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ABSTRACT

To offer an integrated science curriculum that will provide sufficient depth, breadth, and lattice mobility as well as meet basic science needs upon which to build performance success for allied health professionals and technicians, several areas of concern, including basic philosophy, administrative support, faculty involvement, process and product, research input, and evaluation, need to be considered. In any effort to change the curriculum, the employing agency has to redesign certain task descriptions and job slots for the entry health worker and also must provide for worker upward mobility. Administrative support from the medical society and its specialty boards as well as from educational administrators is also necessary. Moreover, without active faculty participation, the curriculum change is doomed. Research is necessary to evaluate the modules developed for chemistry, physics, physiology, health education, and biomedical technology, as well as to share results with others. Additional evaluative data in the form of longitudinal followup studies should be instituted. Several sample modules are appended. A related document is available as VT 012 185 in this issue. (SB)

SECOND REPORT--PROGRAM FOR EDUCATIONAL MOBILITY FOR HEALTH MANPOWER (THE BASIC SCIENCES)

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COORDINATING COUNCIL FOR EDUCATION IN THE HEALTH SCIENCES
FOR SAN DIEGO AND IMPERIAL COUNTIES

December 28 - December 31, 1970

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THE CORE CURRICULUM IN THE HEALTH SCIENCES

Doris A. Meek

The definition of a core curriculum presumes that within the allied health occupations there is a commonality of information and skills which is relevant to all students. The logic, economy and related values of the core course and core curriculum have continued more as pious declarations of intent than a conviction and fact of operational curricular life.

After one brief summer's endeavor in attempting to identify the core components of an integrated science course for community college allied health professionals and again after a December workshop on the same whereby science faculty in anatomy, physiology, physics, chemistry and microbiology met with allied health educators, a few observations may be in order.

Dr. Thomas Klopfenstein, Associate Dean for Health Technologies of Kellogg Community College wrote in November 1970 upon receiving the Preliminary Report, "It was both exciting and spooky to read your 'Preliminary Report' of your committee on integrating science. The charges made to this committee were identical to the ones I made to our faculty committee working on the core curriculum here at KCC.

"I just wish that I could provide you with more information at this time. I will, however, send you all the information as it develops. I am afraid there will be much similarity in some parts though. We are encountering some (many) of the same problems you have identified and the plan of attack is quite similar. . ."

What are some of the problems that must be faced in curriculum development leading to an integrated science, or a core course that will provide sufficient depth and breadth and lattice mobility? How, in addition, at the same time, can the course meet the basic science needs upon which to build performance success of a variety of allied health professionals; radiologic technicians, inhalation therapists, dental assistants, physical therapy assistants, nursing; LVN-RN, Biomedical Technicians? In answering this question the following areas of concern need to be considered: basic philosophy, administrative support, faculty involvement, process and product, research input and evaluation.

Basic Philosophy

The rapid development of the allied health programs as physician support has increased from a ratio of one to ten to one to seventeen in the past few years. Efforts to improve the quality of health care have been in the typical American tradition, see a need - fill it, but sometimes with either utter disregard of what has ever been done before or on the other hand slavish adherence to a set pattern developed in the past tradition when hospitals carried on their own training programs. As a result of the contradictory trends, the AMA Council of Medical Education moved in to give sanction to those they recognized, in cooperation with the professional parent (societies), as accredited programs. This led often to registration and certification. Nursing with its longer tradition had previously received sanction through their professional societies and the State Licensing Boards. There is no need here to repeat the pattern of "topsy" growth around the country. Each "parent" has made tighter and tighter demands as to hours of curriculum studies (only in prisons and schools is time used as a measurement), level of support and accreditation. The community colleges who for the most part have moved into filling the need for training for the allied health professionals as the hospitals withdrew from education, have led to the proliferation of courses, specifications of work tasks and some hierarchies becoming more complex than trade unions.

With the general education function of the community college gradually disappearing to the strait jackets as tight as the diploma schools or "specialties," the students enrolled in an allied health curriculum started together, worked as students together in the clinic and in the classroom and had little contact with other allied health professions even in their own schools or for that matter with any other students. Also in many programs there was no possibility of lateral or vertical transfer. (Some of this recently has been changing, but not fast enough). Consequently, in such a program a graduate operates strictly within his specialty playing a status game or "scapegoating" other members of the health team. (team - what a word to use for much of the interspeciality rivalries and joisting for position!)

As a result of these factors and the continual tightening of financial resources, the smaller hospitals, particularly those who could not afford a "true blue" from each of the specialities, when workload was not equal to a full time job, were caught between the budget and the patient. In order, therefore, to attempt to alleviate this situation the interest in a core program or a basic common experience for the health worker has been suggested. Dilution of quality of patient care, disregard of standards, lack of the precious "accreditation" have all been shouted; but why has the LVN increased in numbers over the past years? Why does the ladder concept to move the LVN to RN with a minimum loss of academic units have California Legislative sanction? If we don't do something legislative action will.

Philosophically, therefore, in any effort to change the curriculum the employing agency has to be ready to redesign certain task descriptions and job slots to permit the employment of such an entry step health worker. Perhaps the new Ameriplan will alleviate the licensing or certification problem the new type of allied health worker will cause. In addition to the job openings, the student has to be provided the opportunity for upward mobility. (Not all may wish to exercise this option, but it must be there!) The employing institution, the corporation must offer in-service education and flexible schedules to permit enrollment in college accredited courses leading to certificates in a specialty or a degree. Many colleges use this system with public service intern education or in the federally-locally funded New Career Programs.

Administrative Support

The need for top level support for such a program is imperative. While the changing employer corporation concept is stressed above, the whole-hearted cooperation of the medical society and its specialty boards also is necessary. Will the lion and the lamb sit down together? Presently when a "home" for nuclear medicine is up for grabs, when inhalation therapist and cardio-vascular biomedical specialists don't speak, it may be a fantasy to dream but without this level of concern the health manpower situation will become increasingly fragmented.

The need for leadership from the educational administrators is another sought for administrative support. With again the fragmentation between arts and science and vocational-technical education in assigned administrative organization - responsibilities and funding, the path is one between Scylla and Charyldis. The California State Plan for Vocation Education grew out of the needs for workers and, later for training of teachers, from the original trade occupations at the time that we had little concern for the more highly technical allied health programs, since this burdgeoning occupation is a much more recent development. In fact in the Bannister Report, after diligent searching, there was no mention of the state college function of educating teachers for the allied health occupations.[1] Again to reiterate, when designated programs in the allied health field are assigned to one pattern of organization and yet a considerable portion of their curriculum is the assigned responsibility of another pattern of organization - with those at the top working under different sets of priorities, how can the faculty upon whom the ultimate work load rests be less than enthused to embark on the nebulous search for a core curriculum? Sister Helene Marie Sauers, Director of Paramedical programs at Southwestern College so aptly stated this when she commented on the faculty's feelings of frustration in trying to move ahead more rapidly in the summer and winter core curriculum workshops, "At least, in the history of the county, for the first time the science faculties and allied health educators are sitting down and talking seriously to one another."[2] It is unfortunate a greater dialog is not always occurring at the administrative levels.

Faculty Involvement

The place "where the action is" rests upon the faculty since without their active participation, curriculum change is doomed. As Dressell has stated:

> "No solution will emerge which is more than a patchwork of compromises, a reluctant agreement by diverse and competing interests to experiment with new ideas as long as they involve minimal interference with vested interests."[3]

Wishing, however, won't make it so unless the message from both within and without coincide. Administrators can't budge the faculty unless administrative positive support and recognition is given, signifying the overall values to the individual teacher, the college, and particularly to learnings tasks of the students.

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[1]Bannister Report, "Industrial Arts/Industrial Technology," California State Colleges, February 1970.
[2]Conversation with Sister Helene Marie - Health Manpower Council. January 1971.
[3]Dressell, Paul College and University Curriculum, McCutchen Publications Corporation, 1968, p. ix.

This support means arranging for released time for curriculum development and/or providing supportive services such as secretarial, some travel funds if needed and testing resources. With this administrative support the faculty feel that what they are doing does have implications for immediate use and their product won't be just another "round file" case. Along with these accoutrements goes the "valuing" of innovative solutions to complex curriculum problems.

The faculty often steeped in their own traditions with the pressure forever on just to "keep up" and particularly with the physical sciences more direct concern with "pure" science, find the first step is one of the need to develop trust in each other's competencies. Unlike one college where the allied health director encouraged students to enroll elsewhere for their chemistry courses because of the lack of communication and understanding between the allied health department and the chemistry department as to the nature of the chemistry courses offered. The science faculty need not only speak in tongues (symbols) and the allied health faculty not only speak in tasks (jobs) if the two groups are to communicate with each other. Here, particularly, in the meeting of the two streams, the academic and the technical-applied is the need to "hang loose" and untie the feelings that C. B. Snow has indicated has developed between these two worlds. This will not come about through words on a piece of paper - perhaps, a bit of human relations or encounter techniques need to be utilized if as in too many colleges the faculty offices and classrooms are on opposite ends of the campus and faculty have little opportunity to see what one another is doing.

Process and Product

When the biologist tells the chemist, "We need you before the students come to us," whereas the chemist says, "But what chemistry do you want them to know?" Next the biologist returns to the allied health educator and inquires, "Just how much in depth do you think they must know? Or is this something 'nice' to know but not must know?" "If you just expect them to make the application of electrolytes and energy, for example, they won't unless they know why and how they can put it to use." So the circle goes, around and around until all can sit down together and agree on the process by which they'll work together and how to get a handle to deal with the problem.

Four diverse models were explored at the beginning of the core curricula project in an effort to find a handle to grapple successfully with the content.[4] The identification of the entry level tasks of the allied health worker became the end point and the use of the California Health Manpower Council's "task analysis" was recommended. Unfortunately limited resources precluded full use of this technique. However, out of the dialogues came the realization that as each allied health occupation indicated its professed needs a commonality was emerging which led from concern shared by all to specificity in depth and breadth. Undoubtedly the reader has already recognized that the original goal of the "health worker" became inoperative under this system as the task analysis of this new job slot was nonexistent. However, when curriculum was synthesized certain competencies were developed in common. When the allied health educator could clearly state in performance terms, "The student will be able. . ." then concrete content discussion followed. The use of behavioral objectives for most of the faculty seemed to more critically identify the end student performance criterion. Specificity also seemed to answer the question as to the depth of understanding required - i.e. knowledge, application, synthesis, etc.

Various required concepts are not based on specific task oriented behavior, for example studying ph as a knowledge base for later application.

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[4]Meck, Doris, "Preliminary Report, Progress for Educational Mobility for Health Manpower (The Basic Sciences) Mimeo Reg. Med. Prog., August 1970.

The module on ph could be set up in such a way that the RN or Inhalation Therapist could select the parts needed. This can occur as long as the module is arranged in an orderly, expedient fashion so it makes sense to the users. The main idea was to get rid of the 'stuff' not needed and at the same time not destroy the inner logic of the material. A unit of learning or a concept was distilled out and the term "module" came to be applied to this concept. The problem became then one of pulling out first in order to examine the schmorgasboard of needs before developing sequencing.

In addition, the modules may be put together in a different way depending upon what the learning objective was based upon or the nature of the occupation's entry level tasks. Also in this phase came the realization of Schwab's premise that concepts can't always be put in an order say of difficulty or of greatest need as there is an internal logic to the material that must be followed.

Another phase developed when it was recognized that beyond a certain amount of knowledge there was little need to break it down further as it was impossible to give first 1/3 without the other 2/3's or fragmented learning occurs.

By now the process became one of eyeball to eyeball confrontation. For example, in the study of osmosis or the movement of particles through a membrane, the chemist needs to know certain physiological principles - but the chemist responds this is not relevant. The allied health educator responds, "I want my students to understand atomic bonding," so the chemist goes into ionic, covalent bond, double bond, polar bonds. "In too great depth for purposes of my students," says the allied health educator. The above dialog leads the allied health educator and the science instructor to having to justify to each other what is being taught, and as one member said, "Don't just become a tour guide and indicate the branches to follow."

A few of the sample modules developed were as follows: Chemistry - terminology, acids and bases and their properties, ionic considerations; Physics - mechanics of motion; Physiology - movement of molecules through the cell membrane, microbiology, ascepis, anatomy, vertebral column; Nursing - diuretics; Health Education - circulatory system; Biomedical Technology - electrical properties of cells.

Research

The whole approach as it developed became a "systems" which meant a fundamental change to the lock-step, lab lecture method semester-hour box. At the same time research on learning indicated that a bushel full of modules tossed at the student no matter how attractively "packaged" with audio-tutorial input and the latest guitar tune background would not automatically result in learning. The whole process had to be first analyzed and then synthesized. A computer seemed to be the need here. In addition certain modules of concern to all in that dream of the core curriculum had not even been discussed, i.e., Health Care Industry, Ethics of the Health Profession, First Aid, etc. Particularly if we return to the concept of the first common experiences that are shared by all, these could be the core of the first semester. In addition the behavioral sciences haven't been considered for the purposes of the paper.

Here is where the research input is necessary - a chance to, on a small scale, try out a program after evaluation has been made of students going through the programs on a trial basis. In addition, here is where the work around the country needs to be shared. The UCLA study, the Kellogg study, certainly would provide hard data to substantiate the pragmatic observations made on such a small scale hereto described. (See Meek "Preliminary Report"). In 1972 when the UCLA study will be available for use, there should be little need for more papers such as this. The action should be out in the colleges with the faculty.

Evaluation

In addition to the above student course evaluations, additional evaluative data are necessary. In order to keep in mind the goal, "To provide core or commonalities, the basic science required for job competence and at the same time to insure career mobility," longitudinal follow-up study of the first graduates even with 'traditional allied health careers' omitting the health worker per se, should be instituted.

If and when the employers will accept a health worker with a list of competencies on the basis of the student's accomplishing 90-100% of the identified performance objectives (cognitive, psychomotor and affective) which are clearly spelled out in advance, the future of the introduction of the first step, the Health Worker will be possible.

Another value will be that the health care industry will become less fragmented, and all health personnel possibly will be able to work as an effective team member. Lastly and most importantly, the patient will receive the highest possible quality of care at the most efficient level.

APPENDIX

CHEMISTRY
John Holleran

UNIT ON ACIDITY

All	Module #1: Terminology (To be best treated by possibly two lecture-demonstration sessions) Practical definitions of acids and bases: properties, taste, reaction to litmus, dangerous aspect. Examples: inorganic, organic, and foods Strength vs. concentration Strong acids: H_2SO_4, HNO_3 and HCl. Weak acids: HOAc, acetylsalicylic Strong bases: KOH, NaOH. Weak bases: NH_4OH Definition of neutralization; neutralization reactions; formation of salts pH as a measure of acidity; pH scale, meaning of 7, <7, >7 Normal body fluid pH ranges; urine, saliva, and esp, blood Possibility of determination of pH, by indicator, by meter Buffer solutions: definition as resisting changes in pH, properties, examples: NaOAc-HOAc, and blood.
All	Module #2: Common Acids and Bases and Their Propertics (To be best treated with one three-hour laboratory)
RN IT	Module #3: Ionic considerations (To be best treated by two lecture-demonstration sessions) Arrhenius definitions of acids and bases: H^+ and OH^-, examples General structure of acids and bases; ionic bonding; ability to dissociate. Ability of some substances to act as both acids and bases; amphoterism; example Molarity as a concentration unit pH and pOH relation Buffers in acidosis and alkalosis; reaction with HCO_3^-.
RN	Module #4: Acid-Base Reaction and Stoichiometry (To be best treated with one lecture-discussion session) Equivalents and milliequivalents; use in acid-base titrations Normality: definition and use Calculations Amphoteric properties of α-amino acids
RN	Module #5: Acid-Base Neutralization Titration (To be best treated with one three-hour laboratory)
IT	Module #6: Mathematics of pH and Dissociation (To be best treated with one lecture and one problem session) Mathematical definition of pH (= $-\log [H^+]$) Conversion to pH (e.g., $[H^+] = 10^{-2}$, pH=2) Meaning of K_w, value numerically, basis of pH Dissociation constants of acids: K_a Meaning of pK_a Henderson-Hasselbalch equation: form and use $CO_2 + H_2O = H_2CO_3$ Acidity and pCO_2 and pO_2: relations among these variables.
IT BT	Module #7: Use of the pH Meter (To be best treated by one three-hour laboratory)

MECHANICS OF MOTION
Bob James

Expected Behavioral Outcome Objective	Content	Activity	Method of Evaluation
1. Defines force	A. Forces: -Explanation -Examples -Demonstration -Analyze system in which forces are in equilibrium	1. Lab experiment using forces in equilibrium 2. L. & Dem. & D. 3. Written and oral reports	Lab report Test item Visual observation Conference
2. Demonstrate how forces act on moving bodies in equilibrium	B. Forces on moving bodies	1. Lab experience - forces on moving bodies 2. L. & Dem. & D.	Same as above
3. Describes involvement of forces in simple machines - from a given situation determine types needed - how they work to do the job	C. Machines -Simple machines -Devices -Mech. Adv. -Output vs. input	1. L. & Dem. & D. 2. Lab experience	Same as above
4. 1. Define torque 2. Give an example 3. Calculate magnitudes, determine solutions 4. For a given situation, apply conditions of equilibrium 5. Relate concept of torque to working of human body and simple common things	D. Torque	1. Lab experience - involving clockwise vs. counterclockwise torques in equilibrium 2. L. & Dem. & D.	Same as above
5. Apply ideas of force and torque in everyday tasks: -lifting -moving objects -operating simple machines	E. Center of gravity of regular and irregular objects (i.e., human body)	Same as #4	Same as above

Expected Behavioral Outcome Objective	Content	Activity	Method of Evaluation
5. (Cont'd) Determine in a given situation how to use the knowledge of where the c.g. is			
6. Describe relationship between torque and rotation - Describe types of rotation - Observe a rotating object and describe what is happening	Rotating Objects	1. Lab experience - involving clockwise vs. counterclockwise torques in equilibrium 2. L. & Dem. & D.	Lab report Test item Visual observation Conference

PHYSIOLOGY

Mike Clark	LVN	RN	BMT	PT
1. Movement of molecules through the cell membrane.	X	X	X	X
2. Function of the heart-lung machine.		X	X	
3. Kidney machine.		X		
4. Capillary dynamics and edema.		X		X
5. Hemo-dialysis and peritoneal dialysis.		X		X
6. Electrical membrane potentials		X	X	

MODULE ON THE VERTEBRAL COLUMN
Ed Roach

Topic	Health Educ.	Inhalation Therapy	L.V.N.	R.N.
General Structure of a Vertebra	x	x	x	x
General Structure of a Disc	x	x	x	x
Five Regions of Vertebral Column	x	x	x	x
Normal Curvature of the Spine	x	x	x	x
Spinal Cord and its Relation to Spinal Canal	x	x	x	x
Spinal Puncture	x	x	x	x
Movements and Limitations	x	x	x	x
Meninges		x	x	x
Exit of Spinal Nerves		x	x	x
General Pattern of Distribution of Spinal Nerves		x	x	x
Movements and Limitations	x		x	x
Detailed Structure of Vertebrae				x
Detailed Structure of Disc				x
Musculature by Groups	x			x

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Topic	Health Educ.	Inhalation Therapy	L.V.N.	R.N.
Development of Spine				x
Sacro-iliac Joint				x
Articulation with Pelvis				x
Articulation with Shoulder Joint				x
Kinds of Joints in the Vertebral Column				x
Posture	x			x
Spinal Deviations	x			
Body Types and Effects on Spine	x			
Effects of Exercise	x			
Congenital Defects	x			
Common Injuries	x			
Spinal Fusion	x			

DIURETICS

Mary Fulton, R. N.

Behavioral Objectives	Content	Activity	Evaluation
Explain the function of diuretics.	1. Review module on movement of molecules through cell membrane.	Plans and provides nursing care for patient receiving diuretic for edema due to cardiac involvement.	
Describe the action of the following diuretics: xanthines, mercurials, carbonic anhydrased inhibitors, benzothrazides potassium salts, urea, glucose.	2. Action of diuretics on kidney. a. inhibit reabsorption by direct action on kidney tubules b. inhibit tubular reabsorption of Na by indirect mechanism 1. osmotic diuretics 2. inhibitors of aldosterone secretion	Administer medication (theophylline), (mercurials) as ordered. Observe for effects of medication. Record urine output.	
Explain why mercurial diuretics may cause alkalosis with prolonged use.	c. Increase glomorular filbration of Na. 1. acidifying salts 2. glucocorticoids 3. corticotrophin 4. plasma expanders d. Inhibit secretion of antidiuretic hormone from posterior pituitary.	Instruct patient to expect increased urinary output within 1-3 hours (ends within 12-24 hours.) Administer diuril as ordered. Observes for effect of medication. Reports and records results.	

A MULTI-DISCIPLINE APPROACH
IN HEALTH EDUCATION
Mike Curran

The following learning approach has been developed in a "Basic Sciences Core Curriculum Workshop" held at San Diego State College and directed by Doris Meek, Ed.D. This module was prepared by Mike Curran (M.A. Health Education) in cooperation with representatives from local area junior colleges in the fields of Nursing Education, Chemistry, Physics, Anatomy and Physiology. The following material is a very brief and primitive example of what might be done in trying to inter-relate the strengths of the various sciences for the student's benefit. Administrative difficulties are not a consideration of this report. The behavioral objectives and other portions of material need revision through student and faculty cooperation. The media used and the packaging of this material is limited only by the imagination and resources of the people who would put it to use.

*SAMPLE

CONCEPT: THE CIRCULATORY SYSTEM IS VITALLY IMPORTANT TO BASIC LIFE PROCESSES

I. The Heart
   A. Function
   B. Anatomy
   C. Problems (congenital, disease, etc.)

II. Blood and Vessels (this is the smaller segment we will look at for the purposes of this report)

Behavioral Objectives of the segment:

1. The student will be able to recognize by identification or recall nine important functions of the blood and vascular system (to be continued)

Rationale:

1. A basic understanding of how the vascular system functions is essential in grasping the next segment of the health course on the value of a "planned program of exercise"
2. This knowledge is paramount to our understanding of the disease process in communicable as well as chronic problems.

Pre-Assessment:

An interesting quiz utilizing current health problems (heart disease, decision on hepatitus). Questions written in such a way that the teacher can extract certain understandings for final test given at completion of modules.

Learning Activities:

Sound filmstrip developed in Nursing Education (available in Multi-Media Center) Health teacher provides worksheet - student proceeds in understanding (identification - recognition) at own personal rate:

*Basic: 1. Distributes nutriment and oxygen to cells (saline as example)
2. Exchanges food for broken down food particles
3. Distributes hormones throughout the body (menstrual cycle)
4. Disposes of waste materials $CO_2 \rightarrow O_2$
5. Fights infectious disease with aid of white corpuscles (clotting)
6. Carries certain immunities (vaccines)
7. Helps equalize body heat (diaphoresis-elevated temp.)
8. Aids in excretion (kidney stones-diabetes)
9. Aids in diagnosis of disease (eye vascular structure)

*At this point student returns to health teacher.

Post-Assessment:

(Partial) student must have color coded worksheet completed in order to view Physics principles film.

We have now completed a module developed by the nursing department in cooperation with the health teacher - this does not complete segment on blood and vessels.

Students discuss nine functions with health teacher and see a video-taped film produced by a physics teacher.

Objectives:

The student will be exposed through video tape instruction to fundamental principles in physics dealing specifically with:

a. elasticity and property of materials
b. density
c. pressure
d. liquid flow
e. viscosity
f. temperature
g. capillary surface tension

The student will apply this knowledge in an essay of 200 words or less on its implications for "high blood pressure".

Rationale:

It is important that the student can apply the above physics knowledge to his own body (this and the chemistry module that is to follow is part of an internal "operators manual" on the marvelous human machine).

Pre-Assessment:

An outline is passed out before film and health teacher presents two brief demonstrations to stimulate interest. The outline is only partially complete (student will later be asked to what % the film was necessary to complete outline task).

Learning Activity:

Video-tape with outline.

Post Assessment:

Possible through short essay and outline evaluation.
Student next goes to a chemistry lab.

Objectives:

Given adequate instruction, the student will be able to perform four lab experiments dealing with solution diffusion, buffers, evaporation, and calories. At the conclusion of these experiments the student will be asked to relate one of his four tasks (the experiments) to the original nine vascular functions. He may option to do this in outline, essay, or question-answer form.

Rationale:

The internal chemistry of the body determines cellular and system function. The student must understand the "how" of normal function before he can solve or at least appreciate the "why" of malfunction.

Pre-Assessment:

Student is given a 15 item True-False test on Chemical information to be given in lab - can be folded to allow retest at conclusion of lab experience (both torn off and turned in).

Learning Activities:

Lab Teacher discussion of ion transport, dialysis, blood chemistry topics, then instruction of lab tasks.
*Tell of each experiment and objectives of each.

The final module will be handled by the Anatomy and Physiology teacher.

Objective:

The student will be able to synthesize the information learned in nursing, physics, and chemistry through a live and dramatic presentation of the physiograph. Students will observe, via overhead monitor, the internal workings of the human body. The demonstration will attempt to incorporate physical and chemical principles and graphically depict their effect on the body. At the conclusion of the demonstration the student will be given a set of physiology tests to be taken home and completed. The health teacher will help interpret the results and together you will design a personal health program. (To be turned in at the conclusion of the next health segment).

Pre-Assessment:

A simple battery of tests will be administered to each student (blood pressure - taken by nursing department, tidal capacity, Harvard Step Test, Cureton Balance and Breath Holding).

Learning Activities:

Live demonstration of the Physiograph. *Exact tests demonstrated and objectives of each.

Post Assessment:

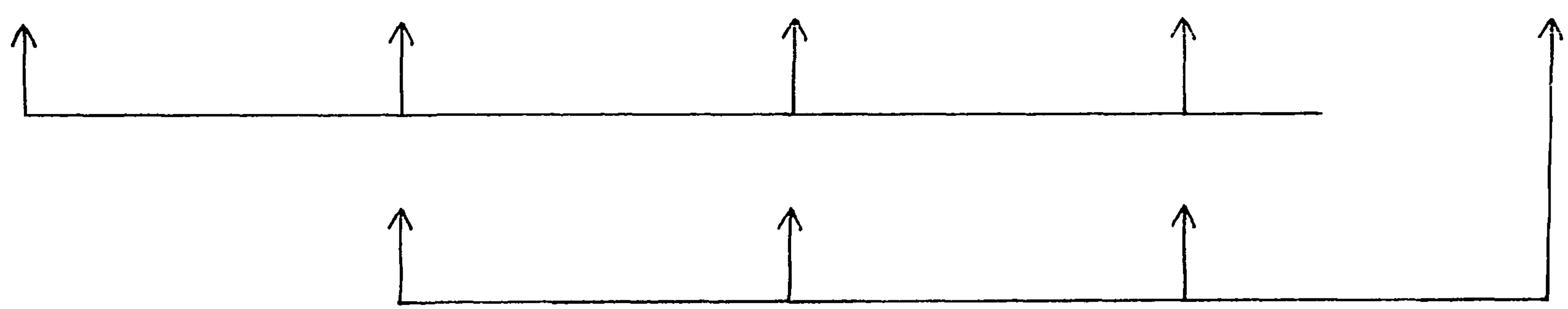
Personal conference with each student - at this time an assessment of the entire segment will be discussed and the student will fill out a post card which will be sent the following year and will attempt to determine the long term value of each module as well as the total segment.

This completes the "external" modules - the student is now ready to approach the next segment which discusses the "value of exercise" to the Cardiovascular System.

*At this point or much sooner the question may have occurred to you: "What is the health teacher doing all this time?" Is he just a tour guide through the various disciplines? Yes, among other things. He should also be concurrently developing programs, modules, etc., that would be of benefit to the others who are also helping him. Perhaps a module on "How to Select a Medical Doctor", maybe something done by the American Heart Association, or perhaps scheduling a famous guest speaker on drug use. Depending on the media, he should be with his class questioning and "sparkplugging" those things of most value to health education students. This working together to impart knowledge might just be the educational catharsis needed to once again get institutions moving!

JOB ANALYSIS

SELECTION CRITERIA	JOB DESCRIPTION (Functional Analysis)	ON-THE-JOB TRAINING (Specific Content)	FORMAL EDUCATION (College)	PERFORMANCE CRITERIA
What the worker needs to know and be in order to carry out the tasks encompassed in the job description (this includes O.J.T. and formal education).	What the worker does in relation to data, things and people (based on functional task analysis).	What is encompassed in training for specific content (on-the-job training).	What is encompassed in the formal education curriculum (conducted by the institution of higher learning).	What is the measure of success and failure (in terms of work habits, on-the-job training and formal education).



INTEGRATED HEALTH SCIENCE CURRICULUM

"THE ELECTRICAL PROPERTIES OF CELLS"

Willard Delleger

APPLICABILITY

This unit should be applicable to Biomedical Technology, Nursing, Inhalation Therapy and Medical Technology. All disciplines should be exposed to the basic concepts and the Biomedical Technology students should be required to complete the entire unit.

INTRODUCTION

All chemical reactions are basically electric in nature. Since they involve exchanging or sharing negatively charged electrons between atoms to form ions or bonds.

The functioning of nerve cells and the brain, which is composed of billions of nerve cells, depends upon the electric events that occur across the plasma membranes of these cells.

METHODS OF PRESENTATION

All subunits are identified as "modules" with three disciplines involved in the presentation. Instructors from the Physiology, Physics and Chemistry Departments will utilize their skill, expertise and equipment to present the material to the students in lecture-demonstration form with independent study and laboratory experience reinforcing the theory involved. Feedback from the students in the form of completed laboratory experiments quizzes and criterion tests shall be used.

Each module will require a "Principal Instructor" to be charged with the scheduling, tests and laboratory exercises. He will be assisted by other instructors to supplement the theory and applications.

REINFORCEMENT

The material presented by the lecture or lecture-demonstration should closely follow the text. A study guide should be available instructing the student in methods of reinforcement such as references to the main text and others suggested for supplementary reading or reference. Instructions regarding multi-media materials should also be clearly presented.

If laboratory exercises are required, the student groups to be involved should be instructed regarding time, place and lab exercise contents.

MODULE #1

TITLE:	Basic Principles of Electricity
APPLICABLE TO:	Nursing, Inhalation Therapy, Biomedical Technology
PRINCIPAL INSTRUCTOR:	Physics
ASSISTANT INSTRUCTORS:	None
PRESENTATION METHODS:	Lecture-demonstrations - multi-media Independent study via texts, multi-media materials
PRESENTATION TIME:	1 hour
INDEPENDENT STUDY TIME:	2 hours
MODULE CONTENT:	Definition of basic units of measurements. Length, time, mass, temperature, electric charge Definitions of velocity, force in terms of basic units Types of charges - Repelling and attracting of charges - protons - electrons Voltage - A measure of potential Current - A movement of charges Resistance - The hindrance of charge movement Conductors - Insulators Ions Lipids in cell membranes
FEEDBACK:	Quiz

MODULE #2

TITLE:	Diffusion Potentials
APPLICABLE TO:	Nursing, Inhalation Therapy, Biomedical Technology
PRINCIPAL INSTRUCTOR:	Chemistry
ASSISTANT INSTRUCTORS:	None
PRESENTATION METHODS:	Lecture - demonstration Independent study via assignments from text and multi-media materials
PRESENTATION TIME:	1/2 hour
INDEPENDENT STUDY TIME:	2 hours
MODULE CONTENT:	Chemical action in a battery Bioelectricity produced by living cells Diffusion of ions can produce voltage difference Diffusion potentials, sodium and chloride ions Moving molecules across a membrane Electrochemical equilibrium Equilibrium potential - polarity and direction of net movement
FEEDBACK	Quiz

MODULE #3

TITLE:	Electrical Properties of Living Systems, Cell-Membrane Potentials
APPLICABLE TO:	Nursing, Inhalation Therapy, Biomedical Technology
PRINCIPAL INSTRUCTOR:	Chemistry
ASSISTANT INSTRUCTOR:	Physiology
PRESENTATION METHODS:	Lecture-demonstration Independent study via assignments in texts and multi-media materials

MODULE #3 (Continued)

PRESENTATION TIME:	1/2 hour
INDEPENDENT STUDY TIME:	1 hour
MODULE CONTENT:	Net movement of Na^+, K^+ CL^-
	Concentration of three major ions
	Membrane potentials - measurements
	Permeability and concentration of ions
	Charge equivalents
	Intracellular concentrations
	Active-transport systems of cell membranes
	Steady-state fluxes of ions across cell membranes
FEEDBACK	Quiz (Test on Modules 1, 2, 3)

MODULE #4

TITLE:	The Electrical Properties of Living Systems, Action Potentials
APPLICABLE TO:	Biomedical Technology, Nursing
PRINCIPAL INSTRUCTOR:	Physiology
ASSISTANT INSTRUCTORS:	Chemistry, Physics
PRESENTATION METHODS:	Lecture-demonstration Independent study via assignments in texts, multi-media materials
PRESENTATION TIME:	1 hour
INDEPENDENT STUDY TIME:	2 hours
LABORATORY EXPERIMENT TIME:	2 hours

MODULE #4 (Continued)

MODULE CONTENTS:

a) Action Potential; change in membrane potential

Cell excitability, stimulation

Propagation of action potential

The ionic hypothesis

Resting potential

Sodium ion and potassium ion permeability

Rising and falling phases, spikes

Changes in membrane permeability

Excitation

Methods of detection of potentials

Glass microelectrodes

Response of axon membrane

Producing a membrane potential

Stimulus: strength, polarity duration

b) Electric Stimulation

Hyperpolarization of membrane potential

Depolarization

Minimal stimulus strength required to initiate an action-potential response

Threshold stimulus

Subthreshold and suprathreshold stimuli

Threshold potential

Cumulative action of polarization and depolarization; positive feedback

c) Refractory Periods

Nonresponse for a finite time of stimulation

Absolute versus relative refractory periods

d) All-or-None Law

Action potential is a fixed unit of response

The characteristics of response in an "all-or-none" fashion

Trigger analogy

Frequency of action potentials, not magnitude

MODULE #4 (Continued)

FEEDBACK: a) Laboratory Exercise

b) Quiz

c) Test on Modules 1, 2, 3, and 4

MODULE #5

TITLE: The Electrical Properties of Living Systems, Propagation of Action Potentials

APPLICABLE TO: Biomedical Technology

PRINCIPAL INSTRUCTOR: Physics

ASSISTANT INSTRUCTORS: Physiology, Chemistry

PRESENTATION METHODS: Lecture-demonstration

REINFORCEMENT: a) Independent study via assignments in texts and multi-media materials

b) Laboratory experiment

PRESENTATION TIME: 1 hour

INDEPENDENT STUDY TIME 2 hours

LABORATORY EXPERIMENT TIME: 2 hours

MODULE CONTENT: Excitation and Conduction Importance

a) Passive electric conduction
Passive electric characteristics of nerve fiber

Voltage gradient along membrane surface

Rate of voltage conduction versus single ion movement

MODULE #5 (Continued)

MODULE CONTENT:

b) Mechanism of action-potential propagation

Response of axon to threshold versus subthreshold stimulus

Magnitude change and time delay

Sequence of events in an excitable membrane

Analogy to burning a string of gunpowder

c) Conduction velocity

Varies with types of excitable membranes

Velocity of propagation varies with cross-sectional area of axon

Myelinated fibers

Node of Ranvier

Myelin - insulating material

Produced a greater current flow

Conduction velocity higher

d) Factors which modify excitability

Varying the extracellular potassium concentration

Calcium concentration effect on membrane excitability

Regulation of the composition of the extracellular fluid is important

Spontaneous generation of action potentials by excitable membranes (heart and brain)

Effects of drugs and local anesthetics

FEEDBACK:

a) Laboratory Exercise

b) Quiz

c) Test on Entire Unit