step Number	
1:	PSYD
2:	PO
3:	PRTE
4:	CLORTH
5:	MLEC
6:	CPPT
7:	NANAT
8:	NPHYS

REGRESSION COEFFICIENTS

Multiple R 0.61568 R Square 0.37906

ANALYSIS OF VARIANCE

	DF	Sum of Squares	Mean Square
Regression	8	3892.26772	486.53347
Residual	16	6375.97228	398.49827

F = 1.22092 Significance of F = 0.3479

VARIABLES IN THE EQUATION

Variable	Beta	SE Beta	T	Sig T
PSYD	0.00704	0.25053	0.028	0.9779
PO	0.07394	0.28660	0.258	0.7997
PRTE	-0.12536	0.20949	-0.598	0.5580
CLORTH	0.35991	0.23391	1.539	0.1434
MLEC	-0.27618	0.22178	-1.245	0.2310
CPPT	-0.32472	0.23273	-1.395	0.1820
NANAT	-0.17745	0.36815	-0.482	0.6363
NPHYS	0.42081	0.45886	0.917	0.3727
(Constant)			0.908	0.3774

TABLE 81

PROBLEM-SOLVING SKILLS AND GRADES: QUARTER 3

BACKWARD ELIMINATION REGRESSION: STEP 15

Dependent Variable: WGCTA 3TOT

Variables Removed on Step Number 15: CPPT

REGRESSION COEFFICIENTS

Multiple R 0.40450 R Square 0.16362

ANALYSIS OF VARIANCE

	DF	Sum of Squares	Mean Square
Regression	1	1680.09135	1680.09135
Residual	23	8588.14865	373.39777

F = 4.49947 Significance of F = 0.0449

VARIABLES IN THE EQUATION

Variable	Beta	SE Beta	T	Sig T
CLORTH	0.40450	0.19069	2.121	0.0449
(Constant)			0.031	0.9758

VARIABLES NOT IN THE EQUATION

Variable	T	Sig T
NANAT	0.660	0.5163
NPHYS	1.332	0.1966
MLEC	-1.077	0.2932
PRTE	-0.136	0.8929
CPPT	-1.234	0.2302
PO	0.748	0.4627
PSYD	0.051	0.9595

TABLE 82

GRADES AND W.G.C.T.A. SUBTESTS: QUARTER 3

CANONICAL CORRELATION

Number	Eigenvalue	Canonical Correlation	DF	Significance
1	0.65244	0.80774	40	0.547
2	0.44693	0.66853	28	0.852
3	0.33352	0.57751	18	0.923
4	0.12983	0.36032	10	0.971
5	0.05755	0.02399	2	0.909

Coefficients for Canonical Variables
First Non-Significant Canonical Correlation

First Set Variables		Second Set Variables	
Variable	Canonical Variate 1	Variable	Canonical Variate 1
NANAT	0.71782	WG31	-0.12966
NPHYS	-1.66142	WG32	-0.44808
MLEC	0.02567	WG33	-0.48493
CLORTH	0.06124	WG34	1.27040
PRTE	0.63868	WG35	-0.57765
CPPT	0.25184		
PO	0.54485		
PSYD	-0.29105		

TABLE 83

PROBLEM-SOLVING SKILLS CHANGES AND GRADES: QUARTER 3

BACKWARD ELIMINATION REGRESSION

Dependent Variable: WGCTA 3DIFF

Variables Entered on Step Number 1: PSYD
2: PO
3: PRTE
4: CLORTH
5: MLEC
6: CPPT
7: NANAT
8: NPHYS

REGRESSION COEFFICIENTS

Multiple R 0.58777 R Square 0.34548

ANALYSIS OF VARIANCE

	DF	Sum of Squares	Mean Square
Regression	8	4782.75835	597.84479
Residual	16	9061.24165	566.32760

F = 1.05565 Significance of F = 0.4382

VARIABLES IN THE EQUATION

Variable	Beta	SE Beta	T	Sig T
PSYD	-0.55910	0.25722	-2.174	0.0451
PO	0.20087	0.29425	0.683	0.5046
PRTE	-0.00876	0.21508	-0.041	0.9680
CLORTH	-0.30046	0.24015	-1.251	0.2289
MLEC	0.22925	0.22770	1.007	0.3290
CPPT	0.10213	0.23894	1.427	0.6748
NANAT	-0.37206	0.37798	-0.984	0.3396
NPHYS	0.17481	0.47111	0.371	0.7155
(Constant)			0.431	0.6723

TABLE 84

PROBLEM-SOLVING SKILLS CHANGES AND GRADES: QUARTER 3

BACKWARD ELIMINATION REGRESSION: STEP 15

Dependent Variable: WGCTA 3DIFF

Variables Removed on Step Number 15: NANAT

REGRESSION COEFFICIENTS

Multiple R 0.40490 R Square 0.16395

ANALYSIS OF VARIANCE

	DF	Sum of Squares	Mean Square
Regression	1	2269.65789	2269.65789
Residual	23	11574.34211	503.23227

F = 4.51016 Significance of F = 0.0447

VARIABLES IN THE EQUATION

Variable	Beta	SE Beta	T	Sig T
PSYD	-0.40490	0.19066	-2.124	0.0447
(Constant)			-0.713	0.4830

VARIABLES NOT IN THE EQUATION

Variable	T	Sig T
NANAT	-0.973	0.3410
NPHYS	-0.374	0.7121
MLEC	0.557	0.5832
CLORTH	-1.121	0.2744
PRTE	0.042	0.9666
CPPT	0.725	0.4763
PO	0.744	0.4645

TABLE 85

GRADES AND PROBLEM-SOLVING SKILLS: QUARTER 3

PEARSON CORRELATION COEFFICIENTS

Variable Pair	Correlation Coefficient	Significance
NANAT; WGCTA 3TOT	0.1941	0.171
NPHYS; WGCTA 3TOT	0.3126	0.060
MLEC; WGCTA 3TOT	-0.1446	0.245
CLORTH; WGCTA 3TOT	0.3442	0.043
PRTE; WGCTA 3TOT	0.1299	0.263
CPPT; WGCTA 3TOT	0.1042	0.306
PO; WGCTA 3TOT	0.1374	0.253
PSYD; WGCTA 3TOT	-0.0709	0.368

TABLE 86

PEARSON CORRELATIONS: QUARTER 3 GRADES

Variable Pair	Correlation Coefficient	Significance
NANAT; NPHYS	0.8011	0.000
NANAT; MLEC	0.1633	0.218
NANAT; CLORTH	0.3243	0.053
NANAT; PRTE	0.2108	0.151
NANAT; CPPT	-0.0703	0.367
NANAT; PO	0.3815	0.000
NANAT; PSYD	-0.3098	0.066
NPHYS; MLEC	0.0854	0.342
NPHYS; CLORTH	0.4672	0.008
NPHYS; PRTE	0.3000	0.068
NPHYS; CPPT	0.0400	0.423
NPHYS; PO	0.6414	0.000
NPHYS; PSYD	-0.3098	0.066
MLEC; CLORTH	0.1433	0.247
MLEC; PRTE	0.0493	0.407
MLEC; CPPT	-0.2045	0.163
MLEC; PO	0.1461	0.243
MLEC; PSYD	-0.2942	0.077
CLORTH; PRTE	0.1140	0.290
CLORTH; CPPT	0.1747	0.197
CLORTH; PO	0.2460	0.113
CLORTH; PSYD	-0.1996	0.169
PRTE; CPPT	0.0667	0.373
PRTE; PO	0.2540	0.105
PRTE; PSYD	-0.0687	0.372
CPPT; PO	0.1016	0.311
CPPT; PSYD	-0.3933	0.026
PO; PSYD	-0.0040	0.492

TABLE 87

NEUROPHYSIOLOGY AND LEARNING STYLES

BACKWARD ELIMINATION REGRESSION: SUMMARY

Step	Mult R	R Sq	F	Sig F	Status	Variable
1					In:	PARTIC
2					In:	INDEP
3					In:	COLLAB
4					In:	DEPEND
5					In:	COMPET
6	0.4119	0.1697	0.647	0.692	In:	GRAV
7	0.4119	0.1697	0.817	0.551	Out:	GRAV
8	0.4108	0.1687	1.066	0.398	Out:	COLLAB
9	0.4056	0.1645	1.444	0.257	Out:	PARTIC
10	0.3877	0.1503	2.035	0.154	Out:	DEPEND
11	0.3297	0.1087	2.926	0.100	Out:	COMPET
12	0.0000	0.0000	0.0	1.000	Out:	INDEP

TABLE 88

NEUROANATOMY AND LEARNING STYLES

BACKWARD ELIMINATION REGRESSION: SUMMARY

Step	Mult R	R Sq	F	Sig F	Status	Variable
1					In:	PARTIC
2					In:	INDEP
3					In:	COLLAB
4					In:	DEPEND
5					In:	COMPET
6	0.2524	0.0637	0.216	0.967	In:	GRAV
7	0.2524	0.0637	0.272	0.923	Out:	GRAV
8	0.2504	0.0627	0.351	0.840	Out:	COMPET
9	0.2480	0.0615	0.481	0.699	Out:	INDEP
10	0.2369	0.0561	0.684	0.515	Out:	PARTIC
11	0.2012	0.0405	1.012	0.324	Out:	DEPEND
12	0.0000	0.0000	0.0	1.000	Out:	COLLAB

TABLE 89

CLINICAL ORTHOPEDICS AND LEARNING STYLES

BACKWARD ELIMINATION REGRESSION: SUMMARY

Step	Mult R	R Sq	F	Sig F	Status	Variable
1					In:	PARTIC
2					In:	INDEP
3					In:	COLLAB
4					In:	DEPEND
5					In:	COMPET
6	0.5520	0.3048	1.388	0.270	In:	GRAV
7	0.5518	0.3044	1.751	0.169	Out:	PARTIC
8	0.5511	0.3037	2.290	0.094	Out:	GRAV
9	0.5483	0.3007	3.153	0.045	Out:	COLLAB
10	0.5221	0.2726	4.310	0.026	Out:	DEPEND

TABLE 90

PROSTHETICS-ORTHOTICS AND LEARNING STYLES

BACKWARD ELIMINATION REGRESSION: SUMMARY

Step	Mult R	R Sq	F	Sig F	Status	Variable
1					In:	PARTIC
2					In:	INDEP
3					In:	COLLAB
4					In:	DEPEND
5					In:	COMPET
6	0.5019	0.2519	1.066	0.416	In:	GRAV
7	0.5004	0.2504	1.336	0.290	Out:	GRAV
8	0.4979	0.2479	1.730	0.181	Out:	DEPEND
9	0.4784	0.2289	2.177	0.119	Out:	COLLAB
10	0.4370	0.1910	2.715	0.087	Out:	COMPET
11	0.3358	0.1128	3.051	0.093	Out:	PARTIC

TABLE 91

PSYCHOLOGY OF DISABILITY AND LEARNING STYLES

BACKWARD ELIMINATION REGRESSION: SUMMARY

Step	Mult R	R Sq	F	Sig F	Status	Variable
1					In:	PARTIC
2					In:	INDEP
3					In:	COLLAB
4					In:	DEPEND
5					In:	COMPET
6	0.4478	0.2005	0.753	0.616	In:	GRAV
7	0.4370	0.1910	0.897	0.503	Out:	PARTIC
8	0.4240	0.1798	1.096	0.386	Out:	DEPEND
9	0.4053	0.1643	1.376	0.278	Out:	COLLAB
10	0.3588	0.1287	1.625	0.220	Out:	GRAV
11	0.2470	0.0610	1.494	0.234	Out:	INDEP
12	0.0000	0.0000	0.0	1.000	Out:	COMPET

TABLE 92

MEDICAL LECTURES AND LEARNING STYLES

BACKWARD ELIMINATION REGRESSION: SUMMARY

Step	Mult R	R Sq	F	Sig F	Status	Variable
1					In:	PARTIC
2					In:	INDEP
3					In:	COLLAB
4					In:	DEPEND
5					In:	COMPET
6	0.6343	0.4024	2.020	0.116	In:	GRAV
7	0.6205	0.3850	2.379	0.078	Out:	PARTIC
8	0.6150	0.3783	3.042	0.041	Out:	GRAV
9	0.5922	0.3507	3.781	0.026	Out:	DEPEND
10	0.5703	0.3252	5.302	0.013	Out:	COMPET
11	0.5319	0.2829	9.073	0.006	Out:	INDEP

TABLE 93

THERAPEUTIC EXERCISE AND LEARNING STYLES

BACKWARD ELIMINATION REGRESSION: SUMMARY

Step	Mult R	R Sq	F	Sig F	Status	Variable
1					In:	PARTIC
2					In:	INDEP
3					In:	COLLAB
4					In:	DEPEND
5					In:	COMPET
6	0.5881	0.3458	1.674	0.182	In:	GRAV
7	0.5877	0.3454	2.111	0.106	Out:	COMPET
8	0.5800	0.3363	2.661	0.061	Out:	COLLAB
9	0.5696	0.3244	3.521	0.032	Out:	GRAV
10	0.5387	0.2902	4.703	0.019	Out:	INDEP
11	0.4685	0.2195	6.750	0.016	Out:	DEPEND

TABLE 94

CARDIOPULMONARY P.T. AND LEARNING STYLES

BACKWARD ELIMINATION REGRESSION: SUMMARY

Step	Mult R	R Sq	F	Sig F	Status	Variable
1					In:	PARTIC
2					In:	INDEP
3					In:	COLLAB
4					In:	DEPEND
5					In:	COMPET
6	0.6113	0.3736	1.889	0.135	In:	GRAV
7	0.6111	0.3734	2.384	0.075	Out:	COMPET
8	0.6095	0.3715	3.103	0.037	Out:	PARTIC
9	0.6092	0.3711	4.327	0.015	Out:	GRAV
10	0.6010	0.3612	6.501	0.006	Out:	DEPEND

TABLE 95

MEDICAL LECTURES AND LEARNING STYLES

STEPWISE FORWARD REGRESSION

Dependent Variable: MLEC

Variables Entered on Step Number 1: COLLAB

REGRESSION COEFFICIENTS

Multiple R 0.53186 R Square 0.28288

ANALYSIS OF VARIANCE

	DF	Sum of Squares	Mean Square
Regression	1	5.83855	5.83855
Residual	23	14.80145	0.64354

F = 9.07252 Significance of F = 0.0062

VARIABLES IN THE EQUATION

Variable	Beta	SE Beta	T	Sig T
COLLAB	0.53186	0.17658	3.012	0.0062
(Constant)			-1.278	0.2139

VARIABLES NOT IN THE EQUATION

Variable	T	Sig T
INDEP	1.175	0.2524
GRAV	-0.184	0.8556
DEPEND	0.895	0.3803
COMPET	-0.443	0.6620
PARTIC	0.651	0.5217

TABLE 96

MEDICAL LECTURES AND LEARNING STYLES

BACKWARD ELIMINATION REGRESSION

Dependent Variable: MLEC

Variables Entered on Step Number 1: PARTIC
2: INDEP
3: COLLAB
4: DEPEND
5: COMPET
6: GRAV

REGRESSION COEFFICIENTS

Multiple R 0.63432 R Square 0.40236

ANALYSIS OF VARIANCE

	DF	Sum of Squares	Mean Square
Regression	6	8.30466	1.38411
Residual	18	12.33534	0.68530

F = 2.01973 Significance of F = 0.1158

VARIABLES IN THE EQUATION

Variable	Beta	SE Beta	T	Sig T
PARTIC	0.19062	0.26366	0.723	0.4790
INDEP	0.29097	0.20038	1.452	0.1637
COLLAB	0.55940	0.18647	3.000	0.0077
DEPEND	0.15738	0.19717	0.798	0.4352
COMPET	-0.25350	0.21935	-1.156	0.2629
GRAV	0.22224	0.27204	0.817	0.4246
(Constant)			-1.844	0.0817

TABLE 97

MEDICAL LECTURES AND LEARNING STYLES

BACKWARD ELIMINATION REGRESSION: STEP 8

Dependent Variable: MLEC

Variables Removed on Step Number 8: GRAV

REGRESSION COEFFICIENTS

Multiple R 0.61502 R Square 0.37825

ANALYSIS OF VARIANCE

	DF	Sum of Squares	Mean Square
Regression	4	7.80710	1.95177
Residual	20	12.83290	0.64165

F = 3.04183 Significance of F = 0.0413

VARIABLES IN THE EQUATION

Variable	Beta	SE Beta	T	Sig T
INDEP	0.25392	0.18863	1.346	0.1933
COLLAB	0.53089	0.17739	2.993	0.0072
DEPEND	0.17050	0.18118	0.941	0.3579
COMPET	-0.20435	0.19162	-1.066	0.2989
(Constant)			-1.881	0.0746

VARIABLES NOT IN THE EQUATION

Variable	T	Sig T
GRAV	0.457	0.6530
PARTIC	0.244	0.8096

TABLE 98

MEDICAL LECTURES AND LEARNING STYLES

BACKWARD ELIMINATION REGRESSION: STEP 9

Dependent Variable: MLEC

Variables Removed on Step Number 9: DEPEND

REGRESSION COEFFICIENTS

Multiple R 0.59222 R Square 0.35072

ANALYSIS OF VARIANCE

	DF	Sum of Squares	Mean Square
Regression	3	7.23887	2.41296
Residual	21	13.40113	0.63815

F = 3.78118 Significance of F = 0.0259

VARIABLES IN THE EQUATION

Variable	Beta	SE Beta	T	Sig T
INDEP	0.26481	0.18776	1.410	0.1731
COLLAB	0.52289	0.17670	2.959	0.0075
COMPET	-0.17035	0.18767	-0.908	0.3743
(Constant)			-1.659	0.1121

VARIABLES NOT IN THE EQUATION

Variable	T	Sig T
GRAV	0.241	0.8123
DEPEND	0.941	0.3579
PARTIC	0.525	0.6056

TABLE 99

MEDICAL LECTURES AND LEARNING STYLES

BACKWARD ELIMINATION REGRESSION: STEP 10

Dependent Variable: MLEC

Variables Removed on Step Number 10: COMPET

REGRESSION COEFFICIENTS

Multiple R 0.57030 R Square 0.32525

ANALYSIS OF VARIANCE

	DF	Sum of Squares	Mean Square
Regression	2	6.71308	3.35654
Residual	22	13.92692	0.63304

F = 5.30223 Significance of F = 0.0132

VARIABLES IN THE EQUATION

Variable	Beta	SE Beta	T	Sig T
INDEP	0.20657	0.17575	1.175	0.2524
COLLAB	0.51451	0.17575	2.928	0.0078
(Constant)			-1.742	0.0954

VARIABLES NOT IN THE EQUATION

Variable	T	Sig T
GRAV	-0.128	0.8991
DEPEND	0.751	0.4610
COMPET	-0.908	0.3743
PARTIC	0.703	0.4897

TABLE 100

MEDICAL LECTURES AND LEARNING STYLES

BACKWARD ELIMINATION REGRESSION: STEP 11

Dependent Variable: MLEC

Variables Removed on Step Number 11: INDEP

REGRESSION COEFFICIENTS

Multiple R 0.53186 R Square 0.28288

ANALYSIS OF VARIANCE

	DF	Sum of Squares	Mean Square
Regression	1	5.83855	5.83855
Residual	23	14.80145	0.64354

F = 9.07252 Significance of F = 0.0062

VARIABLES IN THE EQUATION

Variable	Beta	SE Beta	T	Sig T
COLLAB	0.53186	0.17658	3.012	0.0062
(Constant)			-1.278	0.2139

VARIABLES NOT IN THE EQUATION

Variable	T	Sig T
INDEP	1.175	0.2524
GRAV	-0.184	0.8556
DEPEND	0.895	0.3803
COMPET	-0.443	0.6620
PARTIC	0.651	0.5217

TABLE 101

THERAPEUTIC EXERCISE AND LEARNING STYLES

STEPWISE FORWARD REGRESSION

Dependent Variable: PRTE

REGRESSION COEFFICIENTS

Multiple R 0.46853 R Square 0.21952

ANALYSIS OF VARIANCE

	DF	Sum of Squares	Mean Square
Regression	1	1.42688	1.42688
Residual	24	5.07312	0.21138

F = 6.75029 Significance of F = 0.0158

VARIABLES IN THE EQUATION

Variable	Beta	SE Beta	T	Sig T
PARTIC	-0.46853	0.18033	-2.598	0.0158
(Constant)			6.411	0.0000

VARIABLES NOT IN THE EQUATION

Variable	T	Sig T
INDEP	1.213	0.2374
GRAV	-0.613	0.5460
COLLAB	-0.336	0.7401
DEPEND	1.514	0.1437
COMPET	0.371	0.7142

TABLE 102

THERAPEUTIC EXERCISE AND LEARNING STYLES

BACKWARD ELIMINATION REGRESSION

Dependent Variable: PRTE

Variables Entered on Step Number 1: PARTIC
2: INDEP
3: COLLAB
4: DEPEND
5: COMPET
6: GRAV

REGRESSION COEFFICIENTS

Multiple R 0.58808 R Square 0.34583

ANALYSIS OF VARIANCE

	DF	Sum of Squares	Mean Square
Regression	6	2.24793	0.37465
Residual	19	4.25207	0.22379

F = 1.67411 Significance of F = 0.1819

VARIABLES IN THE EQUATION

Variable	Beta	SE Beta	T	Sig T
PARTIC	-0.65519	0.27612	-2.373	0.0284
INDEP	0.18660	0.20560	0.908	0.3755
COLLAB	-0.09441	0.19268	-0.490	0.6298
DEPEND	0.26249	0.19728	1.330	0.1991
COMPET	-0.02340	0.21764	-1.108	0.9155
GRAV	-0.17312	0.28515	-0.607	0.5510
(Constant)			1.858	0.0788

TABLE 103

THERAPEUTIC EXERCISE AND LEARNING STYLES

BACKWARD ELIMINATION REGRESSION: STEP 9

Dependent Variable: PRTE

Variables Removed on Step Number 9: GRAV

REGRESSION COEFFICIENTS

Multiple R 0.56955 R Square 0.32439

ANALYSIS OF VARIANCE

	DF	Sum of Squares	Mean Square
Regression	3	2.10855	0.70285
Residual	22	4.39145	0.19961

F = 3.52108 Significance of F = 0.0319

VARIABLES IN THE EQUATION

Variable	Beta	SE Beta	T	Sig T
PARTIC	-0.52276	0.18016	-2.902	0.0083
INDEP	0.18626	0.17665	1.054	0.3031
DEPEND	0.24918	0.18143	1.373	0.1834
(Constant)			2.176	0.0406

VARIABLES NOT IN THE EQUATION

Variable	T	Sig T
GRAV	-0.615	0.5451
COLLAB	-0.415	0.6822
COMPET	-0.359	0.7231

TABLE 104

THERAPEUTIC EXERCISE AND LEARNING STYLES

BACKWARD ELIMINATION REGRESSION: STEP 10

Dependent Variable: PRTE

Variables Removed on Step Number 10: INDEP

REGRESSION COEFFICIENTS

Multiple R 0.53875 R Square 0.29025

ANALYSIS OF VARIANCE

	DF	Sum of Squares	Mean Square
Regression	2	1.88662	0.94331
Residual	23	4.61338	0.20058

F = 4.70289 Significance of F = 0.0194

VARIABLES IN THE EQUATION

Variable	Beta	SE Beta	T	Sig T
PARTIC	-0.53090	0.18043	-2.942	0.0073
DEPEND	0.27317	0.18043	1.514	0.1437
(Constant)			3.336	0.0127

VARIABLES NOT IN THE EQUATION

Variable	T	Sig T
INDEP	1.054	0.3031
GRAV	-0.769	0.4501
COLLAB	-0.289	0.7755
COMPET	0.020	0.9844

TABLE 105

THERAPEUTIC EXERCISE AND LEARNING STYLES

BACKWARD ELIMINATION REGRESSION: STEP 11

Dependent Variable: PRTE

Variables Removed on Step Number 11: DEPEND

REGRESSION COEFFICIENTS

Multiple R 0.46853 R Square 0.21952

ANALYSIS OF VARIANCE

	DF	Sum of Squares	Mean Square
Regression	1	1.42688	1.42688
Residual	24	5.07312	0.21138

F = 6.75029 Significance of F = 0.0158

VARIABLES IN THE EQUATION

Variable	Beta	SE Beta	T	Sig T
PARTIC	-0.46853	0.18033	-2.598	0.0158
(Constant)			6.411	0.0000

VARIABLES NOT IN THE EQUATION

Variable	T	Sig T
INDEP	1.213	0.2374
GRAV	-0.613	0.5460
COLLAB	-0.336	0.7401
DEPEND	1.514	0.1437
COMPET	0.371	0.7142

TABLE 106

CARDIOPULMONARY P.T. AND LEARNING STYLES

STEPWISE FORWARD REGRESSION

Dependent Variable: CPPT

REGRESSION COEFFICIENTS

Multiple R 0.49613 R Square 0.24615

ANALYSIS OF VARIANCE

	DF	Sum of Squares	Mean Square
Regression	1	2.13010	2.13010
Residual	24	6.52374	0.27182

F = 7.83636 Significance of F = 0.0099

VARIABLES IN THE EQUATION

Variable	Beta	SE Beta	T	Sig T
INDEP	-0.49613	0.17723	-2.799	0.0099
(Constant)			5.437	0.0000

VARIABLES NOT IN THE EQUATION

Variable	T	Sig T
GRAV	0.361	0.7215
COLLAB	-2.035	0.0535
DEPEND	-0.442	0.6627
COMPET	-0.293	0.7719
PARTIC	0.020	0.9844

TABLE 107

CARDIOPULMONARY P.T. AND LEARNING STYLES

BACKWARD ELIMINATION REGRESSION

Dependent Variable: CPPT

Variables Entered on Step Number 1: PARTIC
2: INDEP
3: COLLAB
4: DEPEND
5: COMPET
6: GRAV

REGRESSION COEFFICIENTS

Multiple R 0.61127 R Square 0.37365

ANALYSIS OF VARIANCE

	DF	Sum of Squares	Mean Square
Regression	6	3.23347	0.53891
Residual	19	5.42038	0.28528

F = 1.88904 Significance of F = 0.1352

VARIABLES IN THE EQUATION

Variable	Beta	SE Beta	T	Sig T
PARTIC	0.06664	0.27019	0.247	0.8078
INDEP	-0.43127	0.20118	-2.114	0.0452
COLLAB	-0.33591	0.18854	-1.782	0.0908
DEPEND	-0.10570	0.19304	-0.548	0.5904
COMPET	-0.01892	0.21296	-0.089	0.9301
GRAV	0.07362	0.27902	0.264	0.7937
(Constant)			2.737	0.0131

TABLE 108

CARDIOPULMONARY P.T. AND LEARNING STYLES

BACKWARD ELIMINATION REGRESSION: STEP 8

Dependent Variable: CPPT

Variables Removed on Step Number 8: PARTIC

REGRESSION COEFFICIENTS

Multiple R 0.60949 R Square 0.37148

ANALYSIS OF VARIANCE

	DF	Sum of Squares	Mean Square
Regression	4	3.21473	0.80368
Residual	21	5.43911	0.25901

F = 3.10296 Significance of F = 0.0374

VARIABLES IN THE EQUATION

Variable	Beta	SE Beta	T	Sig T
INDEP	-0.44362	0.17585	-2.523	0.0198
COLLAB	-0.34497	0.17552	-1.965	0.0627
DEPEND	-0.09857	0.17537	-0.562	0.5800
GRAV	0.02002	0.17551	0.114	0.9103
(Constant)			4.296	0.000

VARIABLES NOT IN THE EQUATION

Variable	T	Sig T
COMPET	-0.071	0.9439
PARTIC	0.247	0.8077

TABLE 109

CARDIOPULMONARY P.T. AND LEARNING STYLES

BACKWARD ELIMINATION REGRESSION: STEP 9

Dependent Variable: CPPT

Variables Removed on Step Number 9: GRAV

REGRESSION COEFFICIENTS

Multiple R 0.60917 R Square 0.37109

ANALYSIS OF VARIANCE

	DF	Sum of Squares	Mean Square
Regression	3	3.21136	1.07045
Residual	22	5.44248	0.24739

F = 4.32707 Significance of F = 0.0153

VARIABLES IN THE EQUATION

Variable	Beta	SE Beta	T	Sig T
INDEP	-0.44490	0.17151	-2.594	0.0166
COLLAB	-0.34721	0.17046	-2.037	0.0539
DEPEND	-0.10053	0.17057	-0.589	0.5616
(Constant)			4.768	0.0001

VARIABLES NOT IN THE EQUATION

Variable	T	Sig T
GRAV	0.114	0.9103
COMPET	-0.028	0.9780
PARTIC	0.093	0.9271

TABLE 110

CARDIOPULMONARY P.T. AND LEARNING STYLES

BACKWARD ELIMINATION REGRESSION: STEP 10

Dependent Variable: CPPT

Variables Removed on Step Number 10: DEPEND

REGRESSION COEFFICIENTS

Multiple R 0.60097 R Square 0.36116

ANALYSIS OF VARIANCE

	DF	Sum of Squares	Mean Square
Regression	2	3.12544	1.56272
Residual	23	5.52841	0.24037

F = 6.50142 Significance of F = 0.0058

VARIABLES IN THE EQUATION

Variable	Beta	SE Beta	T	Sig T
INDEP	-0.45751	0.16774	-2.728	0.0120
COLLAB	-0.34133	0.16774	-2.035	0.0535
(Constant)			5.805	0.0000

VARIABLES NOT IN THE EQUATION

Variable	T	Sig T
GRAV	0.173	0.8646
DEPEND	-0.589	0.5616
COMPET	-0.130	0.8974
PARTIC	-0.043	0.9660

TABLE 111

GRADES AND LEARNING STYLES

CANNONICAL CORRELATION

Number	Eigenvalue	Canonical Correlation	DF	Significance
1	0.79646	0.89245	48	0.141
2	0.62299	0.78930	35	0.598
3	0.41595	0.64494	24	0.880
4	0.30891	0.55580	15	0.947
5	0.06295	0.25089	8	0.996
6	0.01089	0.10437	3	0.981

Coefficients for Canonical Variables
First Non-Significant Canonical Correlation

First Set Variables		Second Set Variables	
Variable	Canonical Variate 1	Variable	Canonical Variate 1
NANAT	-0.69994	INDEP	0.98761
NPHYS	0.77029	GRAV	0.10195
MLEC	0.34869	COLLAB	0.35614
CLORTH	0.40231	DEPEND	0.07302
PRTE	0.06131	COMPET	-0.54171
CPPT	-0.61634	PARTIC	0.03031
PO	0.03869		
PSYD	0.09262		

TABLE 112

PROBLEM-SOLVING SKILLS DIFFERENCE AND GRADES: ALL QUARTERS

BACKWARD ELIMINATION REGRESSION

Dependent Variable: WGCTA DIFF

Variables Entered on Step Number

1:	PSYD
2:	FMS
3:	GANAT
4:	EXPHYS
5:	NPHYS
6:	FANAT
7:	PHYSIO
8:	MLEC
9:	PRTE
10:	BPCS
11:	DBHP
12:	PTAS
13:	PO
14:	RES
15:	NANAT
16:	CLORTH
17:	PPHYS

REGRESSION COEFFICIENTS

Multiple R 0.81657 R Square 0.66679

ANALYSIS OF VARIANCE

	DF	Sum of Squares	Mean Square
Regression	17	920129.79843	5412.52823
Residual	63	45980.89670	729.85550

F = 7.41589 Significance of F = 0.0000

TABLE 113

PROBLEM-SOLVING SKILLS DIFFERENCE AND GRADES: ALL QUARTERS

BACKWARD ELIMINATION REGRESSION: VARIABLES IN THE EQUATION

Variable	Beta	SE Beta	T	Sig T
PSYD	-0.29852	0.27735	-1.076	0.2859
FMS	-0.11404	0.16670	-0.684	0.4964
GANAT	-0.09087	0.31254	-0.291	0.7722
EXPHYS	-0.41113	0.48204	-0.853	0.3969
NPHYS	0.41516	0.49237	0.843	0.4023
FANAT	-0.06452	0.28245	-0.228	0.8200
PHYSIO	-0.20159	0.29422	-0.685	0.4957
MLEC	0.45333	0.24797	1.828	0.0723
PRTE	-0.17550	0.39487	-0.444	0.6582
BPCS	0.24121	0.34016	0.709	0.4809
DBHP	0.06797	0.33125	0.205	0.8381
PTAS	-0.00960	0.36566	-0.026	0.9791
PO	0.12667	0.37721	0.336	0.7381
RES	-0.26820	0.38406	-0.698	0.4876
NANAT	-0.46804	0.43112	-1.086	0.2818
CLORTH	-0.76354	0.45127	-1.692	0.0956
PPHYS	0.20422	0.52885	0.386	0.7007
(Constant)			0.329	0.7436

TABLE 114

PROBLEM-SOLVING SKILLS DIFFERENCE AND GRADES: ALL QUARTERS

BACKWARD ELIMINATION REGRESSION: SUMMARY

Step	Mult R	R Sq	F	Sig F	Status	Variable
1					In:	PSYD
2					In:	FMS
3					In:	GANAT
4					In:	EXPHYS
5					In:	NPHYS
6					In:	FANAT
7					In:	PHYSIO
8					In:	MLEC
9					In:	PRTE
10					In:	BPCS
11					In:	DBHP
12					In:	PTAS
13					In:	PO
14					In:	RES
15					In:	NANAT
16					In:	CLORTH
17	0.8166	0.6668	7.416	0.000	In:	PPHYS
18	0.8166	0.6668	8.004	0.000	Out:	PTAS
19	0.8164	0.6666	8.663	0.000	Out:	DBHP
20	0.8162	0.6661	9.406	0.000	Out:	GANAT
21	0.8158	0.6655	10.256	0.000	Out:	PO
22	0.8153	0.6648	11.237	0.000	Out:	PPHYS
23	0.8149	0.6640	12.397	0.000	Out:	PRTE
24	0.8141	0.6627	13.755	0.000	Out:	FANAT
25	0.8133	0.6615	15.414	0.000	Out:	FMS
26	0.8124	0.6600	17.472	0.000	Out:	EXPHYS
27	0.8094	0.6551	19.807	0.000	Out:	PHYSIO
28	0.8058	0.6493	22.833	0.000	Out:	PSYD
29	0.8021	0.6434	27.060	0.000	Out:	NANAT
30	0.8010	0.6416	34.011	0.000	Out:	NPHYS
31	0.7943	0.6310	43.887	0.000	Out:	BPCS

TABLE 115

PROBLEM-SOLVING SKILLS DIFFERENCE AND GRADES: ALL QUARTERS

BACKWARD ELIMINATION REGRESSION: STEP 31

Dependent Variable: WGCTA CHNG

Variable Removed on Step Number 31: BPCS

REGRESSION COEFFICIENTS

Multiple R 0.79434 R Square 0.63098

ANALYSIS OF VARIANCE

	DF	Sum of Squares	Mean Square
Regression	3	87071.64086	29023.88029
Residual	77	50922.23569	661.32774

F = 43.88729 Significance of F = 0.0000

VARIABLES IN THE EQUATION

Variable	Beta	SE Beta	T	Sig T
MLEC	0.23248	0.13735	1.693	0.0946
RES	-0.73638	0.07865	-9.362	0.0000
CLORTH	-0.99217	0.14196	-6.989	0.0000
(Constant)			2.281	0.0253

TABLE 116

PROBLEM-SOLVING SKILLS DIFFERENCE AND GRADES: ALL QUARTERS

BACKWARD ELIMINATION REGRESSION: STEP 31

VARIABLES NOT IN THE EQUATION

Variable	T	Sig T
GANAT	1.083	0.2820
FANAT	0.423	0.6737
PTAS	0.962	0.3392
BPCS	1.500	0.1379
PHYSIO	-1.142	0.2570
PPHYS	-0.990	0.3255
FMS	-0.691	0.4919
EXPHYS	-1.012	0.3146
DBHP	-0.848	0.3991
NANAT	-0.289	0.7736
NPHYS	0.631	0.5301
PRTE	-0.648	0.5190
PO	0.518	0.6061
PSYD	-1.143	0.2568

TABLE 117

PROBLEM-SOLVING SKILLS CHANGES AND PATIENT CARE COURSES

BACKWARD ELIMINATION REGRESSION: SUMMARY

Step	Mult R	R Sq	F	Sig F	Status	Variable
1					In:	LEC3
2					In:	PTCR2
3					In:	LEC1
4					In:	LEC2
5					In:	PTCR3
6	0.9302	0.8653	79.261	0.000	In:	PTCR1
7	0.9302	0.8653	96.386	0.000	Out:	PTCR2
8	0.9302	0.8652	121.931	0.000	Out:	LEC3
9	0.9292	0.8635	162.320	0.000	Out:	LEC1
10	0.9276	0.8604	240.406	0.000	Out:	LEC2
11	0.9270	0.8594	482.944	0.000	Out:	PTCR3

TABLE 118

PROBLEM-SOLVING SKILLS CHANGES AND G.P.A.

BACKWARD ELIMINATION REGRESSION

Dependent Variable: WGCHNG

Variables Entered on Step Number 1: GPA3
2: GPA2
3: GPA1

REGRESSION COEFFICIENTS

Multiple R 0.24658 R Square 0.06080

ANALYSIS OF VARIANCE

	DF	Sum of Squares	Mean Square
Regression	3	3005.19080	1001.73027
Residual	77	46419.94500	602.85634

F = 1.66164 Significance of F = 0.1822

VARIABLES IN THE EQUATION

Variable	Beta	SE Beta	T	Sig T
GPA3	-0.54946	0.26937	-2.040	0.0448
GPA2	-0.59947	0.27029	-2.218	0.0295
GPA1	-0.56363	0.27054	-2.083	0.0405
(Constant)			1.160	0.2497

TABLE 119

PROBLEM-SOLVING SKILLS CHANGES AND LEARNING STYLES

BACKWARD ELIMINATION REGRESSION

Dependent Variable: WGCHNG

Variables Entered on Step Number 1: PARTIC
2: INDEP
3: COLLAB
4: DEPEND
5: COMPET
6: GRAV

REGRESSION COEFFICIENTS

Multiple R 0.29476 R Square 0.08689

ANALYSIS OF VARIANCE

	DF	Sum of Squares	Mean Square
Regression	6	4294.36337	715.72723
Residual	74	45130.77243	609.87530

F = 1.17356 Significance of F = 0.3297

VARIABLES IN THE EQUATION

Variable	Beta	SE Beta	T	Sig T
PARTIC	0.23643	0.14887	1.588	0.1165
INDEP	-0.10806	0.11675	-0.926	0.3577
COLLAB	0.17354	0.11445	1.516	0.1337
DEPEND	-0.07239	0.12948	-0.559	0.5778
COMPET	0.06355	0.12816	0.496	0.6214
GRAV	0.23404	0.14602	1.603	0.1132
(Constant)			-1.555	0.1241

TABLE 120

LEARNING STYLES AND G.P.A.

CANONICAL CORRELATION

Number	Eigenvalue	Canonical Correlation	DF	Significance
1	0.10181	0.31908	18	0.804
2	0.05618	0.23702	10	0.908
3	0.00535	0.07317	4	0.982

Coefficients for Canonical Variables
First Non-Significant Canonical Correlation

First Set Variables		Second Set Variables	
Variable	Canonical Variate 1	Variable	Canonical Variate 1
INDEP	0.66606	GPA1	1.87200
GRAV	-0.58235	GPA2	1.03553
COLLAB	-0.38119	GPA3	1.69573
DEPEND	-0.16660		
COMPET	0.26967		
PARTIC	0.24523		

TABLE 121

QUESTIONNAIRE: PEARSON CORRELATION COEFFICIENTS

PREREQUISITE COURSES AND W.G.C.T.A. SCORES

Variable Pair	Correlation Coefficient	Significance
PHYSIO Use; WGBTT	-0.0300	0.322
PHYSIO Use; WGB1	-0.1151	0.038
PHYSIO Use; WGB2	-0.1167	0.036
PHYSIO Use; WGB3	-0.0420	0.259
PHYSIO Use; WGB4	0.0523	0.210
PHYSIO Use; WGB5	0.1086	0.047
PHYSIO Grade; WGBTT	-0.0290	0.329
PHYSIO Grade; WGB1	-0.0481	0.232
PHYSIO Grade; WGB2	-0.1009	0.062
PHYSIO Grade; WGB3	0.0106	0.436
PHYSIO Grade; WGB4	0.0555	0.199
PHYSIO Grade; WGB5	0.0596	0.182
PHYSIO G/Agree; WGBTT	0.1083	0.048
PHYSIO G/Agree; WGB1	0.0491	0.226
PHYSIO G/Agree; WGB2	-0.1321	0.021
PHYSIO G/Agree; WGB3	0.1614	0.006
PHYSIO G/Agree; WGB4	0.0255	0.348
PHYSIO G/Agree; WGB5	-0.0313	0.316
BIO Use; WGBTT	-0.2824	0.000
BIO Use; WGB1	-0.2002	0.001
BIO Use; WGB2	-0.1468	0.012
BIO Use; WGB3	-0.0452	0.246
BIO Use; WGB4	-0.1408	0.016
BIO Use; WGB5	-0.1751	0.004
BIO Grade; WGBTT	-0.1630	0.007
BIO Grade; WGB1	-0.1375	0.019
BIO Grade; WGB2	-0.1421	0.016
BIO Grade; WGB3	0.0939	0.079
BIO Grade; WGB4	-0.1330	0.022
BIO Grade; WGB5	0.0060	0.464

BIO G/Agree; WGBTT	-0.0119	0.429
BIO G/Agree; WGB1	-0.0464	0.241
BIO G/Agree; WGB2	0.1014	0.062
BIO G/Agree; WGB3	-0.0568	0.195
BIO G/Agree; WGB4	0.0016	0.491
BIO G/Agree; WGB5	-0.1154	0.040
CHEM Use; WGBTT	-0.1585	0.007
CHEM Use; WGB1	-0.0566	0.191
CHEM Use; WGB2	-0.2267	0.000
CHEM Use; WGB3	-0.0785	0.113
CHEM Use; WGB4	0.0631	0.165
CHEM Use; WGB5	-0.0235	0.359
CHEM Grade; WGBTT	-0.0937	0.081
CHEM Grade; WGB1	0.0156	0.408
CHEM Grade; WGB2	-0.2288	0.000
CHEM Grade; WGB3	-0.0372	0.289
CHEM Grade; WGB4	0.0754	0.130
CHEM Grade; WGB5	0.0762	0.127
CHEM G/Agree; WGBTT	0.2394	0.000
CHEM G/Agree; WGB1	0.1691	0.005
CHEM G/Agree; WGB2	-0.0956	0.071
CHEM G/Agree; WGB3	0.1852	0.002
CHEM G/Agree; WGB4	0.2123	0.001
CHEM G/Agree; WGB5	0.2799	0.000
ENG Use; WGBTT	-0.0450	0.246
ENG Use; WGB1	-0.1216	0.032
ENG Use; WGB2	-0.1523	0.010
ENG Use; WGB3	-0.1225	0.031
ENG Use; WGB4	0.1515	0.010
ENG Use; WGB5	0.2549	0.000
ENG Grade; WGBTT	0.1540	0.010
ENG Grade; WGB1	0.1450	0.014
ENG Grade; WGB2	-0.0268	0.344
ENG Grade; WGB3	0.0513	0.220
ENG Grade; WGB4	0.2496	0.000
ENG Grade; WGB5	0.2396	0.000

ENG G/Agree; WGBTT	0.0954	0.074
ENG G/Agree; WGB1	0.2005	0.001
ENG G/Agree; WGB2	-0.0026	0.484
ENG G/Agree; WGB3	0.1398	0.017
ENG G/Agree; WGB4	0.0441	0.253
ENG G/Agree; WGB5	-0.0056	0.466
PHCS Use; WGBTT	-0.1220	0.074
PHCS Use; WGB1	-0.0760	0.001
PHCS Use; WGB2	0.0667	0.152
PHCS Use; WGB3	0.0284	0.331
PHCS Use; WGB4	-0.0457	0.241
PHCS Use; WGB5	-0.1997	0.001
PHCS Grade; WGBTT	-0.1660	0.005
PHCS Grade; WGB1	0.0342	0.301
PHCS Grade; WGB2	0.1305	0.023
PHCS Grade; WGB3	0.0669	0.154
PHCS Grade; WGB4	-0.0908	0.083
PHCS Grade; WGB5	-0.3059	0.000
PHCS G/Agree; WGBTT	-0.1250	0.027
PHCS G/Agree; WGB1	-0.1570	0.008
PHCS G/Agree; WGB2	0.0649	0.160
PHCS G/Agree; WGB3	-0.0804	0.000
PHCS G/Agree; WGB4	-0.2376	0.000
PHCS G/Agree; WGB5	-0.1493	0.011
PSYCH Use; WGBTT	-0.0886	0.089
PSYCH Use; WGB1	-0.2766	0.000
PSYCH Use; WGB2	-0.2314	0.000
PSYCH Use; WGB3	-0.1181	0.036
PSYCH Use; WGB4	-0.0527	0.211
PSYCH Use; WGB5	0.1919	0.002
PSYCH Grade; WGBTT	0.0013	0.492
PSYCH Grade; WGB1	-0.0912	0.089
PSYCH Grade; WGB2	-0.1098	0.053
PSYCH Grade; WGB3	0.0443	0.257
PSYCH Grade; WGB4	-0.0038	0.478
PSYCH Grade; WGB5	0.1852	0.003
PSYCH G/Agree; WGBTT	0.0759	0.121
PSYCH G/Agree; WGB1	0.8711	0.089
PSYCH G/Agree; WGB2	0.0637	0.163
PSYCH G/Agree; WGB3	0.1874	0.002
PSYCH G/Agree; WGB4	0.1076	0.048
PSYCH G/Agree; WGB5	-0.0080	0.451

TABLE 122

QUESTIONNAIRE: PEARSON CORRELATION COEFFICIENTS

PREREQUISITE COURSES AND GRADES

Variable Pair	Correlation Coefficient	Significance
PHYSIO Use; Grade	-0.0022	0.486
PHYSIO Grade; Grade	0.0438	0.253
PHYSIO G/Agree; Grade	0.2405	0.006
BIO Use; Grade	-0.0113	0.432
BIO Grade; Grade	0.0474	0.238
BIO G/Agree; Grade	0.1562	0.009
CHEM Use; Grade	0.0222	0.366
CHEM Grade; Grade	0.6638	0.161
CHEM G/Agree; Grade	0.0869	0.091
ENG Use; Grade	-0.0103	0.438
ENG Grade; Grade	0.0039	0.476
ENG G/Agree; Grade	0.1385	0.018
PHCS Use; Grade	-0.0643	0.160
PHCS Grade; Grade	0.0144	0.413
PHCS G/Agree; Grade	0.0976	0.067
PSYCH Use; Grade	-0.0839	0.101
PSYCH Grade; Grade	-0.0413	0.271
PSYCH G/Agree; Grade	0.0445	0.246