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Integrating media

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INTEGRATING MEDIA:
A HOLISTIC APPROACH TO INSTRUCTIONAL MATERIALS DESIGN

by

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INTRODUCTION

This thesis follows completion of a project in instructional program design to be used as part of a course in Clinical Pharmacy at the University of California San Francisco. In the process of determining content for that program, a "holistic" approach was adopted. As we examined the whole body of information which needed to be presented in this one segment of the course, an audiovisual presentation of a conceptual model emerged as of central importance together with organization of peripheral course content material to comprise one integrated instructional unit.

The reasons for adopting this perspective were twofold: first, I recognize the limitations of a single instructional device or strategy in information presentation. The fact that various elements of subject matter are interrelated requires that the instructional methods designed to convey the subject matter be similarly integrated; secondly, introduction of a variety of instructional approaches to a given body of subject matter has been found to be beneficial to both students and instructors. When a mixed instructional approach is followed, students gain at least as much comprehension of subject matter as they might in another environment, with the added advantage of a more stimulating learning experience. The incorporation of an effective self-instructional element partially relieves the instructor of the responsibility of presenting repetitive subject matter, freeing

him/her to commit more energy to interact with students on a one-to-one or small group basis.

The goal of the unit which I undertook to produce was instruction of third-year pharmacy students in the accurate interpretation of certain standard laboratory tests of thyroid metabolism. In preparing students to operate in a practical situation, I as project designer, and the instructor as content specialist, faced the prospect of clarifying for students that most difficult aspect of any subject -- its conceptual base.

Because of the limitations imposed by overall organization of the course, Clinical Pharmacy 131, our method of presentation was designed to accomplish our instructional goals within one fifty-minute lecture period and one subsequent thirty-minute conference session.

BACKGROUND OF THE PROJECT

In the Fall of 1975, the Director of the U.C.S.F. Graduate Program in Medical and Biological Illustration initiated a "search" for instructional project proposals to be developed with funding provided by an Innovative Projects in University Instruction Grant. One of several respondants, Dr. Mary Anne Kimble of the Division of Clinical Pharmacy,expressed interest in working on an audiovisual program to provide self-instructional material to supplement and possibly supplant certain portions of lectures she regularly delivered.

Topic Selection

The specific target audience for the program was third-year professional pharmacy students. However, the program could also be used as remedial material for OTHER students of the health professions and as continuing education for post-graduate students.

While convinced of the need for new material tailored to the given audience, Dr. Kimble was uncertain about how much material could be handled in a ten to twenty minute A-V program. Her topic suggestions ranged from renal function tests (i.e., factors altering BUN levels) to effects of pH on potassium levels, and to hematologic variables. Somewhat arbitrarily but certainly influenced by such factors as (a) lack of suitable literature, and (b) the abstract nature of relevant key concepts, we made a decision to deal with the evaluation of thyroid function using competitive protein binding concepts and the influence of drug-related interference factors.

Problems in Teaching and Learning of the Subject Matter

The problems associated with the teaching and learning of this material are several. Clinical Pharmacy courses 130, 131 and 132 are offered as a survey in which students are taught the physiology and medical management of commonly encountered disease states. While formal instruction for students in the clinical interpretation of routine lab tests is important, learning time for this body of subject matter must be compressed into a two-week period. This amount of time is too brief for satisfactory comprehension. The

fact that there is no suitable literature (existing material is either too detailed or too brief for pharmacy students) compounds the instructional problem. In addition, the changing nature of the pharmacy profession requires new and updated resources. Pharmacists now take a more active and direct role in patient care. For example, circumstances occasionally arise where an alert pharmacist has an opportunity to discuss possibly dangerous drug potentiation with the prescribing physician before offending drugs cross the counter.

Students of clinical pharmacy become acutely aware of interactions between drugs, and make it their business to be conscious of potentially harmful responses in patients to dangerous combinations of drugs. As an example, a patient who is pregnant and who shows up at a clinic with complaints of weight loss and shakey nerves might be misdiagnosed as hyperthyroid even after results of hormone level tests are received from the lab. In fact, the surplus production of estrogen hormones in a woman's body as the result of pregnancy, stimulates production of excess globulin proteins in the blood. This creates false readings on thyroid function tests which could result in misdiagnosis of thyroid function.

Wider awareness of drug interactions on the part of all health professionals would increase patient safety. This postulate forms the baseline rationale for the sequence of courses Clinical Pharmacy 130, 131 and 132. While becoming increasingly important in other

professional schools (e.g. Medicine)[1], within a School of Pharmacy, systematic instruction in correct interpretation of laboratory findings is essential.

COURSE DESIGN USING INTEGRATED MEDIA

Rationale

The body of subject matter concerned with thyroid function tests to be incorporated into our integrated media lesson design was originally allocated the following time periods by School of Pharmacy Curriculum planners:

1. Thyroid function tests - 50 minute lecture
   30 minute conference

2. Pathopysiology of thyroid disease
   - 4 hours lecture
   2 hours conference

With Dr. Kimble's assistance, I designed this entire body of material into a multi-media lesson plan for which one component would be presented in a motion medium which would not exceed about twenty minutes in length.

The scripting process for an audiovisual program requires careful consideration of the quantity and nature of the subject matter content. Strictly conceptual material, on the other hand,

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[1]Patrick C.J. Ward, "Systematic Instruction in Interpretive Aspects of Laboratory Medicine," Journal of Medical Education, Vol. 51, No. 8 (August 1976), p. 626.

may be best clarified using a visual motion medium, whereas more didactic information such as review of pertinent physiology or introduction to variability in tests might be communicated more effectively through other media formats. Scripting for the audiovisual component of this program - a conceptual model - demanded careful concurrent scripting of peripheral content which would be presented in lectures and in conference format.

The fact that students all possess a commonality of prerequisite knowledge could not be assumed in designing the unit. Typically, responsibility for assuring that students have this entering level information, rests with the instructor who also must determine what specific new information should be presented, in what order, and in what manner. To meet the goals of this pharmacy course, provision had to be made to present in an appropriate form all information not included in the mediated A-V portion. Many instructors find that heavy teaching schedules prevent them from investing extensive time and thought in course design. But and instructor and an A-V designer may seek opportunity to pool their specialized talents for the increased benefit of students and instructor as well.

In discussing diversity in education and summarizing results of multiple studies in the British Isles, Karl U. and Margaret Foltz Smith agree, "...that there is no one educational technique that is superior to a number of techniques used in an integrated fashion."[2]

[2]Karl U. and Margaret Foltz Smith, "Cybernetic Principles of Learning and Educational Design," Instructional Technology: A Book of Readings, ed. Knirk, Childs (New York: Holt, Reinhart and Winston, 1968), p. 224.

In an academic environment, "...a fact presented in many contexts may be learned more effectively because it can be manipulated in relation to many other facts and can be retrieved in many situations."[3]

The following is the plan developed for presentation of the required body of information on thyroid function testing under the specific circumstances outlined by Dr. Kimble for her Clinical Pharmacy course.

Organization

Students acquire information and retain it longer when they see that materials presented are meaningful and systematically organized. Therefore, content for this presentation is arranged in a relatively linear manner, and because of the interrelatedness of the parts, the total lesson is organized as a complete multi-media unit of experience for students in the Clinical Pharmacy course.

Introduction of Preliminary Material

Although students come into this course with strong backgrounds in the basic sciences, instructors must assume that recall of thyroid physiology will vary from student to student. Therefore, as an element in the integrated lesson design, summaries of material on this topic are distributed as handouts for pre-study prior to the class meeting in which thyroid metabolism will be discussed. A written introduction to existing laboratory tests of hormone levels is also distributed to the students at this same time. These tests examine comparatively

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[3]Robert F. Mager, Ph.D., Preparing Instructional Objectives, (California: Fearon Pubs, 1962), p. 44.

increased specificity from the standard PBI exam to T_4 (thyroxine) by column and by competitive protein binding.

Apparently, different institutions routinely use different thyroid function tests. Some of these tests are more specific than others, yet all quantify the same variable. Results may also be fallacious due to interference factors. This necessitates a complementary test to check values for bound T_4 hormone. Student comprehension of this concept is generally poor, although the principles involved are not difficult to understand. The instructional plan therefore specifies that approximately twenty minutes of time at the beginning of the lesson be spent reviewing content, indicating relative importance, and answering related questions with reference to the handout material. Models for microscopic structures and laboratory test materials are presented in the handouts to establish strong visual symbols. These symbols will be reinforced in the film portion of the class and, hopefully, will be retained indefinitely, serving to aid recall long after completion of course work on the topic.

The Audiovisual Component

After deliberation and study of lesson content, we decided that a dynamic motion medium presentation would best establish conceptual models for physiologic processes occurring on the microscopic level. Further, we concluded that concepts involving inverse proportionality also would be best handled by a motion medium - in this case, 16mm film. Content to be presented included conceptualization of "true"

hyper and hypo thyroid states, introduction to the RT_3U test and its administration, and evaluation of thyroid function by combining test results with known levels of "bound" thyroid hormone.

The visualization techniques which we used incorporate film animation by pixillation. The whole film is about eight minutes in length and after final editing and revisions, an answer print was also transferred to videocassette, which could then be catalogued and made permanently available for study and review in SIMA, the U.C.S.F. self-instructional study area. Presentation via videocassette permits independent study or projection for small classrooms. On the U.C.S.F. campus, the ETV Department provides automatic transmission of video from a T.V. control room to permanent classroom monitors, a service which many users find attractive. The optimum mode, however, for presenting 16mm film to large audiences, is direct film projection.

Building On New Material

A basic objective of Clinical Pharmany 130, 131 and 132 is that students understand the significance of laboratory test results and be able to recognize an erroneous diagnosis arising as a result of failure to consider multiple drug interaction when drugs are prescribed. Conceptual models established in the film are introduced by the instructor following the film using overhead transparencies to demonstrate drug interference mechanisms. These materials include a cel displaying the graphic prototype symbol for TBG protein, developed for the film, and five overlays, each indicating a separate hormonal action affecting

protein binding capacity. In each case, three variables (which in combination make possible an accurate picture of thyroid function) are illustrated. The "drugs" as well as other hormones whose quantities vary, are represented by movable color-coded markers which can be manipulated on the flat surface of the projector to demonstrate drug interactions with thyroid hormones.

Motion picture is a time-based medium which cannot readily be interrupted. Student questions, therefore, must be withheld and asked during the overhead transparency segment of this lesson.

Case Studies

Since course objectives stress applied therapeutics, case histories have proven to be useful both as the basis for didactic material, and as a feedback mechanism for assessing student comprehension. Accordingly, a thirty-minute conference session scheduled into the original course, is retained in the new instructional plan. This meeting convenes a few days after the bulk of subject matter for the lesson has been presented. Written case studies are distributed in advance to give students time to think them through, so that in seminar they are prepared to discuss the clinical problems involved.

VALIDATION

Since a partial but major goal of this program was to improve learner comprehension, a test was prepared to be administered before and after student exposure to the newly designed course material. In

other words, this test would serve as both pre- and post-test when administered to a single group of student subjects. Since the multi-media package was in production while the junior class of 1975 was completing the course in laboratory tests of thyroid function, this group of students was asked to take the new test. The following Spring (1976) the new third-year class took the test both before and after taking the "new" course. Results from all three administrations of the test are shown in Figure 1.

We ran a Z test on the post-test scores for the 1976 and 1977 classes which showed no significant difference at a level of ~~competence~~ confidence of .05.

While these comparisons show no significant difference we know that the new lesson plan results in learning as shown by the differences in scores between the 1977 pre/post-test administrations. To compare the new lesson with the old method of instruction would require control of variables to the extent that one population would be divided into two test groups, one given the old and one the new treatment.

I question whether this additional study is justified. In one sense, the fact that the new lesson plan is well-received and does teach is validation enough. There are ways to look at validation which are not quantitative measures of performance. We may hypothesize, for example, that the package "Evaluation of Thyroid Function" will produce higher scores on tests of comprehension

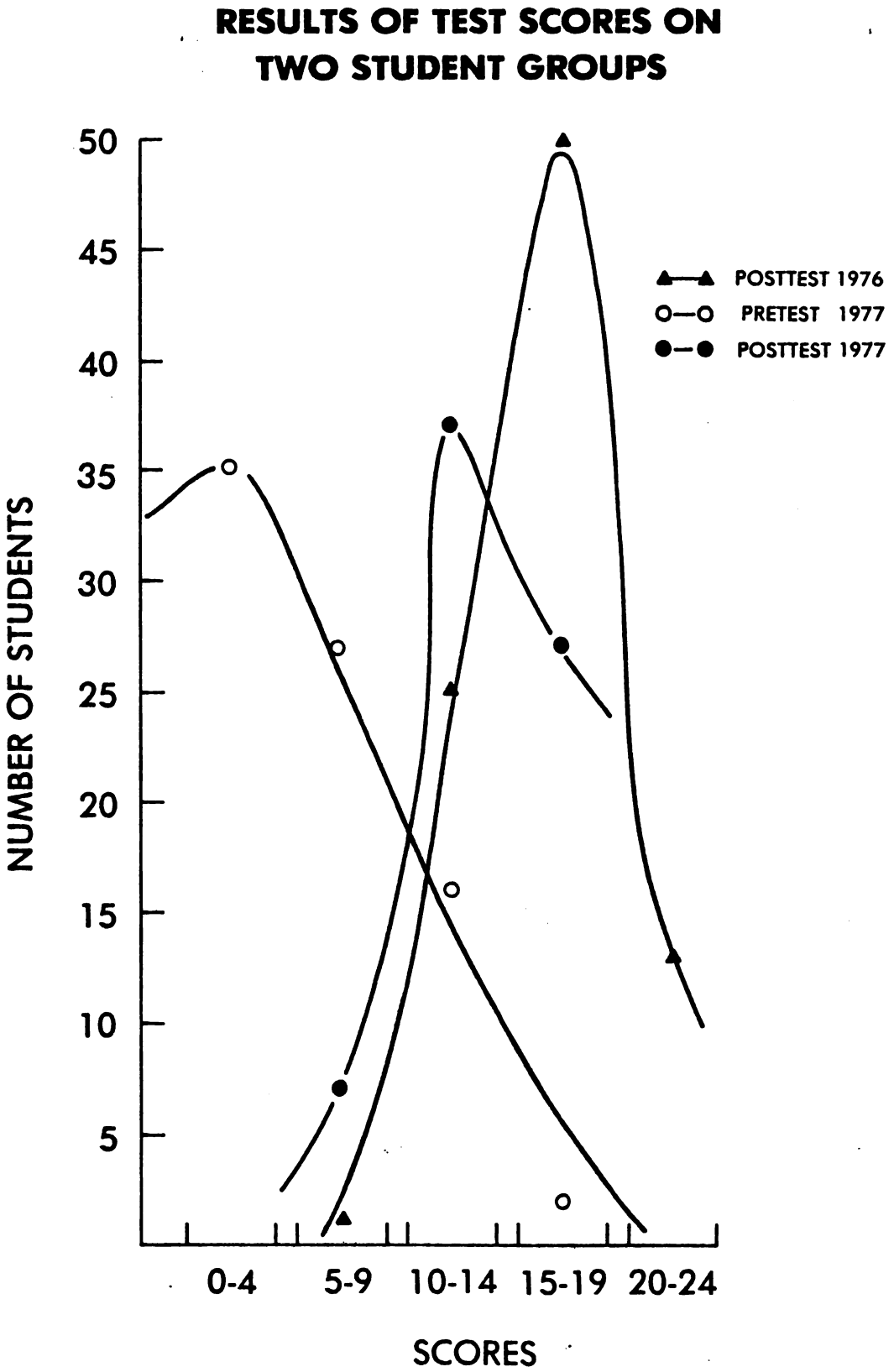
RESULTS OF TEST SCORES ON
TWO STUDENT GROUPS
NUMBER OF STUDENTS
50
45
40
35
30
25
20
15
10
5
POSTTEST 1976
PRETEST 1977
POSTTEST 1977
0-4
5-9
10-14
15-19
20-24
SCORES

Figure 1

after instructors become familiar with the new materials, although we have no data to support this hypothesis. An important planning objective was partially to remove the "instructor as lecturer" from the lesson presentation, providing a diversity through media in addition to direct instructor presentation - a more stimulating and more self-instructional approach which would enlist learner participation in self-education. The instructor at the same time could increase remedial assistance to individual students.

Relieved of repetitive delivery of certain segments of course content by making self-instructional modules available, instructors would also have more time for research and for keeping abreast of new developments in their field.

Other variables affecting test scores of comprehension could be further examined. For instance, the time allowed for taking the post-test might be unrealistic for the kind of deductive reasoning involved. It is also possible that a future study of the same student test subjects might show increased retention of concepts illustrated by the film ("rules-of-thumb"), producing more accurate interpretations of clinical data.

PROPOSALS FOR FURTHER RESEARCH

The future research potential of this instructional package can be broken down into the following categories:

1. Surveying learner appraisal of the audiovisual component alone.

2. Surveying learner appraisal of lesson design including the audiovisual component.

3. Tests of retention among graduating students.

4. Attitudinal surveys and tests of comprehension among professionals pursuing their own education (e.g., viewing the film in a self-instructional media environment).

5. Comparative assessment of instructor input (contrasting the two different instructional systems discussed in this thesis).

CONCLUSION

My five major goals in developing this instructional package were:

1. To provide students with a stimulating and enriching approach to learning about the evaluation of thyroid function.

2. To improve student comprehension and retention of core pharmacological concepts through maximum utilization of the new A-V materials.

3. To design an integrated, innovative presentation of the content through analysis of inherent specific learning problems.

4. To assist the instructor in the planning of one portion(devoted to thyroid function)of the overall content for the Clinical Pharmacy course sequence 130, 131 and 132.

5. To relieve the instructor of responsibility for repetitive delivery of segments of this content.

This teaching package on the clinical interpretation of tests of thyroid function has attempted to explore some options in the integrated use of instructional materials of all kinds. Some of the objectives of this project have already been realized in that it is favorably received and tests demonstrate that it teaches effectively. The "holistic" approach gives promise for wider use in integrated lesson planning in professional health sciences education.

REFERENCES

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APPENDICES

A. Pre/Post-Test

1. The T_3 Uptake test is an indirect measurement of _____

_____

2. The T_4 Displacement Test (also known as the TT_4, Murphy-Patee) measures free/bound T_4. (Circle one)

3. Match the following (more than one answer may be correct):

BEI	_____	a. Organic iodines interfere
TT_4, T_4D	_____	b. Inorganic iodines interfere
T_4 by Column	_____	c. Varies with amounts of TBG
PBI	_____	

4. A 57-year-old post-menopausal female is given a prescription for Synthyroid 0.3 mg q.d. Her medication profile indicates that she is taking Premarin 1.25 mg daily, a drug which increases levels of TBG. You would predict that her...

T_3 Uptake would be increased/decreased	Circle one
T_4D would be increased/decreased	" "
Thyroid function would be normal/increased/decreased	" "

5. Predict the changes in the tests indicated for the following circumstances: (↑ = increased; ↓ = decreased; 0 = no change)

	T_3U	T_4D	FTI
A patient taking diphenylhydantoin a drug which displaces T_4 from TBG			
Hyperthyroid patient			
Hypothyroid patient treated with enough T_4 to produce a euthyroid state			
A euthyroid woman given T_3 75 mcg/day for obesity			

Explain your answer for this situation.

B. Lesson Plan for Evaluation of Thyroid Function - Clinical Pharmacy 130, 131, 132

The method of presentation for this subject matter has been so designed as to accomplish its goals within one 50 minute lecture period plus one subsequent 30 minute conference session.

TIME ALLOTED

20 mins. (A and B)

A. Background material (to be handed out at end of previous class session for pre-study)
- Basic review of thyroid physiology (role of iodine.., TSH feedback loop, etc.

B. Introduction to measurement of hormone levels (handout as above)
- Existent tests of hormone levels with a comparative view, increased specificity from PBI to T_4 by column to T_4 - CPB tests. What is being measured and why.

10 mins.

C. Media production "Testing Thyroid Function" shown
- Establishes a conceptual model which includes illustration of "true" hyper and hypo thyroid states, introduction to RT_3U test, administration of that test, and evaluation of thyroid function by combining results of that test with known T_4 (bound) level.

20 mins.

D. Overhead transparencies based upon conceptual model from films to introduce action of drug interference factors
- Materials include one cel with schematic TBG protein and resin sponge, five overlays each indicating a separate hormonal action on protein binding capacity and in each case a record of the effect on level of bound T_4, on T_3 taken up, and on the free thyroxine index.

30 mins.

E. Case studies
- Prepared in advance for discussion, these pertinent case studies will provide opportunity for practice with feedback from the student in dealing with clinical situations.