INFORMATION TO USERS

While the most advanced technology has been used to photograph and reproduce this manuscript, the quality of the reproduction is heavily dependent upon the quality of the material submitted. For example:

- Manuscript pages may have indistinct print. In such cases, the best available copy has been filmed.

- Manuscripts may not always be complete. In such cases, a note will indicate that it is not possible to obtain missing pages.

- Copyrighted material may have been removed from the manuscript. In such cases, a note will indicate the deletion.

Oversize materials (e.g., maps, drawings, and charts) are photographed by sectioning the original, beginning at the upper left-hand corner and continuing from left to right in equal sections with small overlaps. Each oversize page is also filmed as one exposure and is available, for an additional charge, as a standard 35mm slide or as a 17"x 23" black and white photographic print.

Most photographs reproduce acceptably on positive microfilm or microfiche but lack the clarity on xerographic copies made from the microfilm. For an additional charge, 35mm slides of 6"x 9" black and white photographic prints are available for any photographs or illustrations that cannot be reproduced satisfactorily by xerography.

Wood, Douglas Lee

AN EMPIRICAL STUDY OF THE EFFECTS OF DIFFERENCES IN TEACHING METHODS ON KNOWLEDGE ACQUISITION AND ATTITUDES TOWARD MEDICAL ROUNDS

Wayne State University PH.D. 1986

PLEASE NOTE:

In all cases this material has been filmed in the best possible way from the available copy. Problems encountered with this document have been identified here with a check mark ✓.

1. Glossy photographs or pages _____
2. Colored illustrations, paper or print _____
3. Photographs with dark background _____
4. Illustrations are poor copy _____
5. Pages with black marks, not original copy ✓
6. Print shows through as there is text on both sides of page _____
7. Indistinct, broken or small print on several pages ✓
8. Print exceeds margin requirements _____
9. Tightly bound copy with print lost in spine _____
10. Computer printout pages with indistinct print _____
11. Page(s) _____ lacking when material received, and not available from school or author.
12. Page(s) _____ seem to be missing in numbering only as text follows.
13. Two pages numbered _____. Text follows.
14. Curling and wrinkled pages _____
15. Dissertation contains pages with print at a slant, filmed as received ✓
16. Other _____

_____

_____

University
Microfilms
International

AN EMPIRICAL STUDY OF THE EFFECTS OF DIFFERENCES IN TEACHING METHODS ON KNOWLEDGE ACQUISITION AND ATTITUDES TOWARD MEDICAL ROUNDS

by
DOUGLAS LEE WOOD

A DISSERTATION

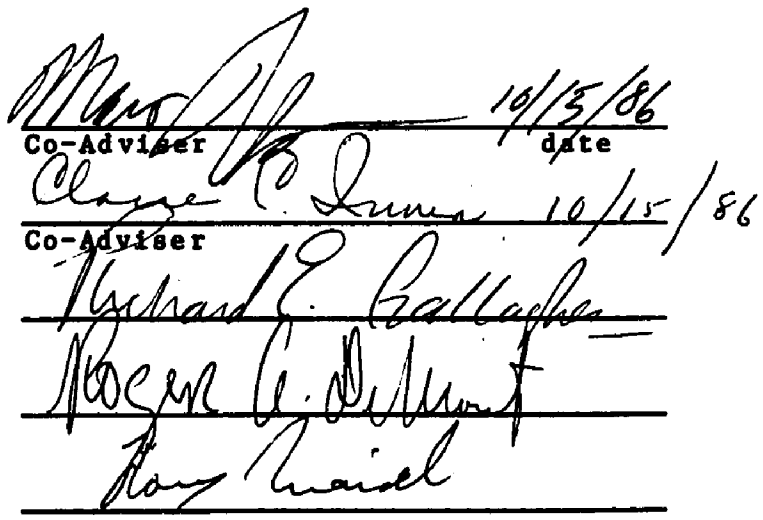
Submitted to the Graduate School
of Wayne State University
Detroit, Michigan

in partial fulfillment of the requirements
for the degree of

DOCTOR OF PHILOSOPHY
1986

MAJOR: EVALUATION AND RESEARCH

Approved by:



Co-Adviser 10/15/86 date

Co-Adviser 10/15/86

To those who are always there when needed:

Jan, Michelle, Jeffrey, Melynda, and Joel

ACKNOWLEDGEMENTS

Although the end product of a dissertation represents the work of a single individual, in almost all instances many entities and people contribute to the effort. The Division of Educational Services and Research of the Wayne State University College of Medicine provided a framework which allowed me to progress through a formal education program in medical education. To that division and those persons who developed it and managed it as a medical education unit of excellence, I owe deep felt gratitude. Its absence will be felt not only by its parent school but also by the medical education community as a whole.

To Dr. Rebecca Henry of the Office of Medical Education Research and Development of the College of Human Medicine at Michigan State University I extend my thanks. Her insight into clinical education was most helpful. Sarah Sprafka, Ph.D., of the College of Osteopathic Medicine at Michigan State University was most helpful in her critical analysis of the design of this dissertation research. Her command of the English language is laudable and her corrections of my mistakes in the use of that language were most helpful.

Howard Teitelbaum, D. O., Ph.D., despite progressing through the stages of a taxing internship during the conduct of this dissertation, was more than generous with his time and advice. His knowledge of practical

statistics was most helpful to me. Dr. Teitelbaum continually prodded me to look beyond the obvious. He also was a friend and counselor (when needed) during this entire dissertation period.

I was fortunate to have had an excellent and supportive dissertation committee. To Dr. Roger DeMont I express my thanks for his careful analysis of the work. I had the good fortune to observe him as an instructor and counselor, areas in which his talent is superb. Students who interact with him in the future truly are fortunate. Richard Gallagher, Ph.D., provided me with many hours of personal instruction in the area of medical education. He has shown me how to carefully analyze published articles and to accept results only after that analysis. His patience with me in my early stages in the areas of educational evaluation and research will never be forgotten. Harry Maisel, M.B., Ch.B., is an insightful researcher and physician. His years of experience were obvious in his practical advice to me. To him I am most grateful.

I was most fortunate to have had two advisors during my time at Wayne State University. The first of these, Dr. Claire Irwin, was the first instructor whom I had in my initial course work at the University. Her unique teaching style is one I only hope I will be able to emulate. Her careful analysis of any endeavor she

undertakes is commendable. My respect for her is of the highest degree. I only hope that my work comes close to meeting her criteria for excellence.

My primary advisor from the College of Medicine, Dr. Martin Hogan, has been an inspiration in this undertaking from day one. He has provided me with a role model which I can only hope to imitate. When appropriate, he offered constructive criticism and always was a friend and gentleman. His knowledge of the entire field of medical education is immense. His ability to teach that stored knowledge to others in an exceptional manner will always be remembered. Without your efforts, Marty, this document would not be a reality.

To the students and interns who participated in this research I owe my thanks. All of you were most understanding and cooperative.

To Linda Borek, my medical office manager, friend, and typist, I offer many thanks. She not only corrected my grammar and spelling but also offered helpful hints in sentence structure. Linda, singlehandedly, typed through the many drafts of this work, an effort rarely performed by one person. Thanks, Linda.

This dissertation is dedicated to my family who truly are always there when needed. To Michelle and Jeffrey, who were not there to experience my ups and downs, but always were there to provide moral support, my gratitude

is extended. To Melynda and Joel, who had not yet reached the age to move away from home and therefore experienced the many problems associated with researching and writing a disserttion, I owe many thanks. Possibly some day I can make up to you the large amount of time I ignored my fatherly duties in deference to the dissertation. Finally, to my wife Jan, I express my love and appreciation. This is the second doctoral degree she has supported me through, neither of which were easy for her. During this recent effort she has not only offered me support, counsel, and prodding when needed, but she has also obtained her second bachelor degree. I only hope I can be as supportive of her as she works to obtain her advanced degree.

TABLE OF CONTENTS

LIST OF TABLES

Page

LIST OF FIGURES

Page

CHAPTER 1

STATEMENT OF THE PROBLEM

The clinical training of undergraduate medical students and postgraduate physicians has long been an enigma for medical educators (the terms clinical training and clinical education will be used interchangeably in this dissertation). Clinical training presents multiple problems for the clinical teacher as well as the student learner. Many of the problems stem from the environment in which clinical education takes place--the patient care, or clinical environment. Weinholtz (1985) has outlined several questions which must be considered by the clinical teacher, and are the basis of continued research. For example:

- -Are didactic presentations during attending rounds an effective teaching strategy?
- -Is the demonstration of physical examinations and observation of physical examinations performed by housestaff and medical students an effective teaching technique?

For the student of clinical medicine working and learning priorities can come into conflict and engender such problems as:

-An overabundance of patients, providing a work load which prevents adequate learning from the patient population;

-Prolonged hours of work, creating fatigue and difficulties with concentration, therefore, ineffective study time;

-Inadequate exposure to various diagnostic entities;

-Ineffective clinical teachers.

The clinical education of medical trainees usually takes place in several different settings (for the purpose of this dissertation, unless otherwise specified, the term trainee will refer to both medical students and postgraduate physicians). Physicians' offices, clinics, outpatient departments,emergency rooms, urgent care centers and hospital wards all provide environments where clinical teaching/learning may occur. Much of the clinical training of medical students, interns, residents, and fellows takes place in the hospital setting, and relies on a format known as rounding or rounds. According to Daggett et al(1979), of all the phases of a student's medical education, clinical teaching conducted on hospital wards by attending physicians could potentially have the most impact on the student's application of medical knowledge to patient care. With so much of student training occurring through rounds it would seem crucial

that we understand if and how rounds contribute to learning.

Clinical rounding has been a part of medical education for a long time. The history of in-hospital instruction for medical students in the United States dates back to 1766 when Dr. Thomas Bond of the College of Philadelphia announced to medical students that he would offer at the Pennsylvania Hospital a course in which he would:

> give you the best information in my power of the nature and treatment of chronical diseases, and of the proper management of ulcers, wounds, and fractures. I shall show you all of the operations of surgery, and endeavour...to introduce you to a familiar acquaintance with the acute diseases of your own country, in order to which, I shall put up a complete Meteorological Apparatus, and endeavour to inform you of all the known properties of the atmosphere which surrounds us, and the effect its frequent variation produce on animal bodies... (Bordley and Harvey, 1976,p.56)

One can infer from this statement that in-hospital instruction of medical students was taking place at the Pennsylvania Hospital as early as the late seventeen hundreds.

The Massachusetts General Hospital was organized in 1810 and early on exhibited features which were not adopted by other hospitals until many years later. Two features of particular importance to clinical education were to (1) make special provisions for the training of both undergraduate and graduate medical students,and (2) assure the maintenance of detailed case records. To this

end the two founding physicians of the Massachusetts General Hospital, James Jackson and J.C. Warren of Harvard University, persuaded the Harvard authorities to permit the use of a small ward for the education of medical students. Jackson and Warren were classified as hospital visiting physicians and, according to documented evidence (letter from Jackson), made regular teaching rounds on patients on their respective services. In 1893, The Johns Hopkins medical school and hospital were coordinated into a German prototype and became a model for medical reform. The students of this school, in their senior year, spent most of their time on the wards of the hospital, taking an active part in patient care. Out of the administrative ranks of Johns Hopkins emerged John Shaw Billings, M.D., who advocated that a medical school curriculum should consist of "a four-year course of medical study: the first two years were to be devoted to a study of disease in living patients in the wards and outpatient department of the hospital"(Bordley and Harvey, 1976,p. 138). This division of the medical school curriculum prevails today, with more than half of U.S. and Canadian schools being organized around disciplines, with the first two years devoted to basic sciences, and the last two years clinical medicine (Physicians for the 21st Century, 1984).

By the early twentieth century hospital-based clinical education had become well entrenched and was the

subject of several editorials in the Journal of the American Medical Association which pointed out the inferior quality of medical education in the United States. In 1904 the American Medical Association created the Council on Medical Education, which gave significant assistance to Abraham Flexner in his thorough and shocking investigation of American medical schools carried out for the Carnegie Foundation for the Advancement of Teaching. Flexner's report, entitled Medical Education in the United States and Canada, appeared in 1910 and since then has been viewed as the document that changed the course of medical education in America. The report contended that most medical schools were inadequate, and most physicians were improperly and insufficiently trained. Flexner stresses the need for supervised clinical education in hospital settings. In reference to the opportunities academic programs must afford students, he said:

> On the pedagogic side, modern medicine, like all scientific teaching, is characterized by activity. The student no longer merely watches, listens, memorizes; he does.
>
> > His own activities in the laboratory and in the clinic are the main factors in his instruction and discipline. An education in medicine nowadays involves both learning and learning how; the student cannot effectively know unless he knows how (Flexner, 1910, p.53).

Shortly after the introduction of Flexner's report into the medical literature dramatic changes were seen in

American medical education. According to Wolinsky (1980), "...medical education was significantly upgraded, and the emphasis was placed on combining theory and research findings, and incorporating them into application oriented university and hospital-based curriculum" (p. 250).

From this brief historical review, we can see that clinical education, as an example of learning by doing, has long been an integral part of medical education, and rounding has been an almost universally accepted instructional method. Yet, few investigators have looked critically at clinical teaching, to say nothing of rounding, and those who have, have focused their attention on the teacher. This study investigated clinical teaching, and rounding in particular, from the perspective of the learner.

STATEMENT OF THE PROBLEM

The impetus for this study comes in part from a perceived need for information concerning teaching and learning experiences that play a major role in medical education, as well as from the author's longtime interest in the rounding process. As outlined above, experience suggests rounds are of educational value for trainees, yet, there is little objective evidence to support that conclusion. On the one hand, studies have demonstrated

that trainees spend considerable time in hospitals as part of their training, LaPalio (1981) showed that the average work week of trainees on a university medical service was between 91 and 105 hours, while Wood and Hogan (1985), in a study of a medical service at a community teaching hospital, demonstrated the average work week of trainees to be 97.4 hours, of which 27% was spent on rounds with an attending physician. In any teaching/learning endeavor, one would like to maximize teacher effectiveness and student learning. The considerable time consumed by rounds must be evaluated carefully to determine if it is time well spent toward increasing the trainee's medical knowledge. In another study, Coppernoll and Davies (1974) followed 180 medical students and faculty at the University of Tennessee Medical Units (Memphis). The groups studied evaluated clerkships and attending rounds as

> the most effective method in the development of (1) of communication skills, (2) factual knowledge, (3) problem solving, (4) laboratory and clinical skills, (5) initiative, and (6) professional behavior.

Payson (1965) also has expressed an opinion on rounds stating: "...rounds are often the most important formal teaching exercise of clinical discipline..."(p.1468). He goes on to state:

> Furthermore, in most teaching hospitals rounds offer the only opportunity of students and junior physicians to observe the clinical performance of the leaders of American medicine. Rounds,

> therefore, powerfully influence the orientation and performance of every new member of the profession (p.1468).

Despite the amount of time spent on rounds, and the apparent importance of rounds for learning, as emphasized by Payson and Coppernoll and Davies, objective evidence to support the effectiveness of rounding is lacking.

Research to this point has centered on improving the effectiveness of clinical teaching (Weinholtz, 1985; Skeff and Strotes, 1985; and Irby, 1978). Those authors offer suggestions for the improvement of clinical teaching which, if utilized would seem logically to increase the knowledge gained by the learner. No research at this time has centered on the learner in the rounding situation. This study attempted to begin filling this void in the medical education literature.

In studying the effectiveness of rounds as a valid educational tool, there are certain assumptions which are made as follows:

1. Patients are available;
2. The patient mix is sufficient for a broad-based education;
3. The complexities of the cases exists for differential learning, i.e., student, intern, resident, and fellow.

Specifically the purposes of this study were:

1. To identify an alternative to rounds that would result in equivalent learning outcomes;
2. To determine whether some of the traditional perceptions of what is learned on rounds are accurate, i.e.,

   1) increase in basic knowledge; 2) increased skill in the area of diagnosis; 3) increased skill in the early stages of the problem solving process;
3. To determine the educational value of rounds from the perspective of the learner;
4. To identify ways of improving rounds as an instructional modality.

The questions which this study attempted to answer are as follows:

1. Is there an alternative to rounds which will help students/interns learn what is anticipated that they learn on rounds?
2. In what ways do students/interns find rounds valuable in their clinical education?
3. Can rounds be made more effective as a teaching modality?

The research hypotheses addressed in this study were as follows:

1. The reinforcement of clinical knowledge and skills, can be achieved better by structured

instructional experiences than they can by rounds (traditional).

2. Students/Interns perceive rounds and an Internal Medicine tutorial as equivalent ways to synthesize basic science and clinical knowledge.
3. Students/Interns perceive rounds and an Internal Medicine tutorial as equivalent methods which will enable them to reinforce clinical knowledge and clinical skills.
4. Rounds can be made more effective as a learning experience by increased standardization and improving the teaching qualifications of clinical instructors.

LIMITATIONS OF THE STUDY

Limitations of this study are with regard to:

1. Control over the teaching/learning process on rounds which is limited by the fact that rounds are not conducted in the typical classroom environment. The environment is one of a constantly changing nature as the rounding group moves from patient room to patient room, and then from ward to ward. Many unforeseen interruptions generally occur which are not present in a typical classroom.
2. Generally, clinical teachers are not trained educators. Therefore, their knowledge of

teaching and evaluation techniques is quite variable. Smith and McGahie(1984) identified six distinct problems in evaluation by clinical teachers one of these being "..lack of preparation of faculty for their educational roles." (p.217). Thus, the variability in the instructors might be greater than that seen in the standard instructional situation.

3. Quality of instruction, and bias in instruction (since all subjects do not round with all instructors).
4. This study was conducted at a community teaching hospital. The patient mix in this hospital is potentially different than at a university teaching hospital, and therefore, the generalizability to larger institutions may be limited.
5. This study was conducted on a single service, namely, Internal Medicine. This also tends to limit ones ability to make generalizations from the results obtained; however, Becker(1961) has stated that rounds in Internal Medicine represent the clearest and most fully developed instances of the phenomena. Therefore, it seems logical that if one is able to generalize findings from the rounding process the

most powerful generalizations should come from an Internal Medicine service.

6. The subjects (students and interns) in this research are generally more stressed than individuals who are studied during other educational endeavors. According to McCue (1985): "Time pressures and sleep deprivation constitute the major stresses of residency training, adversely affecting the ability of residents to learn, the quality of medical care they deliver, and their ability to respond appropriately to urgent problems" (p. 449). Cope (1984) has listed eight sources of house staff stress of which some are these being:
    1. fatigue - (sleep deprivation)
    2. overwhelming work load
    3. fear of being wrong
    4. uncertain career prospects/future planning

Because of the stress present in the study population, generalizability of the results to other situations where clinical teaching is carried out is questioned. It is known that stresses are present in other employment and teaching settings, however, not to the extent that they are found in the medical arena.

CHAPTER 2

REVIEW OF THE LITERATURE

This chapter will place the current study in perspective by focusing on four principal topic areas. Initially, certain historical events in the development of medical education will be explored with particular reference to the division of the four year medical school curriculum into the so-called "basic science years" which have traditionally been followed by the two "clinical years." Included in this section will be comments on the evolution of the medical school curriculum into a unified whole as exemplified by the "Western Reserve Experiment." The next section will review research in the area of the sample (population) to be utilized in this research project. Particular attention will be paid to the differences or similarities between third and fourth year medical students and first year post graduate trainees. The subsequent section will review pertinent literature centering around the intervention portion of this project. Literature on clinical teaching and learning will be reviewed as well as pertinent literature describing methods of instruction which could serve as alternatives to the rounding process, namely, the lecture, group discussions, and video tapes. The last section concerned

with literature review will characterize the dependent measure, namely, multiple choice exams. A select portion of the available literature concerning the reliability and validity of this examining instrument will be presented as well as an analysis of what can be measured with a multiple choice exam. The final section will summarize the important points of the literature review and attempt to provide the reader with insight as to how this study incorporates these significant points into its purpose and design.

I. History - Philisophy

The famous Flexner report was mentioned in Chapter I. The impact of that report on medical education is still being felt today. Despite the efforts of well intentioned, forward thinking medical educators to change the medical school curriculum, 56% of the medical schools in the United States and Canada are still firmly entrenched in the Flexnerian model. Another 35% of the medical schools have a "disciplinary plus a correlative course" curriculum which closely parallels the traditional four year curriculum consisting of two years of basic science education (anatomy, physiology, biochemistry, pathology, etc.) and two years of clinical education (the "2 X 2" curriculum)(Physicians for the Twenty-First Century - Report on the Project Panel on the

General Professional Education of the Physician, 1984, pp 37-38). In order to explore this area further other portions of the Flexner report will be outlined. Since the current study centers around clinical education the reader must understand the philosophy of an integrated type of medical school curriculum as opposed to the standard "2 X 2" curriculum. This area also will be examined.

Flexner was engaged by the Carnegie Foundation to study medical education in the United States. Flexner's savage attack on the medical education system destroyed whatever illusions might have existed about the quality of medical schools and medical schooling. One of the more significant recommedations made by Flexner in order to remedy the situation was a division of the curriculum into two parts. Flexner stated (1910):

> For purposes of convenience the medical curriculum may be divided into two parts, according as the work is carried on mainly in laboratories or mainly in the hospital; but the distribution is only superficial, for the hospital is itself in the full sense a laboratory. In general, the four-year curriculum falls into two fairly equal sections; the first two years are devoted mainly to laboratory sciences - anatomy, physiology, pharmacology, pathology; the last two to clinical work in medicine, surgery, and obstetrics. The former are concerned with the study of normal and abnormal phenomena as such; the latter are busy with their practical treatment as manifest in disease. How far the earlier years should be at all conscious of the latter is a moot question.

> Anatomy and physiology are ultimately biological sciences (p.57).

Thus, the groundwork was laid for the "2 X 2" curriculum model. It is interesting to look even further back into medical history and find that as early as 1883 reference was made to a division of the medical curriculum. The Journal of the American Medical Association carried a notice in its issue of July, 1883 which read as follows:

> At the close of the last academic year of Johns Hopkins University, it was announced that the hospital was nearly ready to open. One feature of the building is unique: It is so arranged that the graduating class of the medical college may be lodged in the building. The last year will be almost wholly devoted to clinical work (p. 32).

Flexner also commented on the clinical work of the student with a recommendation that this portion of the curriculum should be classified under four headings as follows:

(1) Medicine, in which pediatrics and infectious diseases may be included

(2) Surgery

(3) Obstetrics

(4) The specialities, such as diseases of the eye, ear, skin, etc.

Although he did go on to describe the hospital laboratory and its importance in quite a bit of detail he did not particularly address the area of specifics concerning the clinical education of the student. Flexner does state

that there is no substitute for a good clinic in internal medicine and furthermore that even excellent didactic instruction is no substitute for such a clinic.

As the years passed after the Flexner report some medical educators began to question the wisdom of the "2 X 2" curriculum. To some people, the early integration of the student into clinical medicine seemed to make more sense than keeping him/her away from this area until the third year of medical school. In the mid-1950's at the Western Reserve University School of Medicine (called Case Western Reserve University School of Medicine after 1967) such thought began to gain momentum. Under the leadership of Joseph T. Wearn, M.D., Dean of the medical school, the idea of an integrated medical curriculum began to develop. The goals of the new curriculum were, (1) to have a teaching progam integrating the biomedical sciences of the first two years; (2) to integrate the sciences with clinical teaching in the last two years; and (3) clinicians would teach in the first and second years, and basic medical scientists in the third and fourth (Williams, 1980). The philosophy behind such an integration of the curriculum is important and is outlined by Williams (1980) as follows:

1. It is impossible to learn everything there is to know in medicine. Therefore, some selections must be made and this is the responsibility of the faculty at large.

2. The curriculum should be designed as a logical continium by the faculty as a whole and not by departments.
3. Teaching should be interdisciplinary since medical knowledge is derivative and depends upon many disciplines. Disciplinary teaching, both clinical and preclinical, tends to hinder the integration of medical knowledge and causes the student to compartmentalize his/her thinking.
4. The medial school curriculum should not be sharply divided between preclinical science and clinical medicine, rather, there should always be a mix, gradually changing from one with a major emphasis on the basic medical sciences to one with a major emphasis on clinical medicine.
5. The product of this educational experience should be an undifferentiated physician educated to think scientifically, but imbued with a humane concern for the individual patient. All physicians, whether they intend to become surgeons or family physicians, should have the same basic medical education before they specialize (p.vii).

Two ends of the medical education spectrum have been presented, namely, the classic "2 X 2" curriculum and an integrated curriculum. The clinical training of the student is naturally somewhat different depending upon when he is integrated into the clinical learning area. The importance of the rounding procedure to the student could also be dependent upon the time of his entry into the clinical teaching spectrum. These issues will be addressed later. The primary point of this section was to lay groundwork so that the non-medical oriented reader will better understand certain aspects of the clinical teaching of medicine.

II. The Sample - Population

The participants in this research will be from two different levels of the medical education ladder. Medical students as well as interns (PGY I's) will be studied. One of the logical questions which one might ask concerns the similarities or lack of similarities of these two groups. Particularly when one approaches data analysis the question of whether or not data from these two groups must be treated separately or as a whole must be addressed.

Unfortunately, a paucity of literature exists which compares these groups on the same or comparable testing instruments. Downing, Maatsch, Huang, Baker, and Murger (1984) report on the field testing of two different multiple choice question formats. The testing was performed with 94 subjects consisting of 36 board-eligible physicians, 36 PGY II residents in emergency medicine, and 22 fourth-year medical students. Each item was scored as correct or incorrect such that a candidate's raw score was the sum of the number of items answered correctly. The student group scored considerably lower than did the other groups of physicians tested. Although data are not presented concerning the statistical significance of mean differences between the groups, it appears on examination of the data that the large mean differences between the groups (particularly between the student group and the

graduate physician groups) would most probably reach significance.

The research study described herein contains both undergraduate and postgraduate physician trainees. On the basis of the work described above it does not appear that one is able to combine the data from the two groups. This issue is not entirely settled on the basis of one research report and will be explored further in a later portion of this discourse.

III. The Intervention

This portion of the literature review is partitioned into two major divisions, the first dealing with clinical teaching and learning with special reference to rounding, and the second devoted to alternative methods of instruction which will be used in this study as a substitute for the rounding process.

A. Clinical Teaching and Learning

The most extensive recent review on clinical teaching was conducted by Daggett, Cassie, and Collins (1979). Their study was divided into four major areas as follows: (1) General observations on clinical teaching; (2) Sociological studies; (3) Teacher training programs; and (4) Studies on clinical teaching. The categories of importance for this study are those of general observations on clinical teaching, sociological studies,

and studies on clinical teaching. These various categories will be encompassed in the general outline of this section which will be as follow:

1. Literature concerning the attending physician;
2. Research concerning interns;
3. Research concerning medical students;
4. Literature focusing on the rounding process.

So-called clinical teaching does occur in other professional groups, such as nurses, attorneys, psychologists, pharmacists, and social workers; however, a review of this literature demonstrates that findings in these professional areas do not directly impact on this study due to the fact that the clinical teaching used in this study is of a different nature than that used in the listed professions. Therefore, literature concerning these other professions will not be included herein.

1. Literature Concerning the Attending Physician

One of the early studies on the teaching of attending physicians was conducted by Miller (1956) in Illinois. In this study the author and twelve faculty members spent twenty "relatively unstructured" hours discussing the teaching process with instructors. One of their most interesting conclusions was that the teachers might be major obstacles to student learning.

In another review of the attending physician and his role as a clinical teacher, Miller (1961) states that:

> with few exceptions members of medical school faculties do not regard themselves first as teachers even though they appear to prize their academic posts. The full-time staff member generally looks upon original research as his primary obligation and responsibility, and it is the productiveness of this research effort which leads most rapidly to an academic reward(p.65).

Miller goes on to remind the reader that this description should not be interpreted as implying insincerity on the part of the faculty member as a teacher, but it should remind the reader that teaching in medical school generally is a secondary role.

In 1982, Jason conducted a study which was designed to address the following questions: (1) What is medical teaching like on the current American scene? (2) What teacher characteristics and instructional settings contribute to the end result? Although a large number of instructors (380) were observed at seven different medical schools only 25 of the observations were of attending rounds. The study protocol evaluated instructors on the following parameters: (1) Sensitivity to physical setting; (2) Attitude toward students; (3) Use of instructional materials; (4) Reaction to students' needs; (5) Use of teaching methods; and (6) Use of "challenge".

The findings demonstrated that clinical instructors tended to use "challenge" more effectively than classroom instructors. Generally, clinical instructors demonstrated more "democratic" behavior than instructors in the basic

sciences. One of the conclusions which can be drawn from Jason's study is that in the setting of clinical teaching attending physicians can interact with their students in a more facilitative manner than can faculty who are in the basic science area, and therefore, primarily teach in the classroom.

Reichsman, Browing, and Henshaw (1964) conducted a study of 82 clinical teaching sessions at the University of Rochester School of Medicine. The majority of these observations were of attending rounds (68%). This study looked into the areas of attending - student interaction; observation of students during the performance of histories and physical examinations; the evaluation of data obtained by students; the teaching of syndromes and concepts by faculty; and the stimulation of students by faculty. The findings were presented as follows: (1) Even though instructors saw patients with students they often missed teaching opportunities; (2) Students were rarely observed while doing histories and physicals; (3) In many instances the data obtained by students was accepted as presented; (4) Basic science topics were not taught; (5) In only one-fourth of the observed sessions did the instructors stimulate the students to acquire new knowledge.

One of the most important points of this study is that it was conducted at a medical school which was ranked

by Jason as one of his highest rated. If the problems presented exist in a highly rated medical school one must have great concern over the conduct of attending rounds by attending physicians. In defense of the attending physician the authors stated:

> We believe that the difficulty of this task is unique in the entire realm of teaching. In no other field does the nature of the teaching material demand of the teacher the degree of preparedness without preparation. We suggest the problem of learning how to teach as a clinician deserves much thoughtful study if the clinical teacher is to survive as a highly competent and respected scientist(p.161).

Stritter, Hain, and Grimes (1975) attempted "to determine the most effective clinical teaching behaviors of clinical teachers or preceptors in individual or small group settings" (p.876). This study approached the recipients of clinical teaching, namely, the students, and inquired of them which behavior characteristics of clinical teachers made a difference in facilitating student learning. A survey instrument was developed which was supplied to students of the University of North Carolina, Chapel Hill, and the University of Alabama.

The data obtained were factor analyzed and demonstrated loading on six factors. These factors were as follows: (1) Factor 1 - the most effective clinical teacher provides a personal environment in which the student is an active participant; (2) Factor 2 - the

preceptor should have a positive attitude toward teaching and students; (3) Factor 3 - one of the important elements in effective teaching behavior or process is the preceptor's concentraton on the cinical problem-solving process rather than of factual material alone; (4) Factor 4 - the instructor should have a student-centered instructional strategy or approach; (5) Factor 5 - the effective preceptor is humanistic in orientation; and (6) Factor 6 - the preceptor should emphasize references and research. Factor 6 was felt to be of lesser importance than the other factors.

Irby (1978) attempted to determine the characteristics of best and worst clinical teachers by random sampling medical school faculty, residents, and third and fourth year students at the University of Washington. The best clinical teachers demonstrated characteristics of enthusiasm, clarity and organization of presentation and clinical competence. The worst clinical teachers rated much lower on all dimensions with their highest ratings being on modeling professional characteristics, clinical competence and knowledge. These characteristics obtained via factor ratings can be contrasted with those obtained by open-ended questions which revealed the important characteristics for best clinical teachers to be breadth of medical knowledge, enthusiasm, enjoyment of teaching, friendliness, clinical-

competence and others. The worst teachers were characterized as arrogant, apparent dislike of teaching, limited knowledge, inaccessibility and others.

Daggett (1977) presented many factors of importance in the clinical teaching area. This study exhibits an extensive review of the literature as well as providing a systematic set of recommendations for altering attending rounds. His study was conducted at the Montreal Children's Hospital and had as its major objective "to examine the role of the attending physician in the clinical training of clinical clerks and residents" at the study hospital.

Daggett drew ten conclusions from his study as follows: (1) The role of the attending physician was not clearly defined at any level of definition; (2) Likewise, the roles of the senior residents and junior trainees were ambiguous; (3) Teaching which did occur was "haphazard and generally mediocre", (p.131) mostly due to the fact that attendings virtually made no preparations for rounds; (4) "Attending physicians frequently did not systematically learn the strengths and weakneses of each trainee, and when it came time to make an evaluaton of trainees during a particular rotation, attending physicians were unable to do so with any confidence"(p.131); (5) Attending physicians were over-

extended leading to a lack of organization of time and work on ward rounds; (6) The teaching which was done consisted primarily of exchange of factual knowledge; (7) Attending physicians rarely did more than casual examinations of patients during rounds; (8) Attending physicians rarely challenged the trainees; (9) "Little of the teaching of ward rounds was explicit, well organized or followed-up"(p.133); and (10) Attending physicians viewed rounds as opportunities to learn and also were found to have an interest in teaching and in improving their teaching.

The recommendations made by Daggett as a result of his study were substantial and were as follows: (1) Specific definitions of roles for attending physicians and senior residents should be outlined; (2) Studies should identify those skills of attending physicians which are of most practical value to the trainees and an atmosphere should be created in which those skills can be conveyed to the trainees; (3) Educational objectives need to be defined for the clinical training aspects of the medical education program; (4) Standards for trainee performance need to be developed as well as should assessment standards; (5) Increased time should be spent examining patients during ward rounds; (6) Attending physician should be subject to a teacher training program; (7) At the beginning of each rotation the attending physician and

senior resident should discuss the approaches to ward management; (8) Before each rounding session the senior resident should update the attending on the progress of each patient; (9) The attending physician should take time to prepare for rounds; (10) An improvement process oriented toward teaching should be developed wherein a consultant could work with an attending to develop their teaching skills; (11) Different approaches to ward rounds should be systematically developed and tested; (12) Master clinical teachers should be identified and used as role models; and (13) A major research project should be undertaken to study the area of clinical teaching.

The recommendations of Daggett can guide future researchers in the area of clinical training. However, as pointed out by Weinhholtz (1981):

> It is not wise to rush head-on into the testing of haphazardly developed alternative models. New models might benefit from an even closer look at what currently exists. By focusing the microscope of research even more powerfully on attending rounds, and by viewing the findings from a variety of theoretical perspectives; new models might be systematically developed in a fashion enabling innovations while maintaining the best aspects of present models(p.21).

In a recent study Skeff (1983) studied a method for improving the teaching performance of attending physicians. The author outlines four specific reasons for the difficulties found in clinical teaching as follows: (1) Attending physicians must often simultaneously teach

students and house staff who are at various levels of training; (2) The medical cases which are presented are unpredictable; (3) A wide variety of teaching methods is required, from bedside teaching to Socratic dialogue; and (4) Attending physicians are responsible not only for teaching but also for insuring excellent patient care. The study consisted of providing two feedback methods to 67 physician participants. Various questionnaires were developed in order to determine any change in teaching performance. The important finding of this study was that attending physicians could improve their teaching performance. By examining their "own teaching performance using videotape review self-assessment, and trainee questionnaire feedback, attending physicians were able to identify and improve problem teaching behaviors"(p.468).

Finally, Weinholtz (1985) has presented a preliminary description of a method to improve teaching by attending physicians in attending rounds. This study consists of extensive observations followed by intensive feedback. The author feels that the approach is subject to debate but it is hoped that the research will give a "clear picture regarding whether or not the sort of exercise we are recommending yields beneficial results"(p.10).

2. Research Concerning Interns

The role of the intern is difficult in that he is treated as a graduate physician, yet, still is a fledgling

professional as far as experience is concerned. He at times is faced with decisions which he is ill prepared to make because of his lack of experience. Still he is expected to be an advanced learner despite all of his other responsibilities.

One of the initial studies of the intern was performed by Payson, Gaenslen and Stargardter (1961). This group conducted a time study of the internship by observing two medical interns for a ten-day time period. Their results showed that both interns spent more time in staff communication than in any other activity. The authors interpreted this finding as "evidence of the nature of the teaching program and the emphasis placed by teaching personnel and interns on supervision and consultation" (p.442). The finding that most concerned the authors was the small amount of time spent with patients. The amount of time did not vary with new admissions nor did the interns spend more time with old patients on days when there were few or no admissions. After the first day of admission there was a rapid decrease in the time spent with all patients. The findings did not seem to support a theory of insufficient time available.

The authors presented their thoughts on the reasons for the diversion of time away from patients and to peers as follows: (1) the need for security; (2) the need for

approval, tolerance and reassurance; (3) the need for acquiring specific techniques and knowledge of medicine; (4) the need to learn how to relate to other professionals in his first year as a professional; and (5) the need to compete and move ahead on the basis of his diagnostic and pathophysiologic acumen rather than on the basis of his capacity to offer thorough patient care. These composite findings led the authors to encourage the teaching of patient-mnanagement techniques on a professional basis.

In a more recent and extensive study of seven interns performing in a community teaching hospital, Wood and Hogan (1985) determined the average intern was spending 18.9 hours per day on duty in a seven day study period. Of the 113.3 hours per week on duty, 19.9 hours or 17.6% of the time was spent on rounds. The largest percentage of total time was spent in patient evaluation (25.7%) which was defined as any interaction with a patient outside of the time spent on rounds. The authors questioned the significant amount of time spent on rounds, questioning whether or not this time is educationally beneficial. The time spent by interns in patient evaluation activities was substantial and the educational benefits of this time block must be questioned. The interns studied felt that many of the duties required of them in patient evaluations could have been performed by nursing or para-medical personnel.

One of the most extensive studies of the internship performed to date was that of Miller (1968) wherein participant observation techniques were used in an attempt to determine how interns decided on the level and direction of their efforts in the face of overwhelming work and academic demands. In this study which encompassed 18 months, Miller hypothesized that:

> the character of the Harvard Medical Unit would be emergent, a result of the interaction among people, it would be illogical to postulate about the place as if it were a constant set of relationship dictated by the prescriptions of medical education (p.21).

His research problem as he saw it was to "discover the patterned relationships by observing what actually did happen to young men during a year at the Boston City Hospital"(p.21).

The author found that the initial perspective of the intern developed in their first weeks at the hospital and could be summed up in four main points:

(1) An internship entails an almost overwhelming amount of work

(2) The work is hard, it is important, because it is somehow relevant to becoming a good physician

(3) Although all the work is not obviously valuable experience, it is the interns responsibility to do it. He is not privileged to limit himself to caring for patients.

(4) If an intern is not getting his work done, he must find a way to do it. He must organize his effort so as to do everything he has to(p.203).

Miller subsequently goes on to describe the interns perspective on the reality of work. He found that most interns gave up all of their leisure time. In the first month of the internship they tried to do everything they could and when time was not available they sacrificed their leisure or family time. After a time, however, the interns began to question the wisdom of some of the things they have to do. Although staying late at the hospital got the work done, the lack of sleep made it difficult for them to get through the next day. Miller found that "the lack of sleep marks the beginning of a change in perspective." They, thereafter, developed a set of operating perspectives which defined their efforts during the remainder of he internship. This perspective was:

(1) An intern cannot do everything that logically falls within his responsibility

(2) Since the work directly related to the problems of patients provides desirable clinical experience, an intern should direct his effort toward providing patient care.

(3) An intern has medical responsibility for his patients, but must also accept some

responsibility for other kinds of work related to their welfare.

(4) An intern can make the time he needs to perform patient care responsibilities by reducing effort he expends on academic activity(p.222).

One point made by Miller is of paramount interest to this dissertation. He points out that with this change in perspective one of the things affected is the attitude of the intern toward attending rounds. Once the intern has established the operating perspective as outlined above, he is more likely to miss a rounding session if a conflict involving a patient's needs occurred. In view of the emphasis on patient care they are likely to decrease reading time which is necessary in order to increase the educational value of the rounding session. This study and others has shown that house staff members judge attending rounds to be good when centered on important cases which illustrate a variety of practical issues rather than on the esoterica of the attending's specialty.

Mumford (1970) carried out a participant observation and interview study which compared a university-affiliated internship with a community hospital internship. In the community hospital setting, the attending physician controlled access to patients, placed emphasis on the care of patients and were rarely challenged as role models. In contrast, at the university hospital, most of the

attention was drawn to the residents who were chosen as role models because they were generally up to date in the area of medical knowledge and because they were almost constantly available for informal educational interaction.

The interaction of the intern and resident at the university level was viewed by the attending physician as intimidating. Mumford found that the interns and residents viewed the attending as coming to them to learn rather than to teach. Unfortunately, the experience of these attendings in patient-management techniques, which could be taught to the house staff, was lost because of the attitude of the attendings toward their entire situation.

Mumford was concerned with the lack of emphasis on doctor-patient rapport found at both hospitals. Not that the physicians studied lacked concern for patients but rather the attitude that patients could best be served by physicians studying and discussing the facts surrounding their disease was bothersome. The author's concern over the fact that patient compliance is often strongly related to the doctor-patient relationship is a concern well taken.

3. Research Concerning Medical Students

Medical students generally receive the bulk of their patient exposure in the third and fourth years of medical

school. In this time period they begin to assume medical responsibility and see to some extent the utility of the concepts they have been taught during their prior medical school years. According to Weinholtz (1981):

> While the role of the medical student is less influential than that of other members of the medical service team, it is not unimportant. It is as a student in the clerkship that a physician first begins to develop the historical, diagnostic, treatment, and patient-management skills that serve a professional lifetime. Furthermore, it is in the clerkship that a physician is first socialized to the norms of the hospital setting, and it is in the clerkship that decisions are made about future areas of specialization. The role of the medical student is important because it provides an experiential base upon which many future behaviors are built, and upon which many decisions are made(p.30).

One of the earliest and most carefully performed studies of the medical student was the participant-observation study of Becker, Geer, Hughes, and Strauss (1961). Like Miller, Becker attempted to discern how the student determined his level and direction of effort. They concluded:

> Students absorb medical culture in a selective fashion as it helps meet the problems posed by their school environment. Thus what they use of medical culture is by nomeans the same as, or simply a junior version of the culture of the practicing physician. Rather it contains characteristic distortions and omission which... account for many disagreements, both overt and implicit, between students and faculty (p.192).

Becker, et al, found that the majority of the medical student's time is spent in the areas of taking histories, performing physical exams and making differential

diagnosis based on the information obtained. Students are also required to attend lectures, conferences and seminars.

These authors also addressed the problems faced by medical students in their clinical years and outlined them as follows: (1) What to study and learn from the masses of information they are exposed to; (2) How to deal with faculty; (3) How to deal with fellow students.

In reference to the first problem, it was found that students generally studied the materials which were immediately applicable to their clinical exposure. Medical students directed their efforts at increasing both their clinical experience and medical responsibility. They dealt with faculty by modifying their behavior to satisfy the faculty. This behavior modification was especially evident during attending rounds wherein students demonstrated a willingness to put up with anything and suffered from recurring fears of making a bad impression. They dealt with fellow students by adopting a "cooperation perspective." They showed a willingness to help each other and only occasionally took advantage of the other's good will.

Elrick (1967) outlined several of the deficiencies of the clinical education of the medical student. He points out that even at the best medical schools: (1) teaching of clinical skills, attitudes and behavior, and work-study

habits needs to be greatly improved; (2) there is a marked deficiency of planned teaching and critical supervision of the student in basic areas; and (3) in most medical schools the student is largely on his own in the clinical education area. He found a strong tendency to substitute laboratory analysis for the clinical methods of diagnosis and, furthermore, to look upon the clinical analysis as subjective and unreliable and to depreciate the clinician. He summarized the major deficiences as follows: (1) a lack of clearly defined objectives or failure to carry out established objectives; and (2) inadequate or insufficient formal teaching and critical supervision of clinical skills, attitudes, behaviors, and habits. The objectives and philosophy of clinical education must emphasize the ability of the student to establish an effective professional relationship with the patient; further, to emphasize the importance of the ability to obtain clinical information from the patient and others; and finally, to enhance the ability to assemble clinical information into a meaningful, scientific form to enable formulation of the patient's problems. The student, thereafter, must work out a carefully planned individual diagnostic program and synthesize clinical and diagnostic data to arrive at a definite diagnostic and therapeutic program.

Of concern in this study is the influence of previous experience on the student's performance during the study

period. Morse, Levy, Johnson, and Bollet (1975) studied this issue at the Medical College of Georgia. They initially outlined a perception of instructors at their medical school that students who began clerkship experience after experiencing other basic clerkship rotations appeared to be more informed and mature than those starting the same clerkship earlier in the academic year. A study of 120 medical students was undertaken wherein the criterion variable was the total score on the Medical Preclerkship Test. This exam was designed to measure both the objectives of the clerkship itself and also prerequisite knowledge. The classification variable was prior clerkship experience. Data analysis using a one-way ANOVA demonstrated no significant differences in the mean scores of the four groups studied. Thus, the findings were at variance with the impressions of the faculty. The authors concluded that at least with respect to the cognitive behavior measured by the examination instrument used, prior clerkship experience did not influence subsequent clerkship performance. They state, however, that prior clerkship experience does increase a student's ability to cope with hospital procedure; to obtain information from patients; to present patients to faculty members on rounds; and to perform various procedures, such as veni-puncture, intravenous drips, lumbar puncture, and gastro-intestinal intubation.

Smiley, Raman, and Levine (1979) conducted a similar study in which they tested the assumption that students who have completed other clerkships are likely to perform better in internal medicine. The authors studied clerks at the University of Ottawa School of Medicine. Groups of students with little or no clerkship experience before their internal medicine clerkship were compared with groups of students who had had extensive clerkship experience in disciplines other than medicine. The groups were compared with respect to ward-performance scores and scores on identical multiple choice exams. The resultant data revealed no significant differences in the groups studied which could be attributable to previous clerkship experience. The study concluded by stating:

> despite areas of instruction and experience which overlap between medicine and other disciplines, previous clerkship experience apparently does not have a beneficial effect on student performance in internal medicine, as measured by these two commonly used methods of evaluation (p.938).

Foley, Smilansky, and Yonke (1979) videotaped various clinical teaching sessions in a medical school clerkship and, thereafter, used a verbal behavior classification schedule to analyze the videotapes in terms of the proportion of talking done by clerkship instructors, medical students, residents, and others. It was felt by the authors that student problem solving ability is enhanced only if they are engaged actively in problem solving rather than playing a passive role wherein they

observe the teacher solving the problem and thereby effectively receive a preponderance of only low-level, factual information. Of particular interest for the current study is the problem solving ability taught while conducting rounds. Unfortunately, the authors demostrated that on teaching rounds the instructor talked 62% of the time, the resident 33% of the time, and the student only 4% of the time. Comparable figures during working rounds were 52%, 33%, and 4%. The conclusion drawn from these data is that medical students for whom the clerkship experience is designed function as a passive audience. The educational implications of this study seem quite clear.

4. Research Focusing on the Rounding Process

The majority of the studies which have been done on the rounding process have centered around a description of the time spent while on rounds or studies which attempted to improve the educational value of rounds via improving the teaching ability of the attending physician.

Payson and Barchas (1965) conducted a time study of medical teaching rounds at four different hospitals: (1) a university teaching hospital which emphasized basic scientific investigation; (2) a university teaching hospital which emphasized medical care; (3) a university-affiliated Veterans Administration hospital; and (4) a non-univerity teaching hospital. The results were

distinctly different at the four hospitals, particularly in the amount of time spent in discussion of symptoms, signs, or physical circumstances which could be related to the physical illness of the patient. Despite this finding one of the author's conclusions was that rounds were conducted in a roughly similar manner in all four hospitals. The house staff was noted to spend over one-half of its time with patients. Little time was spent in discussion of factors outside of physical factors which could influence, directly or indirectly, the patient's subjective complaints. When these data were analyzed in toto, the authors concluded that "the teaching orientation of medical rounds in some outstanding hospitals is not directed toward thorough patient care"(p.1471). They also demonstrated that there is less emphasis on bedside demonstration of individual or personal aspects of medical care than most attending physicians realize. In final conclusion, they state, "Rounds appeared to show how senior physicians arrive at decisions and relate case findings to medical theory; they did not emphasize the physicians approach to the patient and the establishment of the doctor-patient relation"(p.1471).

Inui, Chen, and Pecoraro (1980) studied medical attending rounds. They state early in their paper that these bedside exercises constitute the clinical faculty's major effort to convey to the medical students and house

staff the principles of practice. They describe a technique for determining the substantive content of attending rounds. The technique was based on a diary kept by participating physicans wherein they recorded data on each patient admitted as well as major topics addressed in attending rounds discussions. The reported data suggested that: (1) a patient's primary diagnosis does not determine the topic of discussion but serves only as a point of departure; (2) general medical attending physicians discuss a broad array of subjects from diverse perpectives; (3) attending physicians may have characteristic discussion emphasis; and (4) categoried disease topics may received different emphasis in discussion.

Maxwell, Cohen, and Reinhard (1983) used a qualitative approach to study teaching rounds in a department of medicine. Both ward services and private services were observed and also open-ended interviews with students, housestaff, and attending physicians were conducted. Although the authors state that bedside teaching is the traditional and expected method of conducting rounds, they found considerable disagreement, not only about its effectivenes, but also about how it should be done. Their current study demonstrated that housestaff did not see bedside teaching as particularly educational. Despite these thoughts, they found that

highly-regarded attendings did a substantial amount of their teaching at the bedside. They found three teaching techniques to be employed in rounds: (1) questioning; (2) lecture; and (3) discussion. Most attendings used a mixture of these techniques.

What constitutes good clinical teaching was addressed in this study. The authors state:

> The issue of what constitutes good clinical teaching is made still more difficult by the fact that students, interns, and residents have different educational needs. Interns are preoccupied with caring for patients, while students and residents, at very different levels, are more interested in academic questions. Nearly all the house staff interviewed felt that rounds should be pitched at the intern's level(p.195).

The authors felt that the most important finding in their study, from the perspective of improving clinical teaching in rounds, was that many different styles and techniques of teaching can be effective. They also concluded that "the area which appears to offer the greatest potential for improving the educational effectiveness of teaching rounds was in reducing disruptions and increasing the seriousness with which rounds are treated"(p.196).

Medio, Wilkeron, Reinhard, Maxwell, and Cohen (1984) used action research as a strategy for planning and accomplishing change in teaching rounds. Action research involves a change consultant working with a client group to bring about improvement in individual performance and

organizational effectiveness. As a result of the action research procedure four specific areas of the rounding process demonstrated positive change. There areas were: (1) ground rules, expectations, and purposes of rounds; (2) scheduling and promptness; (3) fewer interruptions; and (4) increased bedside teaching. Four areas were identified as continuing problems: (1) quality of bedside teaching - 66% of house staff rated the quality as "fair" or "poor"; (2) feedback - 72% of house staff rated feedback as "fair" or "poor"; (3) punctuality - both attendings and house staff were concerned over punctuality; and (4) interruptions - interruptions remained a continuing problem. On an overall basis the authors conclude that teaching rounds can be improved.

The study of Weinholtz (1981) was prompted by the question of how attending rounds might optimally function for instructional purposes. The stated purpose of this study was "to examine in detail the group dynamics of six medical service teams during attending rounds in order to determine the impact of the attending rounds on the team members' educational experiences"(p.5). The author found that of the six medical service teams observed, five attending physicians clearly demonstrated instructional leadership.

The researcher outlines fifteen propositions regarding instructional leadership which could be a basis

for future research and also could be used to improve clinical instruction. The propositions are as follows:

(1) Instructional activities, other than routine work activities, occur in attending rounds to the extent that the attending physician allocates time for these activities in advance.
(2) The attending physician's ability to provide instructional leadership in not systematically affected by the nature of the working relationship established between the attending and team members. However, immediate satisfaction with the attending may vary by level of training, as a function of the working relations established.
(3) The degree of confusion and anxiety experienced by house staff and students at the start of their service on a team is inversely proportional to the comprehensiveness of the attending physician's orientation sessions.
(4) The attending physician's ability to provide instructional leadership varies directly with the clinical credibility of the attending physician among team members.
(5) The attending physician most readily obtains indication of a team member's ability to present a patient by adapting a low-frequency/clarifying questioning style during the presentation.
(6) Systemic clinical problem-solving is modeled and diagnostic and management discussions remain clearly focused to the extent that the attending physician makes a graphic list of problems, diagnoses, tests, and/or treatments.
(7) The attending physician's influence as an instructor is heightened by sharing clinical knowledge and "wisdom" through didactic presentations pertinent to cases on the service, as long a such presentations do not repeatedly dominate attending rounds.
(8) Psychosocial issues of patient care are discussed by the team, to the extent that the attending physician actively models concern for such issues and focuses discussion on their considerations.
(9) Interaction of bedside visits with conference room discussion is favorably evaluated by team members to the extent that the attending models specific techniques for discovering physical findings and/or communicating with patients.

(10) a. Team members' comprehension of what constitutes a good presentation is enhanced to the extent that the attending physician requires the team members to present cases to each other.

b. The attending physician's ability to assess team members' presenting skills is enhanced to the extent that the attending requires the team members to present cases to each other.

(11). a. The attending physician's ability to assess the team's problem-solving skills is enhanced by the attending occasionally adopting a low profile and observing diagnostic and management discussions.

b. Team members' feelings of inclusion and team cohesion are enhanced by the attending physician occasionally adopting a low profile during diagnostic and management discussions.

(12) a. Medical students will demonstrate increased learning and report feelings of inclusion to the extent that the attending physician assigns them didactic presentations on topics related to the care of the student's patients.

b. Residents will report increased feelings of inclusion to the extent that the attending physician assigns to them didactic presentations on topics of their own selection.

(13) The attending physician's ability to assess student's clinical skills is enhanced by observing student's performing case work-ups at the bedside.

(14) The attending physician's ability to provide instructional activities during attending rounds is related to the rounds to visit patients, review charts, and perform liason functions for the team.

(15) Team members acknowledge learning from their experiences on the medical service team to the extent that the attending physician conducts discussions with the individual team members concerning the attending's final evaluation of their performance (pp.155-167).

Those interested in improving clinical instruction might well pay particular attention to the propostions outlined by Weinholtz.

B. Alternative Methods of Instruction

1. The Lecture

According to the Report of the Project Panel on the General Professional Education of the Physician (1984), in the preclinical curriculum the lecture is the predominant method of instruction. The proportion of total schedule time devoted to lectures varies from 36 to 78 percent amongst the U.S. and Canadian medical schools studied. Although the time spent on lecturing decreases in the clinical years, the "mini lecture" given during clinical teaching still remains popular. According to Jason and Westberg (1982) the following percentages of medical school faculty reported using the lecture:

	Basic Science	Primary Care	Other Clinical
Frequently	78	47	45
Occasionally	18	46	43
Never	4	7	12

Although the use of the lecture is less frequent in the clinical teaching area (primary care and other clinical) it still is used by a majority of those instructors surveyed.

The place of the lecture in medical education was put in perspective by Samter, Lepper, and Montgomery (1957) when they pointed out:

> As long as the four-year curriculum of the medicl school is maintained, it seems likely that the

> increasing mass of information cannot be taught at the bedside or in seminars alone if we intend to keep the students abreast of current developments and progress. Our own conclusions resemble those of Welch, who was brought up on lectures and then advocated strongly the teaching in the laboratory and at the bedside; but toward the end of his life he seems to have reached a compromise which restored, at least in part, lectures in their proper place (p.586).

Lowman (1984) describes several different types of lectures among them (1) the formal oral essay; (2) expository lecture; (3) provocative lectures; (4) lecture-demonstration; (5) the question-lecture; (6) the lecture-recitation; and finally, (7) the lecture-laboratory. Each of these types seem to be used in medical education. Lowman also points out what he considers to be a narrow view of the objectives of the lecture, namely that some authorities feel that the lecture is inferior to reading the same material as far as recall is concerned. He goes on to state that:

> research suggests that a first-rate lecture is better than written material at emphasizing conceptual organization, clarifying ticklish issues, reiterating critical points, and inspiring students to appreciate the important key information (p.100).

The lecture also serves as an effective tool to motivate students and above all else, a good lecture is engaging.

Ericksen (1984) also delineates certain aspect of the lecture. He feels that the two basic conditions for learning, namely motivation and meaning, are promoted by the lecture. The techniques for motivating students differ, however, motivation is a prerequisite for

efficient learning and good teaching transforms resistance to interest and sustains the curiosity that brings students into a certain curriculum. This author goes on to say "studies on college learning indicate that when lectures are arranged around questions that pique students' interest, learning is improved"(p.30).

Kent and Spivey (1971) studied the concept of the lecture versus non-lecture in the teaching of gastrointestinal pathology. They randomly divided sophomore medical students into two groups consisting of 62 participants in each group. Each group was given certain instructional materials. One group was given seven one hour lectures while the non-lecture group had the option of attending a one hour question-answer sessions in which questions were answered but no other information was given. At the completion of the instructional period a multiple-choice exam was given and another exam was given two months later. The results showed that the lecture group scored significantly higher on the first test and when the two tests were combined, the lecture group scored higher on problem-solving type questons and on questions judged by the lecturer to be moderately difficult or difficult. On the second test no diffences between groups was noted on factual questions, questions testing understanding of facts or definitions, or questions judged to be easy. A questionnaire was also

distributed to the participants concerning their preference for the lecture versus non-lecture. Of the 124 participants in the study, 52 of the 62 in the lecture group felt they preferred that method of instruction, while only 29 of the 62 in the non-lecture group preferred that method. The majority of the participants in both groups felt that they had or would have learned more in the lecture. The authors conclude that there is no difference in performance on an objective exam given two months after a teaching unit in gastrointesstinal pathology. They also state that "these findings support the well documented but poorly accepted concept that performance on final examination is not affected by teaching technique" (pp.528-529).

One aspect of lecturing which deserves investigaion is the so-called seductiveness of the lecturer. Naftulin, Ware, and Donnelly (1973) reported a study which tested lecture participants satisfaction with the lecturer. Those listening to the lecture included psychiatrists, psychologists, educational administrators, and medical educators. The lecturer, called Dr. Fox, was actually a professional actor who presented, in a very impressive style, a lecture with conflicting and meaningless content. After the lecture the attitudes of the audience toward the lecturer were measured on an eight item questionnaire. The authors concluded that the audience had been "seduced"

into being impressed by the talk. Since this paper was published, articles have appeared which have cast doubt on the techniques used in the study. Evidence has been presented, however, which does support the fact that the personality of teacher might be the most significant variable in the evaluation of teacher effectiveness (Getzels and Jackson, 1963).

Miller (1961) specifically addresses the use of the lecture in the medical school. He feels that under ideal conditions the lecture can lead a student to any of the major objectives of an educational program which he has outlined. He points out that the objectives most commonly achieved by the lecture technique are informational, however, in the course of obtaining information the listener may also gain some understanding and develop new attitudes. This author also enumerates certain advantages of the lectures as follows:

(1) The good lecture can vitalize facts and ideas which often appear cold and impersonal in the printed pages of a book;

(2) The lecture can supplement material found in textbooks and other printed material;

(3) The lecture provides opportunity for classifications of difficult concepts and emphasis of particularly significant information;

(4) The lecture provides opportunity for clarification of difficult concepts and emphasis on particularly significant information;

(5) The lecture provides an opportunity for students to raise questions about matters of interest or difficuty at a time when the answers are particularly significant, rather than delaying such questions until interest or puzzlement has been forgotten.

One can conclude from Miller's presentation that the lecture does have validity as an educational tool.

2. Group Discussion

Not every topic in medical education is best addressed by the lecture technique. There are certain topics which are more suited to the group discussion format than the lecture format. There also are certain aspects of medical education, such as clinical reasoning, which when taught lend themselves more to the group discussion method than the lecture method.

According to Green, Grosswald, Suter and Walthall (1984), the group discussion technique is of advantage because it actually involves the participants in the educational process. It, furthermore, allows for free exchange of ideas and is particularly useful for problem solving, correcting misconceptions, or examining controversial issues. They also feel that because of the participation and interaction of the learners, discussion

may be effective in changing attitudes. One of the other advantages of the discussion is that the method is better suited for small groups.

Jason and Westberg (1982) found that small group discussion was used by a significant percentage of the clinical instructors surveyed:

	Basic Science	Primary Care	Other Clinical
Frequently	54	80	64
Occasionally	39	14	30
Never	8	6	6

It is interesting to compare this data with similar data previously outlined for the lecture technique and see the shift in methods used when one compares the basic science instructors with the clinical instructors. The rounding situation, because of its physical structure, lends itself more to a group discussion format than the lecture format.

Lowman (1984) outlines certain eductional objectives for discussion. He feels:

> that discussion aids in mastery of content by encourging students to actively process what they learn as they sit in the educational environment. The discussion leader also can lead a student through an application of a general concept to a specific problem or example. This process requires students to demonstrate understanding and not mere memorization. The discussion format also is useful to teach the process of learning, that is, thinking. Through this method students learn to approach a problem or topic rationally, monitor their own thinking processes, and question their implicit assumptions (p.122).

Lowman also feels that the discussion method is particularly good at revealing students' attitudes, an area which has been explored to only a minor degree in medical education. Lastly, this author feels that "discussion can promote student rapport, independence, and motivation in ways unattainable by lectures alone"(p.124).

Horne (1979) reviewed the literature concerned with small group teaching in higher education with particular reference to medical education. After his review he concluded that in small groups, if the aims and objectives are formulated, an effective learning experience can be provided. This experience can faciliate the changing of attitudes and beliefs and also the memorization of factual material.

Ways, Loftus, and Jones (1973) studied what they considered to be an innovative method of teaching and learning in medical education, a method they named the Focal Problem Teaching Method. They felt this method would directly simulate the problem solving character of medical practice and, therefore, would cultivate the skills of medical problem solving. This method of instruction is based on small group discussion which according to the authors offers special advantages in problem solving, including: (1) the group as a whole knows more than any one member, and indviduals invest at least as much energy and time clarifiying and developing

others' ideas as they do expressing their own; (2) there is a diminished reliance upon the teacher as an authoritarian truth-teller and an emphasis on active learning roles; (3) there develops an increasing sensitivity to the form and content of communication, including non-verbal clues; and (4) the provision and utilization of more immediate feedback helps members understand the often tentative or limited nature of their conclusions and encourage independent thinking, conclusions, and comparisons with others. They go on to point out that "the observation and evaluation of the student's performance in problem solving provides an opportunity realistically to assess his abilities to do the kind of task which will be required of him in the professional role"(p.568).

Finally, Miller (1961) analyzes the group discussion method in medical schools. He states that the underlying philosophy in group discussion is that each member of the group is an individual and that he is qualified to say something and deserves to be heard. It is obvious that the instructor who is unwilling to accept this assumption must use some other technique of instruction. According to Miller, some of the advantages of group discussions are: (1) it provides the student an oportunity to interact with his instructor as well as his peers; (2) it provides an opportunity for each student to raise questions and to

pursue ideas or problems which are not clear to him/her; (3) it provides an opportunity for the synthesis of varied experiences and data derived from lectures, labortories, clinics, and reading. This is truly a rare opportunity in medical school where the emphasis is on the accumulation of a vast body of information and where seemingly little attention is paid to the achievement of understanding and to the synthesis of this information.

3. Video Tapes

Jason and Westberg (1982) in addition to the various surveys prevously outlined, also looked into the use of various educational resources by medical school faculty. They found that 9% of the faculty used video tapes frequently, 33% occasionally, and 58% never. In their discussion of the uses of the various resources, they state that when effectively used, simulations and video technology can be particularly potent instructional resources. Among the resources listed, they have the potential for fostering active student participation in the learning process. They also found that resources which conveyed static information (slides, assigned texts, readings, and handouts) were used far more than those with the potential for engaging students in more complex from of learning (simulations and video tapes).

Chez and O'Gorman (1970) evaluated video tapes as a teaching method in clinical medicine. They conducted an

experiment in the teaching of obstetrics and gynecology of which the goals were: (1) to present didactic material in an efficient manner; (2) to support the student's initiative and rsponsibity to self-learning; (3) to enhance more effective use of faculty-student contact time. In analyzing the results the authors found that 96% of the students preferred the tutorial system to other educational formats such as rounds, lectures, and work up review as a means of providing meaningful contact between faculty and student. Ninety-nine percent of the students preferred the audiovisual technique to lectures with 80% judging audiovisuals to be more efficient than lectures. The authors concluded that this was an effective approach to learning in clinical medicine.

In another study Beswick, Cooper, and Whelan (1982) attempted to make a formal assessment of the technical skills of medical students after one week of clinical training and to determine whether videotape teaching of physical examination skills was superior to a lecture in supplementing bedside teaching. The initial part of this study consisted of a pretest which was given to all 29 participants. Thereafter, half of the randomly chosen students were shown a videotape outlining an examination of the alimentary system while the other half was taught the same material in a standard manner consisting of slide illustrated lectures. Both groups were exposed to bedside

teaching. At the end of the teaching period all students completed the same instrument as was used in the pretest situation. The authors concluded after an analysis of the data that the teaching program including a videotape demonstration was more effective than the traditional teaching program. They, furthermore, concluded that videotape demonstration of physical examination skills can play an important role in the teaching of clinical medicine to medical students.

The videotape technology seems especially suited to the demonstration of manual skills, such as are used during the physical examination. It can, however, be used for the presentation of other types of materials. One of the major drawbacks of this method is that it prohibits interaction between the student and the instructor.

IV. The Dependent Measure

A. Multiple Choice Examinations

The literature is controversial in this topic area, particularly when attempting to answer the question of what is being measured in an exam consisting of multiple choice questions. Literature will be reviewed which addresses this question as well as the validity and reliability of multiple choice exams (questions).

Ebel (1979) suggests that multiple-choice test items are the mosts highly regarded and widely used form of objective test item. In addressing what exactly this

question format measures, he states, "They are adaptable to the measurement of most important educational outcomes; of knowledge, understanding, and judgment; of ability to solve problems, to recommend appropriate actions, to make predictions"(p.135). Ebel also feels that the multiple-choice format can measure just about anything that could be tested by other evaluation formats. There are many critics of multiple choice test items with some of the criticisms reflecting a general mistrust of all objective testing techniques. Generally, according to this author, critics allege that objective test questions are superficial, ambiguious, and conductive to guessing. He points out, however, that there are at least two weaknesses in the general indictments, namely, that the criticisms are seldom supported by unbiased experimental data and secondly, that critics seldom attempt seriously to make a good case for an improved way of measuring educational achievement. The importance of carefully constructing the test items is repeatedly pointed out. It is reassuring to note that an authority such as Ebel feels that good objective test items do not permit correct responses on the basis of simple recognition, sheer rate memory, or meaningless verbal association.

The versatility of the multiple choice item is also outlined by Gronlund (1985) where he states that this examination format can measure simple learning outcomes as

well as more complex outcomes in the knowledge, understanding, and application areas. In the area of knowledge this format can be used to measure knowledge of terminology, specific facts, principles or methods and procedures. In the area of measuring outcomes at the understanding and application levels the multiple choice test can measure abilities to identify application of facts and principles; ability to interpret cause and effect relationships; and, ability to justify methods and procedures. Gronlund also points out certain advantages and limitations of multiple choice items. Among the advantages are that multiple choice items better structure the situation than seen in short-answer items, therefore, avoiding a certain amount of ambiguity and vagueness. Also in the multiple choice format the pupil must know what is correct and not just that a statement in incorrect such as in a true-false item. Other advantages are that multiple choice items do not favor response sets and also that the incorrect responses may provide clues to factual errors and misunderstandings that need correction. Disadantages are that the format measures learning outcomes at the verbal level; it is not well adapted to measuring the ability to organize and present ideas; and, it is sometimes difficult to find a sufficient number of incorrect but plausible distracters.

The National Board of Medical Examiners uses the multiple choice questions freely. Hubbard (1978) points out that three types of multiple choice questions are employed by the National Board, namely, (1) the one-best-response type; (2) the matching type; and (3) the multiple true-false type. The one-best-response type is the most frequently used type of multiple choice item. It is pointed out that one of the major criticisms of multiple choice items is that the correct response is included among the answers offered. Various ways of constructing the questions are illustratd which show that it is not necessary to include the correct response among the given choices (i.e., "none of the above" may be the correct answer). Matching type questions can be used to test knowledge of entities that may or may not be closely relatd. The multiple true and false items, when properly written, test in depth the candidate's knowledge or understanding of several aspects of disease, a process or procedure.

Levine, McGuire, and Nattress (1970) studied the reliability and validity of multiple choice tests. They initially pointed out that much of the criticism leveled against this exam format is based on the assertion that multiple choice exercises focus on the measurement of the recall of isolated bits of information which have little relevance to any meaningful behavioral objective. They

describe a study undertaken in conjunction with the American Board of Orthopedic Surgery to investigate the reliability and validity of alternative techniques for assessing professional competence. This study demonstrates that "the great stength of the multiple choice technique is it consistently high reliability"(p.70). The reliability was correlated with the number of multiple choice items on the entire test and ranged from .72 with 150 items up to .89 with 230 items. Reliability was estimated using the Kuder Richardson Formula 20.

The content validity of multiple choice examinations was studied by means of process analysis. Via this technique these exams contained a preponderance of items which required only recall. As a result of this determination specific steps were taken to construct questions to measure higher taxonomic levels. Concurrent validity was studied using a composite of performance on in-training exams and performance on certifying examinations. These scores were pooled and correlated with supervisors' ratings. Despite certain methodological problems it was felt that multiple choice exams do have concurrent validity. The construct validity of the multiple choice exams studied was determined by two methods, one of these being an analysis of the factor structure of scores on all oral and written examination,

including those on the mltiple choice test. This analysis revealed that the multiple choice exam loaded significantly on only one of five factors felt to be related to orthopedic competence. The factor showing this loading was felt to be a recall or cognitive functioning factor. It appears that this particular multiple choice exam was constructed in such a way that it primarily measured recall.

Dudley (1973) was also concerned about the low taxonomic level measured by multiple choice questions. He states:

> The application of taxonomic principles to multiple choice questions appears to have established that it is extremely difficult (but not necessarily impossible) to construct multiple choice questions that require anything more than simple recall or the formation of first-order relationships between two or at the most three facts (p.195).

This statement is somewhat distressing, however, there are other authors, such as Ebel and Grunlund who have different opinions on this issue. If one accepts Dudley's assessment of multiple choice items then medical educators must accept as axiomatic that their prime task is to impart facts. Certainly medicine involves much more complicated tasks than mere recall of facts.

Joorabchi and Chawan (1975) studied two different types of multiple choice questions consisting of those measuring recognition and recall and those measuring clinical problem solving. They also included patient

management problems(PMP's) in their study. They attempted to determine to what extent these two types of tests related to cumulative five-year class standings; if the two types of multiple choice questions related to the PMP's; and, what if any, was the correlation between the two types of multiple choice questions. They found that the questions measuring recall and recognition correlated highly with class standing. The correlation with problem solving multiple choice questions and PMP's was less convincing. The authors also felt that PMP's come closest to measuring one of the more important objectives of medical education.

Further study on the reliabiity and validity of multiple choice questions as well as PMP's was conducted by Norcini, Swanson, and Webster(1983). The purpose of their study was "to compare the reliability, validity, and efficiency of their multiple choice question formats and PMP's, with particular focus on whether multiple choice questions and PMP's measure different aspects of clinical competence"(p.53). The three types of multiple choice quesions studied were: (1) one-best answer question, (2) matching questions, and (3) multiple true/false questions. For all of the multiple choice formats, KR 20 reliabilities were calculated. The composite reliabilities for three separate exams using the multiple choice format ranged from .91 to .92. Although PMP's will

be addressed later it is of interest to note that their reliabilities (calculated via coefficient alpha) ranged from .72 to .75. The authors conclude that best answer and multiple true/false multiple choice questions results as well as the PMP results provide strong positive evidence for the reliability of the examination.

Recently, the reliability and validity of two different types of objective examinations (pictorial multiple choice and multiple choice) was studied by Downing, Maatsch, Huang, Baker, Munger (1984). In this study the pictorial multiple choice questions were intended to measure a candidate's skill or competency to interpret clinical data, to diagnose, and to make management decisions based on clinical information shown in the visuals. The multiple choice questions were designed to require the candidate to make a diagnosis and/or management decision about the patient. The Kuder-Richardson 20 reliability coefficient for the total multiple choice score was .96 while that for the pictorial multiple choice format was .89. It was felt that the high reliability coefficients indicated that each test was measuring consistently. It was, furthermore, felt that the content validity and criterion related validity of the question format was estabished.

Brief mention was previously made concerning Patient Management Problems (PMP's). There are persons involved

in medical education who feel that PMP's may be one of the better instruments available to measure clinical problem solving. This study will not utilize PMP's, the reasons for which will be outlined in the next few paragraphs.

The first issue of concern is the reliability of PMP's. Norcini, Swanson, Grosso, and Webster (1983) conducted a study which compared various methods for scoring PMP's. In the initial portion of their paper they state that "multiple choice questions were more reliable and efficient in use of testing time than Patient Management Problems (PMP's)"(p.41). They, furthermore, point out that the American Board of Internal Medicine six hour PMP section typically has a reliability of only 0.8.

Wolf, Allen, Cassidy, Moxim, and Davis (1985) studied PMP's as a method of evaluating medical problem solving. They used four PMP's as a pretest given prior to an intervention intended to improve problem solving ability and, thereafter, gave eleven PMP's as a posttest. Using Cronbach's alpha to determine the internal consistency reliabiity coefficients the pretest PMP's were .515 and the posttest PMP's were .742. These authors felt that the fact that the number of posttest PMP's was almost triple that of the pretest PMP's contributed to the greater reliability of the posttest. Using a different method for determining reliabiity, namely, Angoff Formula 12, Feinstein, Gustavson, and Levine (1983) studied seven

different PMP's and found the coefficient of reliability to range from -.17 to .91. These same authors felt that clinical simulation problems might not be sound psychometric instruments despite the fact that generally a high internal consistency was present as measured by the Angoff Formula 12. The problems lie in the area of the reliability across problem which was found to be quite low as could be seen in their weak intercorrelations. Fleisher, Schwenker,and Donnelly (1982) calculated their reliabilities (coefficient alpha) of various components of two PMP's and demonstrated that the combined reliabilities of the history portion to be .93, of the physical exam portion to be .91, of the laboratory area to be .77, and of the treatment portion to be .70. It can be seen from these various studies that the reliabilities of PMP's have a wide range although generally the reliabiity indices are less than optimal.

The issue of the validity of PMP's also needs to be explored. Wolf, Allen, Cassidy, Maxim, and Davis (1983) examined the concurrent and criterion-referenced validity of patient management problems. They initially state that "PMP's are generally considered to possess adequate content validity, simulating the domain of knowledge, skills, and proceses necessary to competently solve and manage patient cases"(p.224). Their study used fifteen linear PMP's which were administered to 175 medical

students at various points along an intervention curriculum designed to introduce students to the concepts of clinical problem solving, ward experience,and the integration of concepts with facts. The concurrent validity was tested by computing Pearson product moment correlations between student performance on NBME Part I and average scores for the pretest and posttest PMP's. The criterion-referenced validity was calculatd via an analysis of the students pretest-posttest performance using paired t-tests and the Wilcoxon Matched-Pairs Test to measure change in performance on the problem solving, proficiency, errors of omission, and errors of commission indices. The correlations on the PMP pretest index ranged between .21 and .38 ($p<.006$)and between .26 and .53 ($p<.001$) for the PMP posttest index. The authors felt these correlations supported the concurrent validity of PMP's. They also point out the fact that the larger posttest correlation coefficients as opposed to those on the pretest supported the content validity of PMP's. Further data were presented which the authors concluded supported the criterion-referenced validity of PMP's.

Corley (1983) in a synopsis of patient managment problems states that the content validity is high while the concurrent validity as well as the prediction validity required further study. Newble, Hoare, and Baxter (1982) questioned the validity of PMP's as a measure of clinical

competence. Their study consisted of administering a standard written PMP as well as a verbal response type of PMP to various levels of medical students. It was their feeling that a test which validly measures clinical problem solving ability or clinical competence should provide scores consistent with the level of competence of those to whom it is administered. They, further, felt that if these correlations were present the construct validity of the tool could be demonstrated. Little correlation between level of training and competency on the PMP's was found. The results of this study raise concern about the PMP as a measure of clinical competence and, therefore, about the construct validity of this examination format.

In a study of the validity of patient management problems, Goran, Williamson, and Gonella (1973) compared the performance of members of a clinic team on a PMP with that of actual performance in a clinic. They found the clinic teams to be more thorough in their pursuit of a differential diagnosis on the PMP than they were in the clinic setting. Generally, in the simulation situation more history and physical data was obtained and more lab tests were ordered. They felt that the validity of the PMP as a measure of clinical judgment should be questioned and also that the performance on the PMP did

not distinguish between poor, average, and excellent clinical performance.

Feightner and Norman (1972) also were interested in the validity of PMP's and studied the concurrent validity of this test format. They initially state that the content validity of the PMP is clear. Furthermore, the concurrent validity, in their opinion," can be defined as the relationship between scores on the PMP and concurrent performance on another test that represents a direct measure of the relevant skills and activities"(p.149). Clinical clerks were required to examine one simulated patient and to complete one PMP at two different points during a family practice rotation. The result of data demonstrated a significant greater number of options selected in the PMP's. Overall, significant differences in the behaviors on the two testing formats were noted. In almost every instance the individual would not perform as well in a clinical situation as might be indicated by his performance on a PMP. These highly significant differences in behavior would not seem to substantiate concurrent validity of patient management problems.

Finally, McGuire, Solomon, and Bashook in their important work in simulations considered the issue of PMP validity. It is their feeling that content validity in the branching type of PMP is quite significant. The criterion-related validity has been tested by comparing

scores on PMP's with those on traditional objective tests or oral exams wherein correlations have been found to be low consistent with the feeling that skills sampled by written simulations are different from those assessed by conventional techniques. Thus, one is led to conclude that the criterion-related validity is low to moderate at best. Constuct validity has been studied both by factor analytic methods as well as by comparing differenes in group performance on PMP's to determine the extent to which they are compatible with reasonable hypothesis about which these differences should be. The authors felt the results of both types of analysis were encouraging concerning the construct validity of PMP's.

One might conclude from this brief review of the literature concerning PMP's that their reliability is relatively low. If one is to use an instrument to measure clinical problem solving, the reliability across problems should be high. The issue of validity is confusing in that studies contradict each other. The construct validity of PMP's seems to be established, however, criterion-related and construct validities are less firmly established.

An overall analysis of the literature cited in this section would result in the following conclusions:

1. Multiple choice examinations are generally reliable to a significant degree.

2. The validity studies on this type of question format demonstrate that generally content validity is established. Concurrent validity can be established as can criterion-related validity. The single study addressing the issue of construct validity showed a single construct to be measured by the particular exam in question.

3. The question of what is being measured by multiple choice questions depends to a great extent on how the questions is written. Some formats measure simple recall, others may measure recognition, while still others appear measure clinical problem solving skill.

4. PMP's have low reliability generally with content validity established. Construct and criterion-related validity are more difficult to establish.

V. Summary

An attempt has been made in this chapter to review the pertinent literature felt to be of important to this study. Four principal topic areas were explored.

The historical literature reviewed demonstrated a division of the four year medical school curriculum into a basic science portion and a clinical portion. The primary impetus behind this division was Abraham Flexner and one notes that his ideas still permeate more that half of the medical schools in the U.S. and Canada. The integration

of the curriculum into a unified whole as was done at Case Western Reserve University was discussed and the philosophy behind such an integration was explored. The philosophical reasoning behind this integration seems educationally sound making it somewhat difficult to understand why more medical schools have not adopted this type of curriculum.

The sample-population was next discussed. The sample for this study consisted of medical students and interns. The question of combining the obtained data from these two groups was discussed, however, on the basis of scanty information it appears that the differences in knowledge between these groups would lead one to conclude that such a maneuver would be ill-advised.

Thereafter, a review of important literature in the areas of clinical teaching and learning as well as in the area of alternative methods of instruction was presented.

The attending physician is placed in a difficult position in that he must provide teaching and patient care within a situation where he is often viewed as an outsider. In this situation the attending often is forced into a position whereby he provides only detailed medical information. Several recomendations for the improvement of clinical instruction by the attending were offered.

The intern's role is difficult in that he/she is treated as a graduate physician, yet, often is ill-

prepared to make certain of the decisions with which he/she is faced. They, at times, steer their efforts away from patient care for various reasons as outlined. The intern works long hours under much pressure which eventually leads to an operational perspective which they follow throughout the remainder of the internship. Often their orientation causes them to lose sight of important psychosocial patient-management issues.

Medical students initially are excited with clinical exposure, however, they soon grow impatient with the performance of routine duties. They learn how to deal with faculty and fellow students and also develop a perspective on what to study and learn. Interestingly, it seems that prior experience has little influence on student clinical performance. Students, like interns, frequently feel overlooked by senior house staff and also intimidatd by attending physicians. In response to this, they may fall into a passive role.

Significant studies on the rounding process have been few in number. Time studies have demonstrated that time is often spent in unproductive activities. Often the teaching during rounds is less than optimal, however, it appears that it can be improved.
Extensive suggestions concerning the improvement of rounding were reviewed.

Literature concerning the alternative methods of instruction used in this study was then reviewed. The lecture is used extensively in both basic science and clinical instruction. Via various studies one can conclude that the lecture can be used to transmit knowledge, stimulate students, clarify issues, and others. Group discussion is used extensively by clinical faculty. This method can be used to transmit information but more important for this study is the fact that clinical reasoning can be demonstrated and probably taught via this method. Video tapes can foster active student participation which is of advantage. They have the ability to engage the student in complex forms of learning and also serve as an excellent tool for demonstration of physical diagnostic techniques.

The dependent measure, namely multiple choice exams, was then reviewed. It was concluded that this tool is generally reliable to a significant degree. Validity studies have demonstrated that content validity is high while concurrent validity and criterion-related validity can be established. Multiple choice exams, depending on how they are constructed, can measure simple recall, recognition, and/or problem solving skills. Finally, a brief review of patient management problems was carried out and the reasons for not using them in this study was explored.

CHAPTER 3

METHODS AND PROCEDURES

The chapter on methods and procedures consists of five sections: study setting, population, and sample; design; treatment; instrumentation; analysis procedures. In the first section the study setting is described and the population and sample are identified. The method of sample selection is also described. The design section presents the type of design used in the study, the general statistical model for the design, and the types of statistical analyses used with the design. The treatment and its administration is described in the third section. The fourth section includes a presentation of the instruments used in the study. The final section identifies the analysis procedures used in this research.

Study Setting, Population, and Sample

Study Setting

As mentioned previously, one of the limitations of this study is that it was performed in a community teaching hospital and, therefore, its generalizability to large medical centers is questioned. In order for the reader to be able to judge the applicability of the study's findings to his/her own setting a description of the study hospital is provided.

The study setting was a 288 bed community teaching hospital located in a suburb of a large metropolitan area. The hospital is accredited by the American Osteopathic Association and is approved for the clinical training of medical students, interns, and residents. An active teaching program encompassing each of these groups of trainees has existed at the study hospital for many years and was in place while the current study was undertaken.

Further characteristics of the study hospital are provided below:

	1983	1984
Beds	288	288
Bassinets	24	24
Admissions	10,879	10,663
E R Visits	21,176	21,991
Surgeries	9,897	8,535

Table 1. Characteristics of Study Hospital

Select characteristics concerning the attending staff of the study hospital are also provided:

Physicians on medical staff			123
Physicians in Department of Internal Medicine			26
		Board Eligible	Certified
Staff Category:	Active	15	13
	Consultant	11	10

Table 2. Select Characteristics of Study Hospital Staff Physicians.

Since one of the objectives of this study was to determine whether the rounding procedure is or is not educationally beneficial, the medically oriented reader would be interested in the types and numbers of cases to which the trainee was exposed during the rounding exercise. Medical records from the study hospital are routinely abstracted and classified according to discharge diagnosis. From these abstracts the major category and percent of cases in each category on the internal medicine service were determined and are presented below.

Major Diagnostic Category	Percent of Cases
Respiratory	29.15
Cardiovascular	23.29
Gastrointestial	14.44
Neurologic	13.04
Nephrology	9.07
Endocrinology	4.72
Oncology	2.16
Rheumatology	2.13
Infectious Disease	2.0

Table 3. Diagnostic Category and Percent of Cases Seen at Study Hospital - January through December,1984.

Population

Two separate theoretical populations were used in this study. The first was that of the medical student mid-way into the third year of medical school. This population therefore consisted of students who generally had obtained at least bachelor level degrees prior to

entrance into medical school and had successfully completed the first two years of medical school. The second population consisted of interns. Interns are trainees who have successfully completed medical school and are in their first year of post graduate training. The internship of the study population was of the rotating variety meaning that the trainees rotate through the major services of internal medicine, surgery, pediatrics, and obstetrics.

Sample and Selection Procedures

The sample of interns was 15 in number, all of whom were training at the study hospital during the study. The sample of students was 13 in number who likewise were training at the study hospital at the time of the study.

All interns at the study hospital were appraised of the study and presented with the opportunity to participate in the study. Intern schedules had been published several months before the study and the order of participation in the two periods of the study was schedule dependent; therefore, randomization of the order of the study periods was obtained via the schedule.

Medical students training at the study hospital likewise were made aware of the study and were given the opportunity to participate on a voluntary basis. Student schedules, like intern schedules, were published before

the study and thus, the order of participation in the two phases of the study was schedule dependent and therefore randomized.

DESIGN

General Approach

This study employed as subjects medical students and interns assigned to different methods of teaching clinical material, the results of which were analyzed with the expectation of demonstrating the best method relative to scores obtained on an objective test; medical students and interns were analyzed separately. The design also attempted to take into account the order in which students and interns were exposed to the teaching methods. Each subject was exposed to two teaching methods, to be explained later, with the order of assignment being on a random basis. Random assignment was accomplished by using a scheduling method wherein interns and students were assigned to medical rotations prior to the interns and students arriving at the study hospital. Student and intern asssignments at the study hospital consisted of a series of rotations in order to give them broad exposure to various services. The scheduling process consisted of placing these services on a grid and thereafter randomly assigning the students and interns to positions on this grid. This fortuitous arrangement was thus used to assign

students and interns to each teaching method.

The design for this study is a variant of a cross over clinical trial. The design is used because it allows for a comparison of treatments on the same subject at increased precision contrasted with a simple comparison between subjects. By the same token, however, it does require tedious disentangling of the treatment effects from both time and carry over effects. The precision attained with fewer subjects (the major advantage) is desirable because of the necessity of using interns and medical students. The availability of such individuals for the period of time required for this study was a formidable barrier indeed, given the duties of these individuals in a hospital setting.

The study was a two-period time frame, using two distinct groups of interns and two distinct groups of medical students. Results will be reported separately for each classification. Each group was exposed to two teaching methods.

The order of exposure to the different teaching methods was investigated. This was accomplished by exposing the first group of students and the first group of interns to a traditional rounding experience and subsequently exposing those groups to the experimental intervention of an internal medicine tutorial experience. The second group of interns and second group of students

was exposed to the same methods but in reverse order. This accounted for the cross over dimension of the investigation. This notion is diagrammed in Figure 5 below. It is to be noted that the assignment of interns and students to Group 1 and Group 2 was done on a random basis. Thus, the groups were randomly assigned to their order of exposure

	t_1	t_2
Group 1	M_1	M_2
Group 2	M_2	M_1

where t_1 = period 1
t_2 = period 2
M_1 = rounding experience
M_2 = internal medicine tutorial experience

Figure 1. Diagramatic Presentation of Study Design.

All subjects were assessed at the end of each period. The dependent variable to be discussed later, is quantitative in nature. There is a crucial assumption in a cross over design, which is, that the amount of change a subject experiences in time period X is a function of the treatment and the treatment only. Specifically, it implies that a response to a treatment during the second time period should not be influenced by the treatment which was given during the first period. Statistically, this was assessed by testing whether the interaction between treatment and time period was equal to 0. Because of the nature of the crossing over of subjects to

treatments, standard computer programs were not useful in the initial analysis of the data. Consequently, manual calculationss are needed. Formulae developed for a quantitive response must take into account two sources of variation: between and within subjects. Consequently, a basic analysis of variance technique can be used and is of the split-plot type of analysis. Hills and Armitage (1979) outline such a procedure and this technique was subsequently used.

This specific design allows one to investigate three separate questions, namely:

1. Whether or not there is an order difference (signified by period); and
2. Whether or not there is a treatment (method of teaching) effect; and
3. Whether or not there is a treatment by period interaction.

It was through the manipulation of these dimensions which allowed one to address the research hypothesis identifed in Chapter 1 (page 8) and repeated here for ease of reading:

1. The reinforcement of clinical knowledge and skills, can be achieved better by structured instructional experiences than they can by rounds (traditional).

2. Students/Interns perceive rounds and an Internal Medicine tutorial as equivalent ways to synthesize basic science and clinical knowledge.
3. Students/Interns perceive rounds and an Internal Medicine tutorial as equivalent methods which will enable themselves to reinforce clinical knowledge and clinical skills.
4. Rounds can be made more effective as a learning experience by increased standardization and improving the teaching qualifications of clinical instructors.

TREATMENT

Treatment Condition - Rounding

Various authors have classified the rounding procedures in various ways. For the purpose of this study rounds are divided into two types: (1) teaching rounds; and (2) work rounds. Teaching rounds are defined as a procedure wherein members of the housestaff generally proceed from one patient room to the next with an attending physician. During this procedure patients are examined, the medical record is examined, generally case discussion takes place, and conclusions are reached as to further diagnostic directions and patient care. Also, during teaching rounds the attending physician serves usually as a group leader in conducting small group

discussions concerning the patients seen and also at times may give "mini lectures." Periodically during the rounding session the staff person may question the interns and/or medical students concerning various aspects of the patients who are seen during rounds. Small group discussion topics are at times used as a springboard for discussions into other clincial areas. Work rounds are generally conducted by members of the housestaff (students, interns, and residents) at which time the group leader usually is the senior most amongst the group. Patients are usually seen during this procedure, certain decisions may be made concerning patient care, and orders as well as progress notes are entered into the chart. Generally, work rounds will precede teaching rounds so that the senior member of the work rounding group can inform the attending physician concerning the status of his patients. At times, however, work rounds may follow teaching rounds in that the "chart work" such as transcribing orders and writing progress notes may not be done until after the teaching round process has been completed. In its truest sense, teaching during work rounds is at a minimum.

Treatment Condition - Internal Medicine Tutorial

Medical students and interns while in the tutorial portion of this study did not make rounds on the Internal

Medicine service but rather the time period ordinarily occupied by rounds was taken up by the tutorial. Teaching in the tutorial session was carried out by the researcher, a staff internist at the study hospital, and residents in Internal Medicine. The methods of teaching consisted of lecture, group discussions, and video tapes. The topics presented in the tutorial had been determined by an analysis of discharge diagnoses at the study hospital over a two year period of time. Data gleaned from medical records allowed the researcher to determine the types of cases ordinarily seen on the Internal Medicine service over the two year time span as outlined above. From an analysis of this data the types of patients seen on the Internal Medicine service and the numbers of such cases seen on the service was obtained. The topics and length of time spent on the topics had been determined by a further analysis of this medical record data. In the tutorial session, all three components of the tutorial (lecture, case discussion, video tapes) were presented. Each session began with a lecture which was followed by small group case discussion wherein case examples were used to further illustrate certain points mentioned in the lecture as well as areas not covered in the lecture period. As previously cited in Chapter 2, the lecture method can be used to transmit factual knowledge to the trainees. In this study it was used as such. Case

discussion is a method used to teach clinical reasoning and was used as such in this study. Video tapes were utilized to point out various aspects of history taking and to illustrate methods employed during the physical examination.

Administration of the Treatment

In the tutorial session students and interns attended lectures,participated in small group discussions, and viewed video tapes. The basic tutorial design consisted of four separate modules, each of the modules occupied a one week period of time. At the beginning of each module, the participant was presented with a listing of the topics to be covered which had been determined via the method as outlined above. Specific reading assignments were not given to the participants unless a request for same was made by the participants. This follows closely with the procedures which are ordinarily carried out in the rounding procedure in that specific assignments usually are not given by the attending physician on rounds but rather topic areas are outlined. The tutorial sessions lasted approximately two to two and one-half hours each day for five days out of every week which is similar to the actual educational time spent during rounds. Two separate studies previously referenced have demonstrated that approximately four hours per day were spent in the

rounding procedure. It has been the experience of other research (Skeff, 1985) that only approximately two hours of this four hour period of time is spent in productive educational pursuits. As such, this is the time block which was allocated to the tutorial session. In an effort to make the tutorial session non-person dependent other instructors ouside of the researcher were utilized on a random basis.

INSTRUMENTATION

An experimental study requires both identifiable independent variables and dependent variables. Selection of the dependent variables must be logically consistent with the underlying assumptions of the treatment as well as to accurately assess the objectives of the treatment.

Dependent Variables

This study used two different methods of determining the dependent or outcome variables of the study. The first dependent variable was the number of correct responses on an objective test which measured factual medical information. The second dependent measure was a self evaluation instrument which was used by the interns and students to assess their perceptions of the impact of the teaching methods on their learning including knowledge, skills, and attitudes.

1). The instrument used to measure factual knowledge was an examination consisting of multiple choice items. Standardized questions from several different sources have been used to develop this testing instrument. Questions from various national board preparatory books as well as from the Medical Knowledge Self-Assessment Program have been utilized. These questions were reviewed and screened for relevance to the topics discussed in the tutorial as well as to the cases present in the hospital during the experimental period. These questions were further scrutinized for their level of difficulty relative to the level of training required to give a knowledgeable answer. The reviewing mechanism was carried out by the researcher who has had prior educational experience as well as significant clinical experience in the specialty of Internal Medicine as well as in one of the Internal Medicine subspecialities. As a result of the culling of the question pools, four examination of 85 questions each were developed. These tests were administered to both groups of students and interns in the following way:

1. All students and interns received a post-test at the conclusion of each eductional experience. A post-test only analysis can be used since students and interns were randomly assigned to treatments.

2. Each participant, shortly prior to the conclusion of each of the teaching methods, was given the self-evaluation tool which was previously described.

All testing instruments were administered to the participants of the study in a monitored setting with no specified time constraints.

The reliability of each multiple choice test was determined via the Kuder - Richardson - 20 method.

ANALYSIS PROCEDURES

The main objective of this investigation was to determine if an alternative to the traditional rounding method of teaching could be established with demonstrable improvement in factual knowledge acquisition as well as improvement in the initial stages of the problem solving process and to investigate the perceptions of the alternative's usefulness by the participants in the study. The questions which guided this study are cited in Chapter 1 and 3. The next chapter will reformulate these questions into research hypotheses and present their analyses. The cross over design and appropriate statistical tests will be used to adjudicate these hypotheses.

Even though the subjects used in this experiment have similar educational backgrounds in as much as all students have completed two years of basic science instruction and

no previous clincial instruction and the interns all have completed four years of intensive medical training as well as in-depth involvement in clinical settings, it might be assumed that there will be variation within each group relative to the degree of knowledge possessed prior to the beginning of this study. In an attempt to account for prior knowledge all interns with each other and students with each other, a standardized test of medical knowledge was used as a covariate in discernment of amount of knowledge obtained as a result of this study. The covariate was the National Osteopathic Board Part 1. Part 1 is a measure of basic science knowledge acquisition and is a prerequisite for entry into the clinical portion of a medical curriculum. Part 1 of the Board tests knowledge in the areas of anatomy, physiology, biochemistry, pharmacology, microbiology, pathology, and osteopathic principles. It is necessary to point out, however, that an analysis of covariance is not without cost (in an analytical sense of the term). One degree of freedom will be lost in an analysis of covariance. This may be critical since the n in this study is not large. Consequently, a prior analysis was performed and quidelines for covariate retention suggested by Cox (1958) were used.

Specifically -

- if the correlation between covariate and dependent variable is:

< .3	Delete covariate
.3-.6	Retain covariate
> .6	Use covariate as dependent variable

CHAPTER 4

PRESENTATION AND ANALYSIS OF THE DATA

This chapter consists of four sections: preparatory remarks, student and intern performance data concerning knowledge acquisition, student's and intern's attitude data, and summary. The first section presents the examination characteristics of both students and interns on the objective portion of the data as well as remarks about the designs used to analyze the data. Section 2 and Section 3 will formally address the hypotheses of the study relative to knowledge acquisition and attitudes. Section 4 will summarize the overall results of the analysis.

PREPARATORY REMARKS

Preparatory Remarks

The examinations used to assess the acquisition of factual knowledge was, as stated in Chapter 3, a test consisting of multiple choice items. Table 1 presents the examination characteristics of the student's performance after rounds and after the tutorial experience.

Table 1. Examination Characteristics of Student's Performance

	Post Rounds	Post Tutorial
Number of Students	13	13
Number of Items	85	85
Raw Mean	40.77	46.46
Standard Deviation	5.86	4.62

Table 2 presents similar information about the intern's performance on the examinations.

Table 2. Examination Characteristics of Intern's Performance

	Post Rounds	Post Tutorial
Number of Interns	15	15
Number of Items	85	85
Raw Mean	47.73	48.81
Standard Deviation	5.52	6.24

As previously stated, the questions used in the multiple choice examinations were drawn from various national board preparatory books. These questions therefore had been previously tested for reliability by various testing services. The examinations used in this study were pilot tested by medical students.

In order to gain an appreciation for the adequacy of a dependent variable to repeatedly assess the structure of that which it is supposed to measure a reliability coefficient must be calculated. The post rounding

examination used in this study had a reliability of .6493 while the post tutorial examination had a reliability of .5179. The fact that the reliability was somewhat less than expected is partially explained by the n used in this study.

The attitudinal survey used to complete the second part of the study was derived partially from the work of Kelly Skeff (1985) which has appeared in publication and which uses a modified Likert rating scale on statements reflecting aspects of learning on an internal medicine rotation. Substitutions and additions were made at various points in the survey instrument to more adequately reflect the purposes of this study.

The design used to analyze the data from the objective test component of this study is the two period crossover design described in Chapter 3. The basic analysis will follow the outline suggested by Hills and Armitage (1979) and will use the analysis of variance (ANOVA) approach. These authors indicate that using the ANOVA techinque allows one to investigate an interaction effect, should one exist, which is not present in much of the literature discussing this particular design.

The strength of the cross over design is that it addresses directly the question of whether or not there is a carry over effect or influence of one instructional modality upon another. This lingering effect can present

itself in the analysis in at least two ways. First, it could be demonstrated directly as a main effect in the ANOVA table. Such an occurrence would suggest that what one does in period I is significantly different than in period II. It should be recalled that teaching method (i.e., rounding and tutorial) is given to each subject at each period and as such is, in a statistical sense, confounded with each period. That is to say, whatever statements that are made about the period effect must be influenced by methods of instruction--the two notions are tied together. Secondly, time period and order of presentation are themselves linked together and are demonstrated as the interaction term in the ANOVA table. Should this be significant it suggests that any statement made about "order of presentation"or "treatment" must be conditioned upon time period. That is to say, the data must be explored within each time period before any statement can be made which suggests combining time periods. The methods of instruction are linked to order of presentation directly and hence is also a confounding variable with any statement made about whether or not there is a difference in subject performance when one inspects the combination of rounds then tutorial and vice versa. Thus, the period effect must be looked at prior to making statements about methods of instruction.

ANALYSIS OF KNOWLEDGE ACQUISITION

The presentation of these data will be separated into intern's performance and student's performance on the examinations. The research hypotheses pertaining to knowledge acquisition will then be presented and adjudicated.

Intern's Performance

The central questions in this section, as well as the one that follows, is first whether or not an individual's acquisition of knowledge depends on instructional modality. That is, will an individual learn more if they experience a tutorial instructional mode followed by a rounding mode or a rounding experience and then a tutorial experience. Secondly, whether or not there is a carry over effect in learning from the previous treatment period, and lastly, whether or not there is a treatment by period interaction which will suggest a differential effect of the time period tested on the order of instructional modalities for each individual. These questions can be formally stated as statistical hypotheses as was done in Chapter 3. The research hypotheses and their statistical formulation are rephrased here for ease in reading.

Research Hypothesis I. The reinforcement of clinical knowledge and skills can be achieved better by structured instructional experiences than they can by rounds.

$H_0 : \mu_1 = \mu_2$
$H_1 : \mu_1 \neq \mu_2$

where μ_1 is equal to the mean score of subjects on objective tests after teaching rounds. where μ_2 equals mean score of subjects on objective tests after tutorial.

Because of the analysis of variance technique used in this study two other hypotheses can be generated from this central question. They are:

(i) There will be no period effect (i.e., there will be no carry over effect) between time period I and time period II on knowledge acquisition

$H_0 : \mu_1^* = \mu_2^*$
$H_1 : \mu_1^* \neq \mu_2^*$

where μ_1^* is equal to the mean score of subjects on the objective test after period I. where μ_2^* equals mean score of subjects on objective tests after time period II.

(ii) There will be no interaction. That is to say, the effect of time period will not differentially effect those in the tutorial from those in rounds.

$H_0 : \gamma_{ij} = 0$
$H_1 : \gamma_{ij} \neq 0$

where γ_{ij} is equal to the interaction of time period and instructional order for an individual.

The descriptive statistics for the intern's performance in this study are shown in Table 3 and Table 4.

Table 3. Interns (Rounds/Tutorial) Performance on Objective Examination.

Difference	Post Rounds	Post Tutorial	(R - T)
n	8	8	
Mean	48.875	48.125	0.750
Standard Deviation (s.d.)	4.853	6.556	6.205
Standard Error (s.e.)			2.194

Table 4. Interns (Tutorial/Rounds) Performance on Objective Examination.

	Post Round	Post Tutorial	Difference (T - R)
n	7	7	
Mean	46.429	48.143	1.714
s. d.	6.321	6.866	7.544
s. e.			2.851

The correlation between the post rounding and post tutorial examinations was .3777.These values were used to compute the components of the analysis of variance, the results of which are shown in Table 5.

Table 5. Analysis of Variance - Interns

Source	df	SS	MS	F	p
Between Subjects					
T x P	1	44.054	44.054	.839	n.s.
Residual	13	682.860	52.527		
Within Subjects					
Treatment	1	10.798	11.333	.482	n.s.
Period	1	1.735	1.735	.074	n.s.
Residual	13	305.493	23.499		

Because the design is not balanced - 8 vs 7 - the sums of squares used to compute the ANOVA cannot be uniformly partitioned. As a result the interaction term must be investigated first before statements can be made about the main effects, treatment and period. Examination of Table 5 shows that the interaction effect is not significant [$F(1,13) = 0.839$, n.s]. This suggests that treatment is not differentially affected by period nor is period differentially affected by treatment. Therefore, attention can be directed to the main effects. The treatment effect is not statistically significant [$F(1,13) = 0.482$, n.s.] and likewise the period effect is not significant [$F(1,13) = 0.074$, n.s.].

Because the period effect is not statistically significant either as a main effect or as an interaction the carry over effect is negligible. The main effect of order of presentation is not significant for these data. Consequently, one can inspect the interns performance on knowledge acquisition after rounds and after tutorial directly via a paired t-test. The results are shown in Table 6.

Table 6. Assessment of Knowledge Acquisition After Rounds and Tutorial.

			Statistic	Value	df	p
Rounds	Mean	46.429	t	-.4118	14	n.s.
	S. D.	6.321				
Tutorial	Mean	48.875				
	S. D	4.853				

Thus, on the basis of this study one can conclude that acquisition of clinical knowledge at the intern level can be achieved equally well via traditional teaching rounds or using a structured instructional experience.

Student's Performance on Objective Data

The correlation between the post rounding examination and post tutorial examination was .0958. This low correlation is due primarily to the low reliability of the post rounding examination. Table 7 and 8 show the student group's average performance on the respective examinations. The analysis of variance on these data is shown in Table 9.

Table 7. Examination Characteristics Students (Rounds/Tutorial)

	Post Rounds Exam	Post Tutorial Exam	Difference (R - T)
n	6	6	
M	37.833	44.667	-6.833
s. d	4.622	3.933	4.119
s.e.			1.682

Table 8. Examination Characteristics
Students (Tutorial/Rounds)

	Post Rounds Exam	Post Tutorial Exam	Difference (T - R)
n	7	7	
Mean	43.286	48.000	4.714
s. d.	5.908	5.223	9.358
s. e.			3.537

Table 9. Analysis of Variance - Students

Source	d	SS	MS	F	p
Between					
T x P	1	124.7590	124.7590	5.0917	<.05
Residual	11	269.5266	24.5024	--	
Within					
Period	1	215.4068	215.4068	7.7646	<.05
Treatment	1	7.2533	7.2533	0.26148	n.s.
Residual	11	305.1319	27.7393	--	

As mentioned earlier an unbalanced design obliges one to investigate the interaction effects first. Table 9 shows the T x P interaction effects are statistically significant [$F(1,11) = 5.0917$, $p < .05$]. Inspection of the treatment and period main effects show that the treatment is statistically nonsignificant [$F(1,11) = 0.7315$, n.s.] but that there is a significant period effect [$F(1,11) = 7.7646$, $p < .05$].

In an effort to explore these findings, an analysis of covariance was performed using the students' National Board of Osteopathic Medicine scores (Board scores). The "Boards" are a series of questions which examine basic science knowledge in anatomy, physiology, biochemistry, pharmacology, microbiology, pathology, and osteopathic principles. The questions are a multiple choice format and are reported out as percentiles. Permission to use these scores was obtained from the students. The scores were averaged by using their arithmetic mean and this became the covariate. It was felt that should there be a difference among students on their Board scores prior to this study that this may explain the group's differing performance. The correlation between the Board scores average and examination performance was 0.1419 post rounding and -0.1795 post tutorial. As can be seen the correlation is low and thus makes it a questionable covariate. Nevertheless, the ANCOVA was performed and results shown in Table 10.

Table 10. Analysis of Covariance (ANCOVA)Students

Source	Sum of Squares	df	Mean Square	F	p
Covariate (Mean Board Score)	0.098	1	0.098	0.001	0.970
Main Effect Period	379.635	1	379.635	5.673	0.041
Error	602.267	9*	66.919	--	--

*Note: 1 person dropped from analysis because s/he did not take National Boards at the time of this study.

Inspection of the table shows that the covariate does not significantly improve our explanation of the period effect since the effect is still present [$F(1,9) = 5.673$ $p < .05$] while the covariate is ostensibly negligible [$F(1,9) = .001$ n.s.]. This test confirms the earlier suspicion of the doubtful utility of this variable because of its low correlation with the exam scores.

Because of the significant interaction of period and treatment (Table 9), individual cell means for students must be investigated as a way of showing the implications of this finding. It is, in other words, a signal that no statements about carry over effect can be made without due consideration to order of presentation--the two are joined statistically. It should be recalled at this point that instructional modality is linked to both period and order of presentation. As an initial exploration into these findings the cell means for the respective post-tests by teaching modality are plotted for each period in Figure 1.

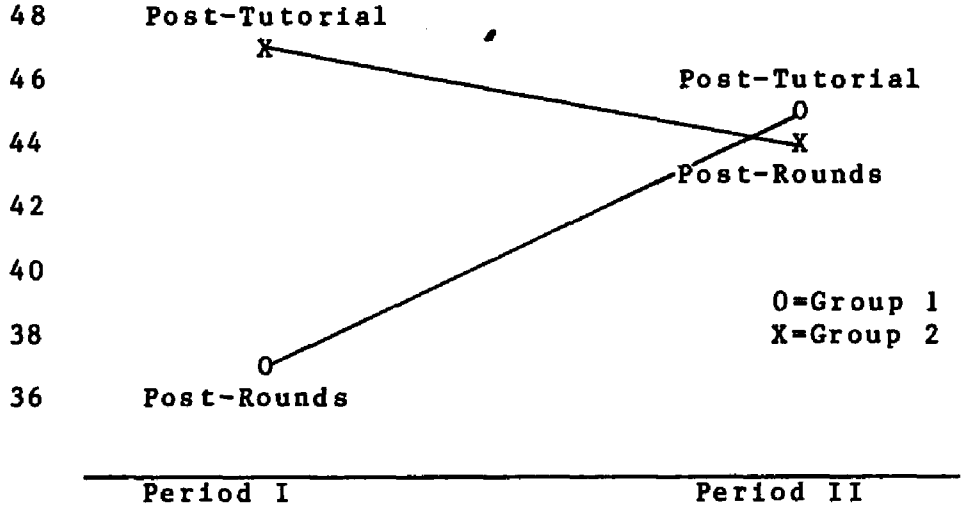


Figure 1: Group means(Post-Tutorial, Post-Rounding Exams)by Teaching Modality Within Periods.

Group means and standard deviations for the respective examinations and time periods are shown in Tables 7 and 8. Within period I a post-hoc comparison of the group means shows the difference to be statistically significant ($t(11)= 3.68$ $p<.05$). Within period II, however, no significant difference exists ($t(11)= 0.486$ n.s.). This statistical significance within period I and not in period II explains the interaction term of the preceeding ANOVA. Moreover, it can be seen that the tutorial method is superior to the rounding method for acquiring factual knowledge in period I but that neither method is superior to the other during period II. Further analysis shows that difference between post-tutorial and post-rounds scores for group 1 (rounds first and tutorial second) do not differ ($t(11)=0.85$ n.s.) and group 2's scores do not differ ($t(11)=0.478$ n.s.). The period main effect as

tested in this design compares the differences between group performances within each period. The data for this comparison are also found in Tables 7 and 8 under the heading DIFFERENCE. Again, the difference score is significantly different from period I and period II ($t(11)=4.06$ $p<.05$).

The major dependent variable for this portion of the analysis has been acquisition of factual information. An attempt to render this term more precise will now be made.

Each of the exam questions was classified into both Bloom's Taxonomy and Guilford's Taxonomy (See appendix A and B for Toxonomies) by two separate observers and differences were mutually adjudicated. Categories with less than ten questions were excluded from the analysis. Using this qualifier, questions from the post tutorial exam and the post rounding exam could be placed in two categories of Bloom's Taxonomy, specifically Simple Recall and Simple Interpretation, and two categories of Guilford's Taxonomy, namely Cognition and Evaluation.

The subscales contain a different number of items on the post rounding and post tutorial examination. This is shown in Table 11.

Table 11. Number of Items Per Subscale Per Examination

	Post Tutorial	Post Rounding
Guilford		
Cognition	31	32
Evaluation	47	38
Bloom		
Simple Recall	59	32
Simple Interpretation	23	46

Because the number of items differ, the scores must be transformed to a uniform scale of measurement. Accordingly, Z-scores were created using the student's respective group mean and standard deviations.

Because there was no difference in performance by the interns no similar breakdown or investigation will be done.

The results of using Guilford's classification are shown in Tables 12 and 13.

Table 12. Students (Rounds/Tutorial) Z-Scores on the Cognition Subscale of Guilford's Classification.

	Post Rounds	Post Tutorial	Difference
n	6	6	6
Mean	-0.1451	-0.2561	-0.1048
s.d.	0.5958	1.3810	1.5256
s.e.			0.6228

Table 13. Students (Tutorial/Rounds) Z-Scores on the Cognition Subscale of Guilford's Classification.

	Post Rounds	Post Tutorial	Difference
n	7	7	7
Mean	0.1245	0.2195	-0.0950
s.d.	0.7571	0.5374	0.7999
s.e.			0.3023

The analysis of variance on this subscale is shown in Table 14.

Table 14. Analysis of Variance: Students - Cognition Subscale

Source	Sum of Squares	df	Mean Square	F	P
Between					
T x P	0.9679	1	0.9679	1.2008	n.s.
Error	8.8668	11	0.8061	--	
Within					
Period	.00015	1	0.00015	.0004	n.s.
Treatment	.0644	1	0.0644	.1668	n.s.
Error	4.2468	11	0.3861	--	

The results show no significant interaction or main effects. Consequently, this subscale cannot serve to explain what aspect of factual knowledge is being assessed. Similar findings are shown for the evaluation subscale of Guilford's scheme. The reader is directed to Tables 15 and 16 and 17.

Table 15. Students (Rounds/Tutorial) Z-Scores on the Evaluation Subscale of Guilford's Classification.

	Post Rounds	Post Tutorial	Difference
n	6	6	--
Mean	-0.0627	0.0640	.4837
s.d.	0.9811	0.5063	1.1880
s.e.			0.4850

Table 16. Students (Tutorial/Rounds) Z-Scores on the Evaluation Subscale of Guilford's Classification.

	Post Rounds	Post Tutorial	Difference
n	7	7	7
Mean	0.1281	0.3597	0.3740
s.d.	0.5176	1.0212	0.9380
s.e.			0.3545

The analysis of variance on this subscale is shown in Table 17.

Table 17. Analysis of Variance Students - Evaluation Subscale

Source	Sum of Squares	df	Mean Square	F	P
Between					
T x P	2.2091	1	2.2091	4.8308	n.s.
Error	5.0302	11	0.4573	--	
Within					
Period	0.0195	1	0.0195	0.0349	n.s.
Treatment	1.1883	1	1.1883	2.1292	n.s.
Error	6.1392	11	0.5581		

The Bloom classification of simple recall (SR) and simple interpretation (SI) is offered as an additional

attempt to clarify the finding. The results are shown in Table 18, 19, and 20.

Table 18. Students (Rounds/Tutorial) Z-Scores on Simple Interpretation Subscale of Bloom's Classification

	Post Rounds	Post Tutorial	Difference
n	6	6	6
Mean	0.7315	-0.3656	1.0971
s.d.	1.5096	1.1576	2.0408
s.e.			0.8331

Table 19. Students (Tutorial/Rounds) Z-Scores on Simple Interpretation Subscale of Bloom's Classification

	Post Round	Post Tutorial	Difference
n	7	7	7
Mean	0.1925	0.205	0.01257
s.d.	1.1505	1.3030	1.4900
s.e.			0.5636

The analysis of variance on the subscale is shown in Table 20.

Table 20. Analysis of Variance: Students - Simple Interpretation Subscale

Source	Sum of Squares	df	Mean Square	F	P
Between					
T x P	.0016	1	.0016	.0010	n.s.
Error	16.3237	11	1.4840		
Within					
Period	1.9000	1	1.9000	1.2242	n.s.
Treatment	1.9891	1	1.9891	1.2816	n.s.
Error	17.072	1	1.5520		

The data on the Simple Recall questions (Bloom's Classification) are shown in Tables 21, 22, and 23.

Table 21. Students (Rounds/Tutorial) Z-Scores on Simple Recall Subscale of Bloom's Classification

	Post Rounds	Post Tutorial	Difference
n	6	6	6
Mean	-0.5281	0.0622	-0.3182
s.d.	0.7880	0.4001	0.7812
s.e.			.3189

Table 22. Students(Tutorial/Rounds) Z-Scores on Simple Recall Subscale of Bloom's Classification

	Post Rounds	Post Tutorial	Difference
n	7	7	7
Mean	0.4418	0.4527	0.3701
s.d.	.03248	0.9821	1.0037
s.e.			0.3794

The analysis of variance on the subscale is shown in Table 23.

Table 23. Analysis of Variance: Students - Simple Recall Subscale

Source	Sum of Squares	df	Mean Square	F	P
Between					
T x P	2.9878	1	2.9878	5.5334	<.05
Error	5.9395	11	0.05399	--	
Within					
Period	0.7653	1	0.7653	1.8510	n.s.
Treatment	0.0044	1	0.0044	0.0106	n.s.
Error	4.5479	11	0.4134		

Table 23 shows that the simple recall classification scheme is statistically significant for the treatment by period interaction. The main effects, however, of order (treatment) and period are not significant. Following the earlier analysis, cell means by period will be plotted and investigated. Figure 2 shows graphically.

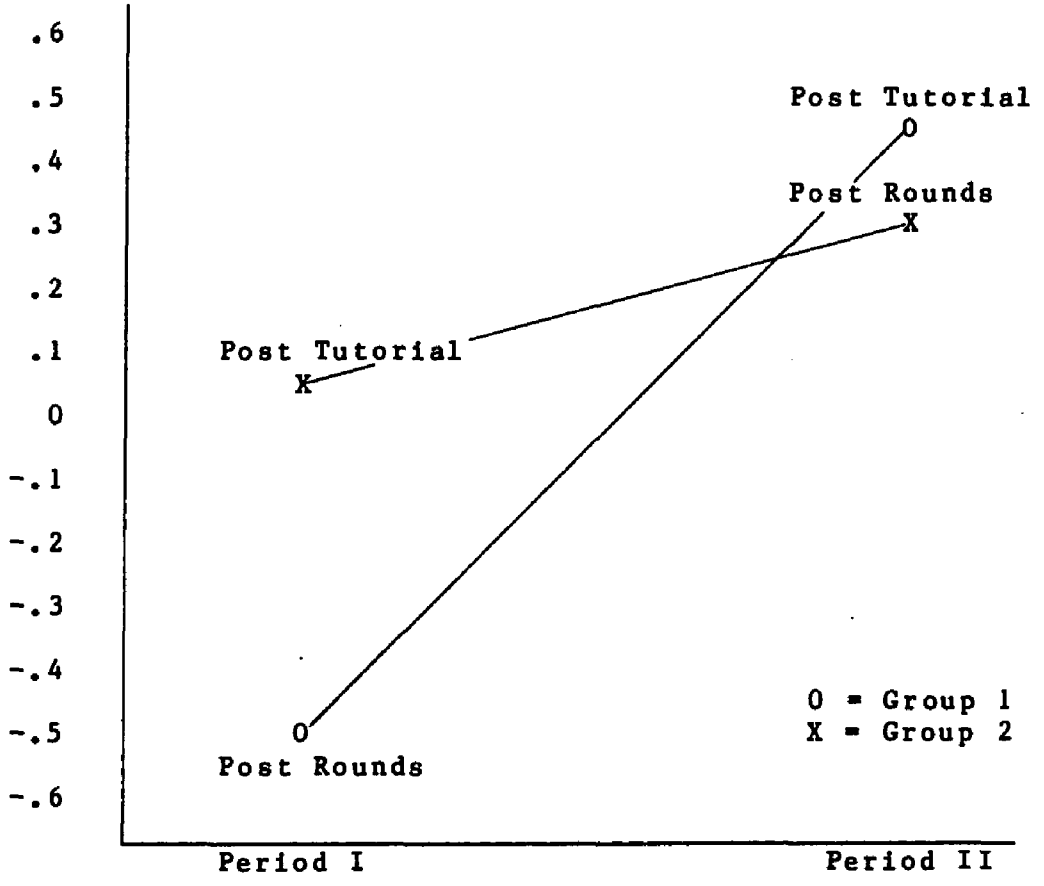


Figure 2. Group Mean Z-Scores (Post tutorial, Post Rounding Exam) By Treatment within Period

Examination of the post tutorial and post rounding Z-scores in period I shows a statistical difference ($t(11) = 2.32$ $p<.05$) whereas there is no difference during period II ($t(11) = 1.97$ $p>.05$). Since treatment is plotted

against period and the tutorial method is seen to be superior to rounding the same pattern obtains as was with the factual information difference found earlier. This similarity of pattern suggests that the simple recall aspect of the overall notion of factual information is a more precise description of the findings. Again, because of the lack of items available for other subscales further testing cannot be done. Should this study be repeated it is suggested that more items be added so that additional subscales may be used. Based then on the preceeding analysis one may conclude that the data from this study show that for the initial acquisition of factual information particularly simple recall of information the tutorial method is a better method for teaching medical students, however, over time this difference is erased. The rounding experience after the tutorial experience decreased one's factual knowledge only slightly but tutorial experience after rounding increased the fund of factual information to the extent that the groups perform equivalently at the conclusion of the study (i.e., period II). It is suggested then that rounding may very well provide the context for factual knowledge acquisition enabling a tutorial experience to successfully impart that information.

At the intern level, quite possibly because they have experienced patients for two years prior to their

internship, no statistical difference exists between method of instruction and period. Thus, either instructional format or order can successfully impart the information.

ATTITUDINAL DATA

The subjective perception of interns and students toward the teaching methods is now presented. As in the previous section, separate remarks will be made about interns and the students.

The instrument used in this study was a 23 item scale using a Likert type 5 point response scale (Appendix C). In order better to understand the internal structure of the instrument and also to gain parsimony in the data, a factor analysis of the responses was performed. Because individual statements about each factor is desired, should the factors be statistically significant over time, a varimax rotation was also performed. This rotation maximizes internal correlation between responses involved in a factor while minimizing the correlation between factors. This decreased between factor correlation tries to assure the fact that what one does on one factor is not statistically dependent upon how one performs on a second factor. Seven factors were determined with this technique. The same pattern among responses for both interns and students was obtained, the results of which

will be presented in due course. To analyze the results relative to change after tutorial and after rounds a Hotelling T^2 multivariate test was performed on the factor scores. The logic of the analysis will be as follows: 1) Perform an overall Hotelling T^2 on all seven factors. This is desirable from two points of view: first, because the breaking down of subject's attitude, while statistically defensible, is in some sense arbitrary. Thus, a simultaneous evaluation of components gives an assessment of the overall impact of the components. Second, while the correlations between factors are minimal they are not zero. Thus, some dependency exists between the components. Any technique which does not take this statistical relationship into account will tend to misleading statements about each component <u>independent</u> of other component. 2) If the overall test is significant <u>then</u> conduct univariate tests to determine which components contribute to the overall change. Then, 3) conduct post-hoc comparisons between the univariate tests to see if attitudes after tutorial differ from rounding. The varimax factor analysis produces a series of numbers or weights for each subject's response on each factor. One can then form a linear combination of these products in the form:

Table 24. Factor Loadings Generated From Varimax Rotation

	Variable Name	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7
1.	Basic Knowledge	42	14	02	44	-31	-26	13
2.	History Taking Skills	13	85	-05	31	-01	-05	23
3.	Physical Exam Skills	12	77	05	-03	07	13	06
4.	Case Presentation	07	66	25	-06	08	10	01
5.	Analysis of Patient Problem	82	13	08	-10	04	-01	01
6.	Ability to Order Lab Tests	74	74	16	14	14	12	09
7.	Patient Management	49	31	08	08	10	-05	02
8.	Communication Ability	16	68	-01	01	02	32	-02
9.	Empathy with Patients	28	29	04	08	-07	71	26
10.	Synthesis of Basic Science and Clinical Knowledge	57	03	16	34	-11	07	20
11.	Amount of Reading	02	08	04	62	12	-03	05
12.	Reinforcement of Clinical Knowledge and Skills	43	-04	01	65	-03	07	-01
13.	Enthusiasm Toward Issues in Clinical Medicine	42	25	14	25	33	03	-02
14.	Ability to Question	35	20	55	50	10	03	-04
15.	Attendence at Lectures	-17	-14	-01	33	20	24	-03
16.	Level of Respect for Colleagues	-16	27	22	-04	06	62	-03
17.	Ability to Use Time	12	15	05	10	80	03	13
18.	Desire to Conduct Research	36	-22	10	04	-04	-15	-22
19.	Desire to Practice Clinical Medicine	06	03	35	13	27	08	65
20.	Desire to Become a Better Physician	21	09	52	18	-18	16	13
21.	Willingness to Seek Assistance	01	07	64	12	-02	10	22
22.	Standardization of Rounds	14	-07	22	-07	-41	08	51
23.	Teaching Qualification of Clinical Instructors	20	01	76	-22	13	-23	01

$Y_j = \sum_{i=1}^{23} F_{ij}X_i$ where F_{ij} is i^{th} factor weight for the j^{th} factor; X_i is the i^{th} response and y_j is the factor score for a given subjett.

for j = 1 to 7

This linear combination is called a factor score. These factor scores will be the dependent variables for the attitudinal analysis. By using these linear combinations of scores correlation between the dependent variables are minimized. The factor weights are presented in Table 24. Inspection of Table 24 demonstrates a range of values within a given factor. Generally speaking the larger the number (ignoring the sign of the number) the stronger that variable influences the factor. The (-) sign preceding the number suggests that it opposes the factor. By inspecting each factor to see what component questions weigh heavily (those with relatively large numbers) one can then name the factor. This naming of the factor, while admittedly arbitrary, is an attempt to uniquely identify the combination of influences which make up the factor. The factor names, as assigned for the study, are listed below:

Factor 1 - Clinical knowledge utilization

Factor 2 - Verbal skills

Factor 3 - Clinical instructor influence

Factor 4 - Knowledge acquisition skills

Factor 5 - Time management

Factor 6 - Empathy

Factor 7 - Clinical Persuasion

This attitude instrument addresses specific questions previously cited in Chapter 1. These questions are recast here in the form of research hypotheses with their statistical form presented below each question respectively. The logic of the analysis of these data as described above.

Research Hypothesis 2: Students and interns will perceive the tutorial experience in a more positive direction than rounds for synthesizing basic science and clinical knowledge.

$$H_0 : \begin{pmatrix} F_1 \\ F_n \end{pmatrix}_{\text{rounds}} = \begin{pmatrix} F_1 \\ F_n \end{pmatrix}_{\text{tutorial}}$$

$$H_1 : \begin{pmatrix} F_1 \\ F_n \end{pmatrix}_{\text{rounds}} \neq \begin{pmatrix} F_1 \\ F_n \end{pmatrix}_{\text{tutorial}}$$

where $\begin{pmatrix} F_1 \\ F_n \end{pmatrix}_{\text{rounds}}$ represents the vector of scores for the rounding group and $\begin{pmatrix} F_1 \\ F_n \end{pmatrix}_{\text{tutorial}}$ represents the vector of factor scores for the tutorial group.

Interns and students tested separately.

Research Hypothesis 3: Students and interns will perceive the tutorial experience as a stronger reinforcement of clinical knowledge and clinical skills than the traditional rounding experience.

$$H_0 : \begin{pmatrix} F_1^* \\ F_n^* \end{pmatrix}_{\text{rounds}} = \begin{pmatrix} F_1^* \\ F_n^* \end{pmatrix}_{\text{tutorial}}$$

$$H_1 : \begin{pmatrix} F_1^* \\ F_n^* \end{pmatrix}_{\text{rounds}} \neq \begin{pmatrix} F_1^* \\ F_n^* \end{pmatrix}_{\text{tutorial}}$$

where $\begin{pmatrix} F_1^* \\ F_n^* \end{pmatrix}$ are the respective vectors of specific factor scores which address clinical knowledge and clinical skills.

Research Hypothesis 4: Students and interns will perceive the rounding experience as enhanced by increased standardization and also enhanced by improving the teaching qualification clinical instructors.

$H_0 : \mu_{\text{rounds}} = \mu_{\text{tutorial}}$

$H_1 : \mu_{\text{rounds}} \neq \mu_{\text{tutorial}}$

where μ_{rounds} equal the mean of the intern group or student group respectively, after rounds relative to their responses on question 22 of the survey instrument and μ_{tutorial} represents the average response to question 22 after the tutorial experience.

$H_0 : \mu^*_{\text{rounds}} = \mu^*_{\text{tutorial}}$

$H_1 : \mu^*_{\text{rounds}} \neq \mu^*_{\text{tutorial}}$

μ^*_{rounds} equals the response on question 23 by each group respectively after rounds and μ^*_{tutorial} is in same fashion the average score on question 23 after tutorial.

Intern Data

The results of the analysis on factor scores for interns is now presented. The cell means and standard deviations are presented Table 25.

Table 25. Cell Means and Standard Deviations by Factor - Intern Data

	Factor	1	2	3	4	5	6	7
Post Rounding	Mean	.016	-.433	.033	-.199	.242	-.195	-.329
	S.D.	.780	.949	.920	.839	.839	.795	.820
Post Tutorial	Mean	-.160	-.173	.021	.129	.111	.155	.145
	S.D.	1.067	1.150	.628	.658	.935	.867	.712

A basic underlying assumption in the Hotelling T^2 technique is that the variances of the populations used be multivariate normal, or at least homogeneous. To test this assumption Box's M coeffecient was calculated. Results are shown in Table 26.

Table 26. Homogeneity of Dispersion Matricies

	Statistics	F	df	p
Box's M	39.5054	1.02	(28,2731)	.429

The statistical nonsignificance shows the assumption of homogeniety to be tenable. The results of the Hotelling T^2 are presented in Table 27.

Table 27. Multivariate Test of Significanc

	Value	Approx F	d f	p
Hotelling's T^2	.284	.894	7.0,22.0	.528

Because of the nonsignificant F test statistic it can be concluded that the interns' attitudes did not change toward methods of instruction from period I to period II. Because of this overall constancy no investigation into individual factors need be done.

Student's Data

In similar fashion to the above presentation the cell means and standard deviation of the factor scores used in the analysis of student data are presented below.

Table 28. Cell Means and Standard Deviations by Factor - Student Data

Factor		1	2	3	4	5	6	7
Post Rounding	Mean	-.132	.360	-.272	.256	-.240	-.112	.054
	S.D.	1.041	.748	1.202	.913	1.025	.975	1.164
Post Tutorial	Mean	.297	.338	.206	-.173	-.172	.158	.159
	S.D.	.796	.714	.839	1.150	.710	.902	.561

The homogeneity of variance assumption is similarly tested with Box's M statistic and found to be

statistically nonsignificant (M=61.18 , F (28,2007)= 1.48, P = .05). The Hotelling T^2 was performed on the factor scores and results displayed in Table 29.

Table 29. Multivariate Test of Significance

Statistic	Value	Approx. F	df	p
Hotelling T^2	.214	.5512	7.0,18.0	.785

The statistical significance is greater than .05, therefore the students did not differ in their attitudes toward rounds and teaching from period I to period II.

In an attempt to further test the research hypotheses previously outlined for this study, the responses to two of the items from the attitudinal survey were analyzed independent of the other items. The first of these items was stated as follows in the survey instrument:

> Your perception that rounds can be more effective as a learning experience by increased standardization of the rounding process.

As previously described, the subjects placed their response to this statement on a five point Likert Scale with the responses ranging from 1 (definitely disagree) to 5 (definitely agree). The responses to this statement from the student group after the rounding experience and after the tutorial experience are presented in Table 30. A t test performed on these response means was nonsignificant, t (24) = -.9450, n.s.

Table 30. Students' Post Rounding and Post Tutorial Responses to Attitudinal Survey Item Number 22.

	Post Rounds	Post Tutorial
n	13	13
mean	4.2308	4.5385
s. d.	1.0129	0.5189

Similarly, the responses of the intern participants to this same statement are demonstrated in Table 31. The *t* test performed on these means was also nonsignificant, $t\ (28) = 1.1711$, n.s.

Table 31. Interns' Post Rounding and Post Tutorial Responses to Attitudinal Survey Item Number 22.

	Post Rounds	Post Tutorial
n	15	15
mean	4.2667	3.8
s. d.	0.8837	1.264

These data demonstrate that the students, after each teaching experience, show moderate to strong agreement with the statement that rounds can be made more effective as a learning experience by increased standardization. No statistically significant difference in attitude was noted in the post rounding period versus the post tutorial period. Interns likewise agreed with the statement with

no difference in the responses after the post rounding as opposed to the post tutorial period.

The second item which was analyzed separately from the other items in the survey stated the following:

> Your perception that the teaching qualifications of the clinical instructor can affect the educational merit of rounds.

The subjects presented their response to this statement on the same scale as was outlined for the previous statement. The responses and analysis of same for medical students is presented in Table 32. A nonsignificant result was also obtained when a *t* test was performed on the means, $t\ (24) = .4802$, n.s.

Table 32. Students Post Rounding and Post Tutorial Responses to Attitudinal Survey Item Number 23.

	Post Rounds	Post Tutorial
n	13	13
mean	4.6923	4.5385
s.d.	0.7511	0.8771

The responses of the intern participants to this same statement are presented in Table 33. The *t* test result when these data were studied are as follows: $t\ (28) = .6426$, n.s.

Table 33. Interns Post Rounding and Post Tutorial Responses to Attitudinal Survey Item Number 23.

	Post Rounds	Post Tutorial
n	15	15
mean	4.6667	4.5333
s. d.	0.4880	0.6399

These data demonstrate that both the student and intern groups moderately to definitely agree with this statement. No significant difference in the responses was noted for either group when the post rounding period is contrasted with the post tutorial period.

SUMMARY

Hypotheses have been proffered concerning student and intern performance on the acquisition of factual knowledge imparted by the sequence of teaching methods. Further investigation into their attitudes toward each teaching method followed each experience. Based on the analysis of subject responses one can conclude:

1) For Interns:

   a) Structured experiences are equally effective as rounds in imparting factual information.

b) No carry over effect exists over time to diminish their fund of knowledge, should teaching methods change.

c) Their attitudes toward both methods are the same.

2) For Medical Students:

a) The tutorial experience is superior to the rounding experience in imparting factual information (of a recall type) as a first exposure to clinical medicine. However, once those who experience rounds are then exposed to a tutorial experience their change in recall information is markedly enhanced.

b. This carry over effect is interpreted as a context in which to place factual information for better information retrieval.

c. Attitudes toward teaching methods are relatively constant.

CHAPTER V

DISCUSSION, IMPLICATIONS, AND RECOMMENDATIONS

This study was an attempt to identify an alternative to clinical rounding which would result in equivalent learning outcomes as well as to determine whether some of the traditional perceptions of what is learned on rounds is accurate. It furthermore attempted to determine the educational value of rounds from the perspective of the learner and also attempted to determine if the trainees felt that increased standardization and improving the teaching qualifications of clinical instructors would increase the effectiveness of rounds as a learning experience. The extent to which the study data allowed one to accept or reject these various statements will be discussed. Furthermore, the author will attempt to point out ways rounds could be improved as an instructional modality, using the findings of this study as a basis for his remarks, and finally, recommendations for future research will be presented.

DISCUSSION

An Alternative To Rounding

Rounding as an instructional modality is a form of education that currently is in the most significant period of flux that has been seen since the Flexner report was published. All areas of medical education are being affected. It seems,however, that the area of Internal Medicine finds itself particularly affected by these recent changes. The driving forces behind these changes seem to be the revised methods of hospital and physician reimbursement (the Diagnosis Related Group System; Preferred Provider Organizations; and, Health Maintenance Organizations) and the resultant alteration in the medical care system. Physicians practicing in the area of internal medicine have seen declining length of patient stays in hospitals; increased intensity of hospital care; a shift of important diagnostic and management decisions from the hospital to the office setting; and, an increasing proportion of internal medicine admissions to teaching hospitals for specific invasive procedures. These elements of change will affect teaching and learning in internal medicine and the traditional ways in which clinical internal medicine has been taught to students and interns. Medical educators will no longer be able to depend upon the traditional rounding experience to impart to trainees the clinical knowledge which is essential for

the practice of medicine. Thus, it becomes imperative to inquire as to the alternatives which are open to the medical educator.

This study attempted to determine if an alternative to the traditional rounding experience could be developed which would result in equivalent learning outcomes at least in the area of knowledge acquisition.

One of the basic questions which initially was an impetus for this study was an attempt to determine whether or not rounds were of educational value to the extent that one could justifty the amount of time spent in the rounding experience. Although the design of the current study was not of the nature that would allow one to answer this question directly, an indirect answer can be gleaned from the data obtained in the analysis. Evidence was presented in Chapter II that medical trainees do learn from traditional teaching methods such as the lecture, group discussions, and video tapes, all of which were used in the internal medicine tutorial portion of this study. One might infer from this that study participants did learn certain elements of internal medicine in the tutorial. Further, since the results of the post rounding and post tutorial examinations were not statistically different, it is suggested that certain elements of internal medicine were learned in the rounding portion of the experiment as well. This was the case in this study

and therefore medical educators can have some assurance that the significant time spent in the rounding experience is of educational value. This argument is strengthened for interns when one considers that no carry over effect from one teaching method to the other was demonstrated.

Any discussion of the data in reference to students must take into consideration the interaction effect (period x treatment), as well as the period effect. In period I the tutorial method was found to be superior to the rounding experience for acquiring factual knowledge but that neither method was superior to the other in period II. These facts would lead one to conclude that the tutorial method could be used as an alternative to rounding, at least to convey factual clinical information, in the student population. The fact that students who experienced the rounding/tutorial sequence demonstrated a markedly enhanced informational recall score when compared to those who experienced the tutorial/rounding sequence has educational implications in itself which will be discussed in the next major section of this chapter. Considering that both the interaction and the period effects have been explained in Chapter IV, it appears justified to conclude that students, like interns, can be taught certain elements of clinical internal medicine as well by the tutorial experience as they can by the rounding experience. This statement cannot, however, be

made with the same strength as it was for interns considering that a carry over effect was present.

Perceptions Of What Is Learned On Rounds

As one may have concluded, the question of what is actually learned on rounds is one which has been poorly explored. It is felt that the rounding procedure is a complex learning experience with several types of information being presented concomitantly. For example, the clinical instructor while questioning and examining a patient might demonstrate history taking techniques; physical examination techniques; problem solving techniques; treatment options, and several other entities. This study attempts to determine if some of the traditional perceptions of what is learned on rounds are accurate. Specifically, the following areas were explored: 1) increase in basic knowledge, 2) increased skill in the area of diagnosis, 3) increased skill in the early stages of the problem solving process.

By classifying the post rounding and the post tutorial examination questions into two taxonomic systems one can determine if the above mentioned perceptions are correct.

The area of increase in basic knowlege was measured by the simple recall level of Bloom's taxonomy and the cognition level of Guilford's taxonomy. The fact that

both students and interns scored well on this sub scale, and that the scores were similar after both the rounding and tutorial experiences, would allow one to conclude that basic knowledge is increased during both the rounding experience and the tutorial experience.

The subject of increased skill in the area of diagnosis was approached very subjectively by the study. During the rounding sessions a determined attempt was made by the clinical instructors to assess the diagnostic skills of both students and interns. It was felt that the skills did increase during the rounding sessions.

Unfortunately, the post rounding and post tutorial examinations could not be used to measure the problem solving process in toto due to the fact that neither exam contained enough problem solving type questions to be included in the analysis. However, the simple interpretation questions (Bloom's taxonomy) or the evaluation type questions (Guilford's taxonomy) do seem to fit into the early portions of the problem solving process. Both students and interns did equally well on this sub scale on the post rounding and on the post tutorial examinations. Evidence was presented in Chapter II that problem solving can be taught by case discussion; the method which was utilized in the tutorial experience. Once again, due to the deficiency of items on the post tests used in this study a direct statement cannot be made

relating post tutorial and post rounding performance; yet, one can anecdotally state that problem solving was taught during both the rounding experience and the tutorial experience.

One can conclude on the basis of the data presented and the subjective interpretation of a portion of the data that some of the traditional notions of what is learned on rounds appear to be correct.

Student/Intern Perceptions Of Rounds

The attitudinal survey employed as part of this study measured several perceptions that students and interns had toward the rounding and the tutorial experiences. In order to evaluate these perceptions a factor analysis of the data was performed.

Students and interns were asked to determine if, in their opinion, rounds and the tutorial were equivalent methods which would assist them in the synthesis of basic science and clinical knowledge. Factor 1 from the factor analysis data (Use of Knowledge in the Clinical Setting) addressed this issue. The statistical analysis demonstrated no difference on this attitudinal parameter between the post rounding and post tutorial groups for both students and interns. This suggests that the study participants feel that the two methods are equivalent in

assisting one to synthesize basic science and clinical knowledge.

The study participants were also asked to determine which of the two teaching methods enabled them to better reinforce clinical knowledge and clinical skills. Factor 4 from the factor analysis data addressed this issue. Interns as well as students demonstrated no significant difference on their attitudes toward this concept. Therefore, one may conclude that from the participants perspective, the two methods are equivalent in enabling them to reinforce clinical knowledge and clinical skills.

The final two issues addressed on the attitudinal survey concerned the opinions of the study participants in reference to improving rounds with increased standardization and the affect on the educational merit of rounds that is dependent upon the teaching qualifications of the clinical instructors. As previously stated, these questions were included in the overall factor analysis data, however, they were isolated as individual entities because of their importance in the possible future implications of this study. For ease in reading, these individual questions will be repeated and followed by a discussion.

Item 22 - Your perception that rounds can be more effective as a learning experience by increased standardization of the rounding process.

Medical students demonstrated an overall mean score on this item of 4.38 which relates a moderate to definite agreement with the statement. Interns produced an overall mean score of 4.03 which also places their responses in the moderately to definitely agree range. Thus, one can conclude that the study participants feel that standardization of the rounding experience can increase the effectiveness of this process as a learning experience. The attitudes of the two groups were similar after the rounding as well as after the tutorial experience. The methods by which the rounding experience could become a more standardized educational endeavor are outlined in the next section of this chapter.

The next item which was analyzed separately:

Item 23 - Your perception that the teaching qualifications of the clinical instructor can affect the educational merit of rounds.

The overall mean score of the medical students to this item was 4.60 which places them in the moderately to definitely agree region. Interns also demonstrated moderate to definite agreement with this statement with

their mean score of 4.60. No significant difference in response was noted in the post rounding and the post tutorial groups for either the interns or students. The evidence presented leads one to conclude that both groups of study participants feel that the teaching qualifications of the clinical instructor can affect the educational merits of the rounding process. One can logically deduce then that those instructors with superior teaching qualifications would more positively affect the educational value of rounds than would one with a lower degree of teaching expertise.

IMPLICATIONS

From the preceding statements it would be unfair to conclude that the many facets of clinical medicine which are learned during the rounding experience could be replaced entirely by tutorial sessions. Possibly with the advance of educational technology, such as further refinement of simulations, one could continue to replace more and more of the type of clinical education obtained during rounding with tutorial sessions. Today, medical education is not at that juncture and it appears that now only portions of the rounding experience could be replaced by tutorial experiences. The issue of replacement of the rounding sessions with some other alternative is extremely important because of the rapid reduction in the clinical

teaching material available in hospitals wherein one of the primary teaching methods is that of rounding. For example, the average length of stay for all hospitalized patients decreased from 7.82 days in 1970 to 6.67 in 1984, a 15% decline. For Medicare patients an even more substantial drop was seen, namely from 12.6 to 7.4 days, a 41% decrease. If rounds are to continue as one of the primary methods of clinical teaching in hospitals, one might logically ask where the instructors will find the patients on whom to make rounds. The patient-mix in hospitals is becoming more skewed and less and less representative of the type of patient population the physician of the future will face on a day to day basis. It seems to be an accepted fact that the many facets of clinical education which are learned during rounds are essential for the efficient and effective practice of medicine. The logical conclusion one may draw is that some alternative to the rounding experience must be developed and be available for medical educators in the near future. This study has attempted to provide a partial answer to this significant problem.

The results of this research indicate that, at two taxonomic levels, the information gained during rounds can be obtained as well by a carefully structured tutorial educational experience. This statement is equally true for interns as well as medical students. For interns, the

sequence of the educational endeavors (i.e., rounds/tutorial; tutorial/rounds) does not seem important. Since interns had been exposed to clinical instruction for approximately a two year period of time prior to the internship, they have a sound context for factual knowledge acquisition from either teaching method. The sequence of exposure does appear to be important for medical students. The rounding experience followed by the tutorial experience is the preferred sequence for students as far as factual information acquisition is concerned. It is felt that rounding may provide the context for factual knowledge acquisition enabling the tutorial experience to successfully impart that information.

Possibly even more important for the medical educator of today is the use of a combination of the rounding and tutorial methods of teaching. This method would appear to be particularly important for medical students in that the rounding experience can provide a framework wherein factual knowledge presented in the tutorial sessions can be placed in proper context. It therefore is suggested that medical educators attempt to include a combination of these elements of teaching into their clinical education programs. For more advanced trainees, the inclusion of a tutorial experience also seems logical in that it would serve to emphasize the knowledge gained in the rounding experience. Other researchers have pointed out that one

of the complaints trainees have concerning clinical instructors is their lack of preparation for the rounding sessions. If the clinical instructor presented a tutorial within twenty-four hours of a rounding session (the time period allowing him/her an opportunity for preparation) this complaint might well dissipate.

The issue of increased standardization of the rounding experience also deserves further discussion. The majority of the study participants moderately to definitely agreed with this statement. The tutorial used in combination with the rounding experience would be a positive step toward standardization in that the tutorial, by its very nature, is a moderately standardized educational experience. Further standardization of the rounding experience could be accomplished by the following:

1) Comprehensive orientation sessions prior to the rounding service.
2) Daily educational assignments to be provided for the rounding team members.
3) Instruction in case presenttion to be given by the clinical instructor to the trainees.
4) Observation by team members of the clinical instructor performing comprehensive patient examinations.

5) Formal patient discussions by the clinical instructor whereby the trainees may follow the instructor's problem solving sequence and model after same.

6) Interruptions to clinical teaching sessions must be decreased or eliminated.

7) Comprehensive formative and summative evaluation programs must be initiated and utilized to guide the rounding process.

Study participants also moderately to definitely agreed that the educational merit of the rounding experience could be affected by the teaching qualifications of clinical instructors. One of the major problems with clinical instructors is that the majority of them have had no formal training in teaching techniques. A few of the major clinical education centers in this country have teacher education programs, however, these programs are practically nonexistent at the community hospital teaching level. This study, and the studies of others, have indicated that the clinical learning experience can be enhanced by improving the quality of the clinical instructor in the area of teaching techniques. Therefore, it is recommended that programs aimed at enhancing the teaching ability of these instructors be instituted.

IMPLICATIONS RELATED TO THE GENERAL EDUCATIONAL LITERATURE

Select elements of the general educational literature can be related to and have implications pertaining to this study. New directions in the areas of intelligence and motivation are being explored in recent research and are important when related to this study. The areas of classroom instruction and teaching, testing, and problem solving also have been the topics of research of late and relate to the findings of this work. Each of these areas will be briefly explored.

Learner characteristics of intelligence and motivation have been subjects of educational research for an extended period of time. Although there is a generally held perception that most medical students are intelligent, recent literature is concerned with "what is intelligence?" Guilford (1982) proposed that there are 150 factors underlying intelligence while more recent research identifies fewer factors but yet presents intelligence as a complex phenonenon. Gardner (1983) has suggested that intelligence varies across different domains and therefore proposes examining the profile of learners' intelligences in relation to eductional goals and matching students with subject matters and teaching methods. Relating these ideas to this study one might conclude that after an analysis of a medical student's intelligence, one could match that student with one of the two teaching methods examined in this work and therefore

develop further his/her intellectual strength. This seems to be a fruitful area for research.

Medical trainees also are felt to be highly motivated learners. In most instances this appears to be true. Recent research has suggested relationships between cognition and motivation. Nicholls (1984) and Dweck and Elliot(1983) both have proposed that students approach instructional tasks differently depending on their concept of ability. They have found that students who believe ability can change and improve with learning will approach a task with an orientation to learn and focus on the process of how to do the task. Medical trainees should be indoctrinated with these concepts in order to facilitate their learning certain tasks. Prior research on clinical teaching has demonstrated that students benefit more from clinical education when an adequate orientation has been provided by the clinical instructor. The clinical instructor in both rounds and tutorial sessions, being that they are equivalent methods of learning certain elements of clinical medicine, should emphasize these concepts as part of an orientation assembly.

The tutorial experience, as used in this study, is a classroom instructional technique and therefore can be related to recent research. Research in this area over the past several years has focused upon a correlational relationship between teacher classroom behavior and

student achievement, highlighting the importance of engaging in maintaining student involvement with tasks. If tutorial sessions are to be used in future medical education, the instructor must be of high quality and he/she must involve the trainees in certain of the tasks he/she would be performing during rounding (simulations could provide this training in the classroom). Brophy and Good (1986) have defined these three important teaching behaviors, namely 1) giving information, 2) asking questions, and 3) providing feedback. Organized information must be presented by clinical instructors in both the rounding and tutorial experiences. Questions of sufficient difficulty must be posed in order to transmit needed information. Feedback, which is important in both the rounding and the tutorial sessions, to be effective should be provided as specific information for the student, including acknowledging correct and incorrect responses as such but not involving personal praise or criticism of the student. Thus, it would be beneficial for clinical instructors to be cognizant of these research findings. Another technique that is of importance to the methods used in this study was explored by Peterson, et al (1982) wherein they found that students who used specific cognitive strategies (e.g. relating information being taught to prior knowledge) performed better on an achievement test. The sequences of educational

presentations used in this study (rounds/tutorial; tutorial/rounds), therefore, could lead to better test performance and hopefully improved knowledge acquisition.

Testing has been a problem in medical education for a long period of time. As previously outlined, the tests used in this research examined at two taxonomic levels. Recent research has centered on the linkage between testing and instruction (instructionally relevant testing). Recently developed computer-based assessment shows promise and might allow one to better compare various educational methods in medical education. Since clinical teaching is a dynamic event the recent research in the area of dynamic assessment might allow one to better assess medical trainees.

Problem solving is a basic skill that a physician must possess. The current research briefly looked into the early stages of problem solving and found both teaching methods to be subjectively equal in the teaching of this needed skill. Sternberg (1983) has suggested that problem solving training programs should satisfy the following criteria: 1) Be based on an informational processing theory; 2) Be culturally relevant for the individuals involved; 3) Provide direct instruction in the desired skills; 4) Give attention to motivational components and individual differences; 5) Have relevance to real-world behavior; 6) Show empirical evidence of its

effectiveness; 7) Be particularly durable; and 8) Transfer. These criteria should be incorporated into medical problem solving training programs particularly during the rounding experience. Problems which are considered must be relevant to various medical problems for as Glaser (1984) points out, there seems to be little doubt that there is no substitute for extensive experience and knowledge in the problem solving domain in which a problem lies. Therefore, clinical instructors in either of the instructional methods described in this research must select material to be used in problem solving exercises meticulously.

RECOMMENDATIONS FOR FUTURE RESEARCH

1) This study was conducted at a community teaching hospital and therefore its generalizibility to a university teaching center is one of its limitations. Other researchers might consider performing a similar study in a university teaching center.

2) The current study was performed on two levels of trainees. It would be of interest to determine if the same results would be found at higher levels of medical trainees,i.e., residents or fellows.

3) The tutorial experience and the rounding experience used in this study were evaluated at only two taxonomic levels. Further study could be carried out in order to evaluate other levels. The area of clinical problem solving seems to be a particularly interesting component of clinical learning to investigate.

4) A study of this type might also be conducted on other clinical services where rounding takes place such as general surgery or the various medical subspecialities.

5) The use of the tutorial teaching method in settings outside of a hospital (clinics, emergency centers, outpatient surgical centers) also needs further investigation.

6) The overall impact of the cost of the tutorial versus the cost of rounding must be investigated to see if one is more cost effective than the other in view of the continually decreasing funding for medical education.

This study has suggested an alternative to a portion of the traditional rounding experience on an internal medicine service. The future will determine the usefulness of this approach.

APPENDIX A

BLOOM'S TAXONOMY - MODIFIED

LEVEL 1 - Simple Recall - Items testing predominantly the recall of isolated information.

Example: The most frequent complication of measles is:

A. Pneumonia

B. Encephalitis

C. Otitis media

D. Bronchitis

E. Mastoiditis

LEVEL 2 - Simple Interpretation - Items requiring the student to make simple interpretations of data.

Example: A 49-year-old woman presents with fatigue and is found to have consistent blood pressure readings of 170/100 mmHg. Clues should be sought for all of the following causes EXCEPT:

A. Cushing's syndrome

B. Idiopathic hypertrophic subaortic stenosis

C. Polycystic kidney disease

D. Coarctation of the aorta

E. Estrogen ingestion

LEVEL 3 - Problem Solving - Items requiring the analysis of data.

Example: A patient is begun on a regime of quinidine for a ventrical arrhythmia. Shortly after starting therapy he has an episode of syncope; he is found on monitoring to have intermittent runs of a ventricular tachycardia with rising and falling height of the QRS complexes. A plasma quinidine concentration at that time is 2 mg/ml. When the patient is in sinus rhythm he will probably have:

A. A prolonged PR interval

B. A prolonged QRS duration

C. S - T segment depression

D. A prolonged QT interval

E. Mobitz type II heart block

APPENDIX B

GUILFORD'S TAXONOMY - OPERATIONS

Guilford defines operations as follows: Major kinds of intellectual activities or processes; things that the organism does in the processing of information, information being defined as "that which the organism discriminates."

Operations are of five types which are described below with examples of questions which exemplify each operation.

I. Cognition - Immediate discovery, awareness, rediscovery,or recognition of information in its various forms; Comprehension or understanding.

Example: The cardiac lesion commonly associated with rheumatic spondylitis is:

A. Aortic insufficiency

B. Aortic stenosis

C. Mitral insufficiency

D. Mitral stenosis

E. Multiple valve disease

II. Memory - Fixation of newly gained information in storage. The operation of memory is to be distinguished from the memory store.

Example: Identify the tissue at the end of the pointer:

A. Bone

B. Hyaline cartilage

C. Calcified cartilage

D. Collagenous connective tissue

E. Mesenchyme

III. Divergent production - Generation of logical alternatives from given information, where the emphasis is upon variety, quantity, and relevance of output from the same source.

Example: A 24-year-old female presents to your office for evaluation of hypertension, weakness, headaches, and polyuria. List various diagnostic entities which could cause this complex of findings.

IV. Convergent Production - Generation of logical conclusions from given information, where the emphasis is upon achieving unique or conventionally best outcomes. It is likely that the given (cue) information fully determines the outcome, as in mathematics and logic.

Example: A 64-year-old man has fever, diarrhea, abdominal pain, weight loss, headache, ataxia, vertigo, and tinnitis, as well as

nondeforming arthritis of the ankles, elbows, and knees.

The most likely diagnosis is:

A. Whipple's disease

B. Ulcerative colitis

C. Ischemic bowel disese

D. Scleroderma

E. Amyloidosis

V. Evaluation - Comparison of items of information in terms of variables and making judgments concerning criterion satisfaction (correctness, identity, consistency, etc.).

Example: A 56-year-old hypertensive woman experiences the acute onset of vomiting, headache, and inability to walk. Her blood pressure is 220/110 mmHg. Physical examination shows slight nuchal rigidity, impaired conjugate lateral eye movements, full power in the extremities without limb ataxia, and inability to walk.

The most appropriate next step in management would be:

A. Computed tomography

B. Examination of cerebrospinal fluid to ascertain whether blood is present

C. Angiography

D. Immediate lowering of blood pressure

E. Immediate decompression of the posterior fossa

APPENDIX C

POST ROUNDING/TUTORIAL LEARNER OUTCOME FORM

Identification Number: _____

Date: _____

Segment Completed: _____

Instructions: This form is to be used to assess your perception of the impact of the rounding and tutorial portions of the project on various areas of learning, including knowledge, skills, and attitudes. The items included in this form are all relevant to clinical teaching. In completing the form, please circle the number above the descriptor which best reflects your perception of the impact of rounding or the tutorial on that item.

1. Your basic fund of knowledge

1	2	3	4	5
Definitely Decreased	Moderately Decreased	No Change	Moderately Increased	Definitely Increased

2. Your history - taking skills

1	2	3	4	5
Definitely Decreased	Moderately Decreased	No Change	Moderately Increased	Definitely Increased

3. Your ability to do a physical exam

1	2	3	4	5
Definitely Decreased	Moderately Decreased	No Change	Moderately Increased	Definitely Increased

4. Your ability to present a case

1	2	3	4	5
Definitely Decreased	Moderately Decreased	No Change	Moderately Increased	Definitely Increased

5. Your ability to analyse patient problems

1	2	3	4	5
Definitely Decreased	Moderately Decreased	No Change	Moderately Increased	Definitely Increased

6. Your ability to order lab tests judiciously

1	2	3	4	5
Definitely Decreased	Moderately Decreased	No Change	Moderately Increased	Definitely Increased

7. Your knowledge of patient management

1	2	3	4	5
Definitely Decreased	Moderately Decreased	No Change	Moderately Increased	Definitely Increased

8. Your ability to communicate effectively with patients

1	2	3	4	5
Definitely Decreased	Moderately Decreased	No Change	Moderately Increased	Definitely Increased

9. Your empathy with patients

1	2	3	4	5
Definitely Decreased	Moderately Decreased	No Change	Moderately Increased	Definitely Increased

10. - Your ability to synthesize basic science and clinical knowledge

1 Definitely Decreased | 2 Moderately Decreased | 3 No Change | 4 Moderately Increased | 5 Definitely Increased

11. The amount of outside reading relative to patients and/or patient problems.

1 Definitely Decreased | 2 Moderately Decreased | 3 No Change | 4 Moderately Increased | 5 Definitely Increased

12. - Your reinforcement of clinical knowledge and clinical skills

1 Definitely Decreased | 2 Moderately Decreased | 3 No Change | 4 Moderately Increased | 5 Definitely Increased

13. Your enthusiasm to learn issues in clinical medicine to which you are being exposed.

1 Definitely Decreased | 2 Moderately Decreased | 3 No Change | 4 Moderately Increased | 5 Definitely Increased

14. Your ability to raise questions and state opinions during rounds/tutorial.

1 Definitely Decreased | 2 Moderately Decreased | 3 No Change | 4 Moderately Increased | 5 Definitely Increased

15.- Your attendance at lectures on medical topics

1 Definitely Decreased | 2 Moderately Decreased | 3 No Change | 4 Moderately Increased | 5 Definitely Increased

16. The level of respect you show for colleagues and para-medical personnel.

1 Definitely Decreased | 2 Moderately Decreased | 3 No Change | 4 Moderately Increased | 5 Definitely Increased

17. Your ability to use time efficiently, e.g. with patients, reading, etc.

1 Definitely Decreased | 2 Moderately Decreased | 3 No Change | 4 Moderately Increased | 5 Definitely Increased

18. Your desire to conduct research.

1 Definitely Decreased | 2 Moderately Decreased | 3 No Change | 4 Moderately Increased | 5 Definitely Increased

19. Your desire to practice clinical medicine.

1 Definitely Decreased | 2 Moderately Decreased | 3 No Change | 4 Moderately Increased | 5 Definitely Increased

20. Your desire to become a better physician.

1 Definitely Decreased | 2 Moderately Decreased | 3 No Change | 4 Moderately Increased | 5 Definitely Increased

21.- Your willingness to seek out an attending for assistance with patient problems.

1 Definitely Decreased | 2 Moderately Decreased | 3 No Change | 4 Moderately Increased | 5 Definitely Increased

For the following item note that the rating scale descripters have been changed:

22.- Your perception that rounds can be more effective as a learning experience by increased standardization of the rounding process.

1 Definitely Disagree | 2 Moderately Disagree | 3 Agree | 4 Moderately Agree | 5 Definitely Agree

23.- Your perception that the teaching qualifications of the clinical instructor can affect the educational merit of rounds.

1 Definitely Disagree | 2 Moderately Disagree | 3 Agree | 4 Moderately Agree | 5 Definitely Agree

BIBLIOGRAPHY

Association of American Medical Colleges. (1984). Physicians for the twenty-first century. Report of the project panel on the general professional education of the physicians and college preparation for medicine. Washington, D. C.

Becker, H. S., Geer, B., Hughes, E., and Strauss, A.(1961). Boys In White. Chicago: University of Chicago Press.

Beswick, W., Cooper, D., and Whelan, G. (1982). Videotape demonstration of physical examination: evaluation of issues in medical undergraduate teaching. Medical Education, 16, 197-201.

Bloom, B. S. (Ed.) (1956). Taxonomy of Educational Objectives: Cognitive and Affective Domains. New York: David McKay.

Bordley, J., and Harvey, A. M. (1976). Two Centuries of American Medicine. Philadelphia, London, Toronto: W. B. Saunders.

Brophy, J., and Good, T. (1986). Teacher behavior and student achievement. In Wittrock, M. (Ed.), Handbook of research on teaching. New York: MacMillan.

Chez, R. A., and O'Gorman, D. (1970). Evaluation of an audiovisual carrel tutorial course in clinical medicine. Proceedings of the 9 Annual Conference on Research in Medical Education, 63-66.

Cope, D. W. (1984). Dealing with stress during and after training. Proceedings of the 23rd Annual Conference on Research in Medical Education, 403-405.

Coppernoll, P. S., and Davies, D. F. (1974). Goal-oriented evaluation of teaching methods by medical students and faculty. Journal of Medical Education. 49, 424-430.

Corley, J. B. (1983). Evaluating Residency Training (2nd. ed.). Lexington, Massachusetts: The Collamore Press.

Cox, D. R. (1958). Planning of Experiments. New York: Wiley.

Daggett, C. J. (1977). A study to determine the role of attending physicians in the clinical training of medical students and resident physicians. Unpublished doctoral dissertation, University of Massachusetts, Amherst.

Daggett, D. J., Cassie, J. M., and Collins, G. F. (1979). Research in clinical teaching. Review of Educational Research, 49 (1), 151-169.

Downing, S., Maatsch, J., Huang, R., Baker, D., and Munger, B. (1984). Reliability and validity of objective examinations. Proceedings of the 23rd Annual Conference on Research in Medical Education, 65-69.

Dudley, H. A. F. (1970). Taxonomy of clinical educational objectives. British Journal of Medical Education, 4, 13-18.

Dweck, C. S., and Elliott, E. S. (1983). In Mussen, P. H. (Ed.), Handbook of research on teaching. New York: MacMillan.

Ebel, R. L. (1979). Essentials of Educational Measurement (3rd ed). Englewood Cliffs, NJ: Prentice-Hall.

Elrick, H. (1967). The clinical education of the medical student. Journal of Medical Education, 42, 453-459.

Ericksen, S. C. (1984). The Essence of Good Teaching. San Francisco, Washing, London: Jossey-Bass.

Feightner, J. W., and Norman, G. R. (1972). Concurrent validity of patient management problems by comparison with the clinical encounter. Proceedings of the 15th Annual Conference on Research in Medical Education, 149-153.

Feinstein, E., Gustavson, L. P., and Levine, H. G. (1983). Measuring the instructional validity of clinical simulation problems. Evaluation and the Health Professions, 6(1), 61-76.

Fleisher, D. S., Schwenker, J., and Donnelly, M. (1982). Isomorphic patient management problems: A counterpart to parallel multiple choice tests. Proceedings of the 21st Annual Conference on Research in Medical Education, 143-148.

Flexner, A. (1910). Medical Education in the United States and Canada: A Report to the Carnegie Foundation for the Advancement of Teaching (Bulletin No. 4). New York: The Carnegie Foundation for the Advancement of Teaching.

Foley, R., Smilansky, J., and Yonke, A. (1979). Teacher - student interaction in a medical clerkship. Journal of Medical Education, 54, 622-626.

Gardner, H. (1983). Frames of mind. The Theory of Multiple Intelligences. New York: Basic Books.

Getzel, J. W., and Jackson, P. W. (1963). The teachers personality and characteristics. In N. L. Gage (Ed.), Handbook of research on teaching (pp 506-583). Chicago: Rand McNally.

Glaser, R. (1984). Education and thinking - the role of knowledge. American Psychologist, 37 (3), 292-305.

Goran, M. J., Williamson, J. W., and Gonnella, J. S. (1973). The validity of patient management problems. Journal of Medical Education, 48, 171-177.

Green, J. J., Grosswald, S. J., Suter, E., and Walthall, D. B. (Eds.). (1984). Continuing Education for the Health Professions. San Francisco, Washington, London: Jossey-Bass.

Gronlund, N. E. (1985). Measurement and Evaluation In Teaching (5th ed). New York: MacMillan.

Guilford, J. P. (1982). Cognitive psychology's ambiguities: Some suggested remedies. Psychological Review, 89, 48-59.

Guilford, J. P., and Hoepfner, R. (1971). The Analysis of Intelligence. New York: McGraw-Hill.

Hills, M., and Armitage, P. (1979). The two-period cross-over clinical trial. Journal of Clinical Pharmacology, 8, 7-20.

Horne, D. J. de L. (1979). Large 'small' groups: Their place in higher education. Medical Education, 13, 242-246.

Hubbard, J. P. (1978). Measuring Medical Education (2nd ed). Philadelphia: Lea and Febiger.

Inui, T. S., Chen, M. S., and Pecoraro, R. E. (1980). Demonstration of a technique for describing the content of medical attending rounds. Journal of Medical Education, 55, 63-65.

Irby, D. M. (1978). Clinical teacher effectiveness in medicine. Journal of Medical Education, 53, 808-815.

Jason, H. R. (1962). A study of medical teacher practices. Journal of Medical Education, 27, 258-261.

Jason, H., and Westberg, J. (1982). Teachers and Teaching in U. S. Medical Schools. Norwalk, Conn.: Appleton - Century - Crofts.

Joorabchi, B., and Chawhan, A. R. (1975). Multiple choice questions. British Journal of Medical Education, 9, 275-280.

Kent, T. H., and Spivey, B. E. (1971). Lecture versus nonlecture in teaching gastrointestinal pathology. Journal of Medical Education, 46, 525-531.

LaPalio, L. R. (1981). Time study of students and house staff on a university medical service. Journal of Medical Education, 56, 61-65.

Levine, H. G., McGuire, C. H., and Nattress, L. W. (1970). The validity of multiple choice achievement tests as measures of competence in medicine. American Educational Research Journal, 7 (1), 69-82.

Lowman, J. (1984). Mastering the Techniques of Teaching. San Francisco, Washington, London: Jossey-Bass.

Maxwell, J. A., Cohen, R. M., and Reinhard, J. D. (1983). A qualitative study of teaching rounds in a department of medicine. Proceedings of the 22nd Annual Conference on Research in Medical Education, 192-197.

McCue, J. O. (1985). The distress of internship. The New England Journal of Medicine, 312(7), 449-452.

McGuire, C. H., Solomon, L. M., and Bashook, P. G. (1975). Construction and Use of Written Simulations. The Psychological Corporation.

Medio, F. J., Wilkerson, L., Reinhard, J. D., Maxwell, J. A., and Cohen, R. M. (1984). Improving teaching rounds: Action research in medical education. Proceedings of the 23rd Annual Conference on Research in Medical Education, 283-288.

Miller, G. E. (1956). Adventure in pedagogy. Journal of the American Medical Association, 162, 1448-1450.

Miller, G. E. (Ed.) (1961). Teaching and Learning in Medical School. Cambridge, MA: Harvard University Press.

Miller S. J. (1968). The educational experience of interns. (Report No. CPR-2586): Waitham, MA: Brandeis University. (ERIC Document Reproduction Service No. ED 023 353).

Morse, R. K., Levy, M., Johnson, C. J., and Bollet, A. J. (1975). Effect of previous clerkship experience on readiness for basic medicine clerkship. Journal of Medical Education, 50, 199-200.

Mumford, E. (1970). Interns: From Students To Physicians. Cambridge, MA: Harvard University Press.

Naftulin, D. H., Ware, J. E., and Donnelly, F. A. (1973). The Doctor Fox lecture: A paradigm of educational seduction. Journal of Medical Education, 48, 630-635.

Newble, D. I., Hoare, J., and Baxter, A. (1982). Patient management problems - issues of validity. Medical Education, 16, 137-142.

Nicholls, C. S., and Elliott, E. S. (1982). In Mussen, P. H.(Ed.). Handbook of child psychology (pp 643-691). New York: Wiley.

Norcini, J. J., Swanson, D. B., and Webster, G. O. (1963). Reliability, validity, and efficiency of various item formats in assessment of physician competence. Proceedings of the 22nd Annual Conference on Research in Medical Education, 53-58.

Norcini, J. J., Swanson, D. N., Grosso, L. J., and Webster, G. D. (1983). A comparison of several methods for scoring patient management problems. Proceedings of the 22nd Annual Conference on Research in Medical Education, 41-46.

Notice In: Journal of the American Medical Association. 1883), 1, 32.

Payson, H. E., Gaenslen, E. C., and Stargardter, F. L. (1961). Time study of an internship on a university medical service. The New England Journal of Medicine, 264(9). 439-443.

Payson, H. E., and Barchas, J. D. (1965). A time study of medical teaching rounds. The New England Journal of Medicine, 273(27). 1468-1471.

Peterson, P. L., Swing, S. R., Brauerman, M. T., and Buss, R. (1982). Students' aptitudes and their reports of cognitive process during direct instruction. Journal of Educational Psychology, 74(4), 535-547.

Reichsman, F., Browning, F. E., and Hinshaw, J. R. (1964). Observations of undergraduate clinical teaching in action. Journal of Medical Education, 39, 147-152.

Samter, J., Lepper, M. H., and Montgomery, M. M. (1957). The teaching of internal medicine: The evaluation of lectures and lecturers. Annals of Internal Medicine, 46, 568.

Skeff, K. M. (1983). Evaluation of a method for improving the teaching performance of attending physicians. The American Journal of Medicine, 75, 465-470.

Skeff, K. M., and Stratos, G. A. (1985). Issues in the improvement of clinical instruction. Paper presented at the meeting of the American Educational Research Association Symposium. Chicago, Illinois.

Skeff, K. M. (1985). Personal communication.

Smiley, R. K., Raman, S., and Levine, D. Z. (1979). Student performance in internal medicine: The effect of previous clerkship experience. Journal of Medical Education, 54, 938-943.

Smith, A. C., and McGahie, W. C. (1984). Student evaluation in clinical education: A field of study at one medical school. Proceedings of the 23rd Annual Conference on Research in Medical Education, 217-222.

Sternberg, R. J. (1983). Criteria for intellectual skills training. Educational Researcher, 12, 6-12.

Stritter, F. T., Hain, J. D., and Grimes, D. A. (1975). Clinical teaching re-examined. Journal of Medical Education, 50, 876-887.

Ways, P. D., Loftus, G., and Jones, J. M. (1973). Focal problem teaching in medical education. Journal of Medical Education, 48, 565-571.

Weinholtz, D. (1981). A study of instructional leadership during medical attending rounds. Unpublished doctoral dissertation, University of North Carolina. Chapel Hill.

Weinholtz, D. (1985). Improving clinical teaching through extensive observation and intensive feedback. Paper presented at the meeting of the American Educational Research Association Symposium, Chicago, Illinois.

Williams, G. (1980). Western Reserve's Experiment in Medical Education and Its Outcome. New York: Oxford University Press.

Wolf, F. M., Allen, N. P., Cassidy, J. T., Maxim, B. R., and Davis, W. K. (1983). Concurrent and criterion-referenced validity of patient management problems. Proceedings of the 22nd Annual Conference on Research in Medical Education, 116-121.

Wolf, F. M., Allen, N. P., Cassidy, J. T., Maxim, B. R., David, W. K. (1985). A criterion-referenced approach to measuring medical problem solving. Evaluation and the Health Professions, 8(2), 223-240.

Wolinsky, F. D. (1980). The Sociology of Health. Boston, Toronto: Little Brown.

Wood, D. L., and Hogan, M. J. (1985). Time and medical education. Manuscript submitted for publication.

ABSTRACT

AN EMPIRICAL STUDY OF THE EFFECTS OF DIFFERENCES IN TEACHING METHODS ON KNOWLEDGE ACQUISITION AND ATTITUDES TOWARD MEDICAL ROUNDS

by
DOUGLAS LEE WOOD
December 1986

Co-Advisers.. Dr. Martin J. Hogan and Dr. Claire C. Irwin
Major..... Evaluation and Research
Degree..... Doctor of Philosophy

The clinical training of medical students and postgraduate physicians has several components. One of the important components is clinical rounding. The educational value of the rounding process is felt to be of significance by most medical educators, yet, little objective evidence exists to support their subjective perceptions. The purpose of this study was to determine the educational value of rounds from the perspective of the learner; to identify an alternative to rounds; to determine whether some of the perceptions of what is learned on rounds are accurate; and, to identify ways of improving rounds.

By using a variant of a cross over clinical trial two theoretical populations consisting of third year medical

students and interns were studied. Each group was exposed to two different methods of teaching clinical material, namely internal medicine clinical rounds and an internal medicine tutorial which presented material in a classroom setting similar to that which is presented on rounds. The order of exposure was randomized. At the conclusion of each segment each participant completed an objective examination and an attitudinal survey.

The following conclusions were drawn:

1) For Interns:
    a) Structured experiences are equally effective as rounds in imparting factual information.
    b) No carry over effect exists over time to diminish their fund of knowledge, should teaching methods change.
    c) Their attitudes toward both teaching methods are the same.

2) For Medical Students:
    a) The tutorial experience is superior to the rounding experience in imparting factual information (of a recall type) as a first exposure to clinical medicine. However, once those who experience rounds are then exposed to a tutorial experience their change in recall information is markedly enhanced.

b) A carry over effect was noted and was interpreted that rounds provided a context in which to place factual information for better information retrieval.

c) Attitudes toward teaching methods were relatively constant

AUTOBIOGRAPHY

Douglas Lee Wood

Birthplace and Date: Muskegon, Michigan November 20, 1938

Marital Status: Married - Four Children

Undergraduate Education: University of Michigan,
Ann Arbor, Michigan
B.S. in Zoology (1961)

Postgraduate Education: University of Health Sciences
Kansas City, Missouri
Doctor of Osteopathy (1966)

Internship: Mount Clemens General Hospital
Mount Clemens, Michigan (1966-1967)

Residency: Mount Clemens General Hospital
Mount Clemens, Michigan (1967-1970)
Internal Medicine

Fellowship: Henry Ford Hospital - Detroit, Michigan
(1973-1974) - Nephrology

Certificationsn: Internal Medicine (1976)
Nephrology (1981)

Current Positions: Senior Consultant in Nephrology and
Director of Dialysis Services
Mount Clemens General Hospital
Mount Clemens, Michigan

Director of Medical Education
Mount Clemens General Hospital
Mount Clemens, Michigan

Publications: Carbamazepide Toxicity - Journal of the
American Osteopathic Association
Time and Medical Education - Submitted for
Publication