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ABSTRACT

The nature of the clinical teaching and learning process in three disciplines of a clinical clerkship program was examined. The nature of student learning, the organization of students' time, and the role of various individuals were investigated across the disciplines, and the relationships among the various types of learning were explored. Emphasis was directed to evaluation techniques for both instruction and for student learning. The first study phase involved the development and validation of instruments for assessing clinical teaching and learning. The second phase examined one clinical program and the effect of instructional variables on clinical competence. A total of 160 senior medical students were randomly assigned to three hospitals over a 12-month period. The learning environment (time organization, role of instructors, and student and faculty attitudes) and students' clinical competence in the following three domains were evaluated: cognitive (factual knowledge, problem solving), psychomotor (clinical skill, interpersonal skill) and affective (attitude toward health care). In general, it was confirmed that the clinical teaching process is a complex one and that neither clinical teaching nor clinical competence can be studied as units in themselves. The clinical clerkship program in medical education involves study in distinct disciplines and the attainment of types of skills and knowledge that are somewhat independent. It was found that the disciplines in the clerkship program clearly facilitate different types of learning. (SW)

Improving Teaching in the Clinical Area

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Abstract

To date much of the work in the area of instructional development has focused on the traditional classroom; e.g., the improvement of teaching skills such as lecturing and discussion leading, the evaluation of classroom instruction by students. However many faculty members, particularly those in the professional schools, provide instruction in clinical settings. This paper examines the teaching and learning process in the clinical area with emphasis on evaluation techniques for both instruction and for student learning.

The first phase of the described study is concerned with the development and validation of instruments for assessing clinical teaching and learning. The second phase examines in detail one particular clinical program (a clerkship) determining the effect of various components of instruction on student learning (clinical competence). One hundred sixty senior medical students who were randomly assigned to three hospitals participated in the study over a twelve month period. The learning environment was described in terms of time organization, role of instructors, and student and faculty attitude. Students' clinical competence was assessed in three domains: cognitive (factual knowledge, problem solving), psychomoter (clinical skill, interpersonal skill) and affective (attitude toward health care) The resulting data provided answers to questions such as: Which aspects of the clerkship program facilitate the different types of learning? How does utilization of time affect performance? How do different instructor roles influence student learning?

The instruments developed in this study, and the design used to assess the effect of the program on students' clinical competence is seen as an important step in the area of evaluating and improving clinical teaching.

Improving Teaching in the Clinical Area

Instructional development work has traditionally focussed on the classroom setting both in terms of research and practical application. Strategies have been developed, and to some extent, evaluated for the improvement of such teaching skills as lecturing, discussion leading, and organization of class time. In many disciplines, particularly in the professional schools, teaching and learning occur in natural settings, or clinical areas. Stritter and Flair (1980) define clinical instruction as "the teaching/learning interaction between clinical teacher and student which normally occurs in the intellectual vicinity of a patient and focusses on either the patient or some clinical phenomenon which concerns a patient or a class of patients" (p. 1). Given this definition, it becomes clear that clinical instruction differs substantially from classroom instruction in terms of the learning environment, the nature of the learning itself, the role of the instructor, and the type of instructor-student interaction.

This study will examine, in detail, the effect on student learning (clinical competence) of various components of clinical instruction, and will discuss the implications of these findings for the instructional developer who works in the are of clinical teaching. Clinical competence will be defined as "the ability to apply in the practice situations the essential principles and techniques of medicine required and to apply those concepts, skills and attitudes required of all medical practitioners to fulfill their role" (Williamson, 1973).

Previous Research

Earlier studies of the competency of physicians relied heavily upon the "critical incident" technique, in which hundreds of statements of effective and ineffective behavior on the part of the physician were collected and analyzed in order to make a list of critical performance required (Flanagan, 1950; Hubbard et al., 1965; Sanazaro & Williamson, 1968).

Burg et al (1976) extended the findings of earlier investigators and identified three dimensions of competence: subject matter, abilities and tasks. The first of these

dimensions is the clinical content or subject matter which will be different in various disciplines (e.g., Pediatrics, Internal Medicine and Surgery).

Abilities, the second dimension, are defined according to the following five categories:

1) **Attitudes** represent the ability to maintain working habits and reaction patterns which indicate appropriate sensitivity, empathy and devotion to the continuing care of patients and their families.

2) **Factual Knowledge** represents the ability to recall certain basic and ... information immediately, locate the use references, and understand the information that has been obtained.

3) **Interpersonal Skill** represents the ability to interact effectively with patients, peers and other members of the health team.

4) **Technical Skill** represents the ability to perform a variety of technical procedures. The largest group of such skills is required in performing physical examinations.

5) **Clinical Judgement** represents the ability to derive appropriate conclusions present in different forms and use such conclusions in the formulation of appropr... ns for evaluation and management.

The third dimension of competence relates to the specific tasks perfo... different specialists, e.g., Pediatricians, Surgeons, or Obstetricians.

The critical issues in measuring clinical competence are defining the c... ent of performance and furthermore to separating out the measurable compon... since there is a great deal of overlap between different components. Traditiona... ...nical competence is measured by assessing clinicians' cognitive knowledge, usi... ...tiple choice questions and a clinical examination (Bashook, 1976). While deficien... n the conventional or traditional clinical examination have been identified (Wilson et al. 1979) no attempts have been made to improve the assessment of a student's clinical skills. In North America, the tendency has been to move away from examination at the bedside and towards patient management problems (Newble, 1976). As for the cognitive knowledge, the assumption is that if the physician has the knowledge, it will be applied.

In light present d[illegible]nderstanding of clinical actions this assumption cannot be accepted [illegible]valid. [illegible]n contrast to the above method, clinical competence is also assessed [illegible]he scope of clinicians' problem solving ability without taking into consideration [illegible]skills or the attitudes (Bashook, 1978). Recent writers have noted [illegible]the similarity [illegible]l students, house officers and even practising doctors are probably often [illegible]in the techniques of interviewing and examination skills, but are only merely monitored [illegible]these activities (Engel, 1976; McGuire & Parkes, 1976).

[illegible]nearly [illegible], the implicit assumption is that clinical competence as measured by any [illegible]he above techniques can be generalized across all medical disciplines. However, current data suggests that performance in making decisions depends on the content in which the decision is to be made (Elstein et al., 1978). Thus the studies usually [illegible]d out in one specific disicpline or content area cannot be generalized to an overall [illegible]ca[illegible]omain.

The conflicting data from studies built around this approach (Smiley, 1978; Scott, 1977; Schwartz et al., 1974; Morse, 1975) suggest the need for rethinking the underlying concepts of [illegible]nical competence.

Assuming that [illegible]nical competence is complex, perhaps the appropriate approach is to [illegible]easure competency in each of the domains in which a clinician is required to function. Thus cognitive, psychomotor and affective domains should all be included and a [illegible]ty of disciplines should be represented to find specific and unique factors associated with individual disciplines. Finally, it is necessary to sample clinical cases from [illegible] domains of patient care, namely, acute, ambulatory, emergency and chronic cases.

From the instructional development point of view, [illegible]some researchers have attempted to define affective clinical teaching, or to isolate those teaching behaviors which appear to facilitate student learning in the clinical area. Sritter, Hain, and Grimes (1975), for example, describe six general factors of clinical teaching behavior, based on data gathered from medical students. These factors included a participatory environment, a positive attitude toward students, a problem solving emphasis, discussion

of practical applications, a humanistic orientation, and an emphasis on preferences and research. Several other authors report similar factor analytic findings. These are reviewed by Irby (1978).

Some instructional development research has centered on observations of the teaching-learning process in the clinical area. This work is reviewed by Barnett (1977). In addition, some practical guidelines for clinical instructors have been developed (cf. Stritter, 1980) based on principles of teaching extracted from the classroom research.

The limitation of this research to date is that clinical instruction is viewed as a single concept and clinical learning is viewed as one type of learning. Instructional developers are beginning to realize that there can be no one strategy for improving classroom teaching: the instructor-student-environment interaction is a complex one. Similarly, perhaps even to a greater extent the complexity of clinical instruction demands a comprehensive analysis.

Procedure

The study was conducted in two phases: (1) the development and validation of instruments for the assessment of clinical competence, and (2) the assessment of students during their senior clerkship program in order to determine the effect of various components of the program on student learning.

Sample

One hundred sixty senior medical students in their last year of clinical training, participated in this study over a twelve month period. Students were randomly assigned to three teaching hospitals. Three major core disciplines, surgery, medicine and pediatrics were selected for detailed study.

Instruments

Instruments were developed in each of the three learning domains, cognitive, affective and psychomotor. In addition, the learning environment for each of the disciplines (surgery, pediatrics, medicine) was assessed using three techniques. The instruments are summarized in Table 1. Phase I of the study which consisted of reliability and validity studies of each of the instruments is described in detail

elsewhere (Patel, 1980). In general, instruments were constructed by committees of senior clinical instructors and were pilot tested on samples of students not involved in the second phase of the study. The instrument for measuring interpersonal skill was adapted from the Hopkins Interpersonal Skills Assessment (Grayson et al., 1977).

Design

In the cognitive domain, factual knowledge and problem solving were assessed at the beginning and end of each rotation. In the psychomotor domain, clinical skill and interpersonal skill were measured once during each rotation using two techniques (see Table 1) for each skill. For interpersonal skill, a control group was utilized in order to isolate the growth which could be attributed to the rotation itself. In the affective domain, attitude toward health care was rated at the beginning and end of the entire clerkship program; a control group of 30 students was used. Data describing the learning environment of each discipline were collected using three techniques: a randomly selected sub-sample of students recorded their daily activities for six days in the middle of each eight week rotation; an attitude scale assessed the organization of the program and the roles of the instructors, and general student and faculty attitude were rated by questionnaire and interview.

Hypotheses

It was hypothesized that:

1) The different disciplines in the clerkship program would facilitate different domains and types of learning;

2) The sequence of rotations would faciliatate different domains of learning;

3) The students' organization of time would vary among disciplines;

4) The role of the instructors would vary among disciplines and would affect student performance;

5) Performance in one domain of learning (cognitive, psychomotor or affective) would not be related to performance in another domain of learning.

Results

Hypothesis 1

Each of the [illegible]pes of learning was examined separately in three disciplines. It was found that [illegible]al knowledge was facilitated by the medicine and pediatrics rotations, and problem solving by medicine and surgery. Gains in interpersonal skill, however, were made only during the pediatrics rotation (there is, however, indirect evidence that psychiatry also influences this skill). Clinical skill showed equivalent gains in medicine and surgery, and slightly less change in pediatrics. Overall, no changes in student attitude were recorded. Tables 2, 3, 4, 5, and 6 summarize these results.

Hypothesis 2

The effect of the sequence of rotations was examined separately for factual knowledge, problem solving, interpersonal skill and clinical skill (see Tables 7, 8, and 9). It was found that factual knowledge was enhanced in pediatrics when students had already completed medicine and surgery. However, when students were entering medicine or surgery after having completed the other two rotations, no influence was apparent.

In the area of problem solving, prior experience in any other rotation resulted in a decrease in certain types of errors, but no other influence was apparent. Interpersonal skills were obviously affected by the pediatrics and psychiatry rotations: students entering either medicine or surgery following these experiences showed higher levels of interpersonal skill than those who entered without them. In clinical skill, again, different types of errors were made by those students who had previous experience.

Hypothesis 3

The amount of time spent in various activities during the rotations in the three disciplines was found to differ. For students in surgery there was a significant difference when comparisons were made with students in Medicine and Pediatrics. The latter two disciplines differed; however the difference was not significant (see Table 10).

Hypothesis 4

When the role of instructors was examined across disciplines (Table 11), some variations were found. Residents in Medicine and Surgery were seen to contribute to different types of learning. Interns also played different roles in Medicine than in Surgery; however Pediatrics did not differ from Medicine.

Hypothesis 5

Correlations among the types of learning for all disciplines combined are presented in Table 12. These correlations reveal varying degrees of independence among the five types of learning, and even within the domains (problem solving and factual knowledge, in the cognitive domain correlate -.331). It should be noted that attitude and interpersonal skill correlate .730, possibly indicating that interpersonal skill contains a larger component of the affective domain than expected.

A multiple regression analysis was conducted in which factual knowledge was used as the criterion variable, and problem solving, clinical skill, interpersonal skill, and attitude were used as a set of predictor variables. Table 13 presents the results of this analysis. Overall, the predictor variables account for nearly 50% of the variance of factual knowledge.

Discussion

In general, it was confirmed that the clinical teaching and learning process is a complex one and that neither clinical teaching nor clinical competence can be studied as units in themselves.

The clinical clerkship program in medical education involves study in distinct disciplines and the attainment of types of skills and knowledge which are somewhat independent. First, it was found that the disciplines in the clerkship program clearly facilitate different types of learning. This appears to be partially related to the amount of time spent in different activities in each discipline (e.g., more time spent in didactic instruction in pediatrics produces an emphasis on factual knowledge in that discipline), and partially related to the nature of the discipline (pediatrics facilitates interpersonal skill through interaction with patients' families). Instructional developers,

then, should work within that framework, realizing that the learning outcomes in different clinical areas will vary, and this is a result of both the content area, and the ways in which students actually spend their time. In classroom instruction it is accepted that an English literature course is different from an applied statistics course, and that a large introductory lecture course requires different teaching skills from an advanced seminar. The results of this study confirm that "clinical instruction" is as diverse as "classroom instruction," a point which appears not to have been considered by instructional developers.

It was also found that the sequence of rotation through the various disciplines affected different types of learning. This result would be expected given that the disciplines facilitate different types of learning. The instructional developer working in a particular clinical area should, then, consider the prior clinical experience of students and should be aware of the effect of this variable in interactions with the instructor. It may be necessary, in some situations, to change the emphasis placed on certain types of learning, dependent on students' previous experiences.

Not only does the type of learning and the organization of student time vary across disciplines, but also the roles that individuals play in the instructional process are different, and the degree to which different individuals contribute to types of learning varies. This point underlines the complexity of clinical instruction. Classroom instruction involves interactions among an instructor, a group of students and the "task environment." Clinical instruction takes place in a setting where a number of individuals, in different roles, are involved to varying degrees in the process, and are contributing to different types of learning. This is a point which the instructional development expert must consider if the clinical teaching and learning process is to be understood and improved.

Finally, it is important to realize that clinical competence, or the nature of student learning in clinical instruction consists of a set of competencies which are, to a large degree, unrelated to each other. Students are expected to become proficient in all three domains of learning (as opposed to the usual cognitive goals of the

classroom process), and different experiences are required for each of these domains. It is clear from the results of this study that, for example, a student who is proficient in factual knowledge is not necessarily also proficient in clinicial skill or interpersonal skill. This is quite different from the more familiar situation, where a student who is achieving highly in a course or program is achieving in most aspects of that course or program. The instructional developer in the clinical process who works with only one or two criteria of success will likely be ignoring several important aspects of the instruction.

Conclusion

This study examimed the nature of the clinical teaching and learning process in three disciplines of a clinical clerkship program. The nature of student learning, the organization of students' time, and the role of various individuals was investigated across the disciplines. In addition, the relationships among the various types of learning were explored. As predicted, it was found that the clinical process is an extremely complex [illegible] each of the variables mentioned above vary across disciplines and the types of [illegible] are relatively independent. The instructional development process, therefore, must take into account a number of variables that are not usually relevant in the classroom setting.

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Table 1

Summary of Instruments

Domain	Skill	Instrument
Cognitive	Factual knowledge	Multiple choice questions
	Problem solving	Chart review
Psychomotor Skill	Clinical skill	Physical exam checklist Patient rating form
	Interpersonal skill	Video tape of doctor-patient interviews Multiple choice questions
Affective	Attitude towards	Questionnaire
	Health care	Written report during the ward performance
Learning Environment	Time organization	Student diary
	Role of instructors	Questionnaire
	Student and faculty attitude	Questionnaire and interview

Table 2

Factual Knowledge

	Pre-test $\bar{X}$	Pre-test SD	Post-test $\bar{X}$	Post-test SD	t
Medicine					
Rotation I	26.1	4.62	32.1	5.69	14.418*
Rotation II	28.7	5.60	32.9	6.18	6.413*
Surgery					
Rotation I	16.7	1.97	16.8	2.86	.192
Rotation II	16.4	2.06	16.6	2.39	1.55
Pediatrics					
Rotation I	29.1	5.02	38.8	6.0	12.177*
Rotation II	33.2	4.79	40.1	4.33	15.968*

*significant at $p<.001$

Table 3

Problem Solving

	Pre-test		Post-test		
	$\bar{X}$	SD	$\bar{X}$	SD	t
Medicine					
Rotation I					
Chart #1	16.7	3.23	24.2	3.14	7.1198*
Chart #2	15.5	2.89	25.1	2.99	9.8555*
Rotation II					
Chart #1	18.8	3.54	24.2	2.61	4.573*
Chart #2	18.0	3.53	24.9	2.60	6.772*
Surgery					
Rotation I					
Chart #1	10.2	3.50	15.7	2.57	3.3278*
Chart #2	10.5	3.44	15.6	3.11	5.2870*
Rotation II					
Chart #1	11.5	3.38	15.5	2.56	5.485*
Chart #2	11.1	3.48	15.8	2.45	4.004*
Pediatrics					
Rotation I					
Chart #1	5.0	2.45	5.14	3.45	3.556*
Chart #2	2.4	1.23	5.1	3.7	.1261
Rotation II					
Chart #1	7.9	3.05	7.8	2.556	3.1882*
Chart #2	8.3	3.39	4.8	2.36	.6150

*significant at $p < .01$.

Table 4

Interpersonal Skills

	Pre-test		Post-test		
	$\bar{X}$	SD	$\bar{X}$	SD	t
Medicine					
Rotation I	10.4	.25	10.7	.23	1.761
Rotation II	13.6	.24	13.8	.23	1.662
Surgery					
Rotation I	10.2	.19	10.6	.14	1.800
Rotation II	13.7	.23	13.7	.19	.270
Pediatrics					
Rotation I	10.5	.11	11.8	.14	5.73*
Rotation II	11.3	.19	12.6	.19	5.79*

*significant at $p<.001$.

Table 5

Clinical Skill
Physical Examination Skill

Post-test only

	Rotation I		Rotation II	
	$\bar{X}$	SD	$\bar{X}$	SD
Medicine	.82	.112	.82	.19
Surgery	.75	.06	.74	.08
Pediatrics	.80	.09	.74	.10

Table 6

Attitude Towards Health Care

	N=150 Pre-test		N=140 Post-test		
	$\bar{X}$	SD	$\bar{X}$	SD	t
Compassion	4.1	.20	3.9	.28	3.899*
Patient's rights	2.9	.66	3.3	.38	1.752
Geriatrics care	3.0	.99	2.6	.86	3.799
Psychiatric care	3.6	.55	3.5	.45	.4854
Assuming responsiblity	3.1	1.01	3.4	.88	3.227*
Preventive medicine	3.8	.172	3.8	.24	.3530
To work as a team	3.7	.43	.37	.63	.4948
Confidence	2.7	.59	2.9	.56	3.329*

*significance at $<.05$.

Table 7

Factual Knowledge

	Pre-test $\bar{X}$		
	Rotation I	Rotation II	t
Medicine	26.1	28.7	1.646
Surgery	10.7	16.4	.59015
Pediatrics	29.1	33.2	2.643*

*significant at $p<.001$.

Table 8

Problem Solving

		Pre-test $\bar{X}$		
	Chart #	Rotation I	Rotation II	t
Medicine	1	16.7	18.8	1.91496
	2	15.5	18.0	2.41345*
Surgery	1	10.2	11.5	1.5353
	2	10.5	11.1	.1889
Pediatrics	1	5.0	7.9	3.3105*
	2	2.4	4.6	3.8907*

*significant at $p<.05$.

Table 9

Interpersonal Skills

	Pre-test $\bar{X}$	
	Rotation I[1]	Rotation II[2]
Medicine	10.4	13.6
Surgery	10.2	13.7
Pediatrics	0.5	11.3

[1]Rotation I
Disciplines tested

1) Medicine - no prior experience
2) Surgery - no prior experience
3) Pediatrics - no prior experience

[2]Rotation II
Disciplines tested

		Prior Experience
1)	Medicine	- surgery, pediatrics, psychiatry, holidays
2)	Surgery	- pediatrics, medicine, psychiatry, holidays
3)	Pediatrics	- medicine, surgery, psychiatry, electives

Table 10

Organization of Student Time during the Ward Activities

	Percentage of Student Time		
	Pediatrics	Medicine	Surgery
Patient care	(*)	(*)	(*)
Educational	30 (3.5)	36 (3.0)	24 (3.0)
Joint patient-care and educational	25 (2.0)	29 (3.0)	38 (2.4)
Mechanical	15 (+)	20 (1.5)	29 (1.8)
Unaccounted time	10	0	0

*educational value

not available

Table 11

Role of Instructors

Attending staff	$\overline{X}$	SD	t
Pediatrics	2.6	.514	t 3.0355
Surgery	2.1	.451	t 1.2052
Medicine	2.9	.508	t 4.338
Residents			
Pediatrics	3.4	.528	t 1.7438
Surgery	3.0	.619	t .72312
Medicine	3.5	.404	t 2.5701
Interns			
Pediatrics	3.7	.393	t 1.7411
Surgery	3.4	.500	t 2.7104
Medicine	3.3	.295	t .38713

Table 12

Correlations Among all Measures of Learning

	F/K	PS	CS	IP	Attitude
F/K		-0.331	.235	.039	.272
PS			.149	.063	-.183
CS				.033	.013
IP					.730

Table 13

Prediction of Factual Knowledge from
Other Measures of Clinical Competence

Variable	Regression Coefficient	S.E.	Beta	Partial Correlation
Problem solving	-.175	.05	-.29	-.29
Clinical skill	.249	.07	.28	.31
Interpersonal skill	-1.082	.59	.23	-.17
Attitude	.371	.12	.37	.28

$R^2 = .479$

$F = 9.26$ (significant at $p < .001$)