A COMPARISON OF KNOWLEDGE GAINED USING COMPUTERIZED SELF-INSTRUCTION VERSUS LECTURE METHOD TO TEACH PEDIATRIC HEART DEFECTS TO ASSOCIATE DEGREE NURSING STUDENTS

by

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CHAPTER I

INTRODUCTION

Instructional technology has provided educators with many forms of media that can be used to supplement and enrich the educational process. Nurse educators employ a variety of audiovisual tools as an adjunct to classroom instruction. The computer is also being used by educators, including nursing educators, to assist in the teaching-learning process. As computers have become more available, nurse educators have identified a variety of educational uses for the computer. It is critical that nursing educators identify uses for the computer that meet the needs of nursing education and not simply to utilize the capabilities of the computer for the sake of technology. This study examined the question: "Can a computer program be as effective as the lecture method in teaching nursing content at a knowledge level?"

The cost of owning and operating a computer has greatly decreased due to the availability of the microcomputer. No longer is one main, large computer system required. Instead, each school can own one or many microcomputers, each one operating independently of the others. For example, Lane Community College (a school with a full-time equivalency of approximately 7,500 students), has 30 Apple microcomputers, 4 of these are owned by and housed in the Nursing Department.

The computer can be a valuable adjunct to the nursing educator by managing some of the tasks of the educational process as well as by assisting the instructor to dispense some information. Some of the educational tasks managed by the computer include assisting with testing, grading and evaluation of nursing students. Other tasks managed by the computer

include allocations of available equipment and managing student clinical rotations.

The computer can have a valuable role in dispensing information to the student. Many nursing schools are following a trend toward increased self-instruction. Advocates of computers in nursing education appreciate the advantages of programmed self-paced teaching units and see the computer as offering these advantages. The computer can be self-paced so that it can adapt to individual rates of learning and diverse student backgrounds. The computer can also be available to the student for many more hours per week than the instructor, perhaps even 24 hours a day.

Before developing self-paced computer programs for use in nursing education, it is important to identify what levels of learning are necessary in nursing education. It is also necessary to consider what level of learning is best achieved at an independent pace and what level of cognitive development is best achieved with the guidance of a highly qualified nursing instructor. Nursing education involves learning to use the nursing process. Effective use of the nursing process requires learning at all levels of Bloom's (1981) taxonomy: knowledge, comprehension, application, analysis, synthesis, and evaluation.

This researcher seeks answers about the appropriate "teaching" role of the computer. Is it to transfer information at a knowledge or maybe even a comprehension level? Clearly, the role of the instructor is to be involved in the application of information to the nursing process. The nursing instructor should be actively involved in improving the ability of the student to make nursing judgments and guiding the student into creating innovative nursing actions. Perhaps nursing educators can use the computer to supplement and enhance the transfer of knowledge so that more instruction

time is available to help students to learn at higher levels of Bloom's taxonomy.

In order to evaluate the effectiveness of the computer in transmitting information at a knowledge level, this study compared knowledge gained using a computer programmed self-instructional teaching unit versus lecture session to teach a unit of nursing content. The lecture session was chosen as a vehicle for comparison because the lecture is the most traditionally used method of instruction.

CHAPTER II

REVIEW OF LITERATURE

The review of the literature includes the following: learning theory as it relates to educational media, the cognitive domains of nursing education, computer capabilities for education, and the lecture as a teaching tool. The review of learning theory and media summarizes the literature which addresses the question of how the learning process affects the application and selection of audiovisual materials. The cognitive domains of nursing education are considered in terms of the nursing process as it relates to Bloom's Taxonomy of the Cognitive Domain (Bloom, 1981). The literature review related to computer capabilities for education enumerates ways in which the computer is being utilized by educators. Lastly, literature related to the status and considered value of the lecture in the educational process is discussed.

Learning Theory and Media

As a basis for learning theory, Gagne (1970) stated that

> A learning event takes place when the stimulus situation (the events that stimulate the learner's senses affects the learner in such a way that his performance changes from a time before being in that situation to a time being in it. The change in performance is what leads to the conclusion that learning has occurred. (p. 5.)

Gagne sees that the role of the educator is to plan and to manage the stimulus situation in such a way that learning is enhanced. In other words, the educator manipulates the stimulus situation in an attempt to maximize student learning.

The stimulus situation, events that stimulate the learner's senses, can be comprised of any form of media. "Media" is defined as "anything that carries information between the source and the receiver" (Heinich, Molenda, & Russell, 1982). Media, then, would include the spoken and the written word as well as any other form of sensual stimulation. Some examples of media are film, television, radio, audio recordings, photographs, projected visual and printed materials. Media are considered to be instructional media when they are used to carry messages of an instructional intent (Heinich et al. 1982). Media can be used within the classroom setting or out of the classroom as a self-instructional tool. Media used in education are sometimes referred to as the products of educational technology or as audiovisual tools.

To assist educators in the process of selecting audiovisual materials, Dale (1969) arranged various teaching methods into a hierarchy called Dale's Cone of Experience. Dale's Cone classifies learning experiences from the most concrete experience at the bottom of the cone to the most abstract experience at the top. The position of the computer in Dale's hierarchy fluctuates dependent on whether the computer program contains text only or includes diagrams or pictures. A computer program which includes illustrations to supplement the written word is less abstract and thus moves down Dale's Cone toward the more concrete forms of media.

According to Heinich et al. (1982), Dale's intention for use of the cone is based on Brunner's Theory of Instruction which proposes that the instruction provided to a learner should proceed from direct experience, through representations of experience (as in pictures, films, etc.), through symbolic representation (as in words). Dale's Rule for using the cone is: "Go as low on the scale as you need to in order to insure

learning, but go as high as you can for the most efficient learning." (Gagne & Briggs, 1974, p. 150.) The computer has the capability to move slightly up or down Dale's Cone to present content in a way that will help meet the learning needs of the student.

Educational technology is frequently polarized against the written or spoken word by audiovisual and educational technology advocates. Rakow (1980) believes that educators must use language conjointly with educational technology to "fill the cracks" in educational technology. This means that words (lecture and printed text) and educational technology are best used together, to supplement, but not to replace each other.

Cognitive Domain and Nursing Education

The field of nursing education has benefited from the classical work of Bloom (1954) who saw the need for a taxonomy of educational objectives which is intended to assist in classifying goals for education. Bloom's Taxonomy classifies cognitive learning into six distinct levels: knowledge, comprehension, application, analysis, synthesis, and evaluation. Like Dale, Bloom has ordered learning and developed a classification scheme which considers knowledge to be the lowest level of learning, and evaluation to be the highest level of learning.

The learning needs of nursing education can be readily analyzed using Bloom's taxonomy by examining the components of the nursing process. The nursing process is a theoretical framework which produces a scientific approach to nursing practice (Griffith & Christensen, 1982). According to Griffith and Christensen, nursing practice is based on the integration and application of knowledge from the natural, behavioral and humanistic sciences. Nurses use theoretical frameworks and conceptual models to organize knowledge, understand the client's health status and guide nursing

practice. The theoretical approach assists nurses in interpreting the client's health and determining appropriate nursing strategies (Griffith & Christensen, 1982).

According to Yura and Walsh (1983) the nursing process has four components: assessing, planning, implementing, and evaluating. Assessing includes gathering data related to the wellness or illness state, and identifying a nursing diagnosis. Data gathering requires learning at the knowledge, comprehension and applications levels. A nursing student must first gain knowledge about basic anatomy and physiology, and pathophysiology as it relates to various disease processes. The student must understand (comprehend) what she is learning in order to recognize the signs and symptoms in a patient in comparison to the written words. Then, the student must apply this information to the theoretical framework of the nursing process by labeling the information as "data". Next, the student must analyze the relationships between the data to form a nursing diagnosis. The next step in the nursing process is to plan patient care. This requires a synthesis of knowledge involved in data collection, with knowledge of nursing actions that are appropriate for various patient problems. Finally, after the nursing care plan has been implemented, the nurse must evaluate the effectiveness of the nursing care plan and modify as necessary.

Nursing education involves learning to use the nursing process. Effective utilization of the nursing process clearly requires learning at all levels of Bloom's taxonomy. The computer, along with other forms of educational media, can be used to assist students in acquiring knowledge about anatomy and physiology and various disease processes and nursing actions. When nursing students gain basic knowledge and comprehension outside the

classroom, then the classroom time can be used to assist students to learn at higher levels, i.e., application, analysis, synthesis and evaluation. The nursing instructor can help the student learn to apply information to the nursing process and can be actively involved in improving the ability of the student to make nursing judgments, guiding the student in creating innovative nursing actions as well as evaluating achievement of outcome criteria.

Computer Capabilities for Education

Research and writing in the area of computerized education reveals that functions of computers in education can be divided into two categories: computer-managed instruction (CMI) and computer-assisted instruction (CAI) (Baker, 1978; Hauseman, 1979). An instructional management system (CMI) utilizes the computer to direct the educational process. This includes primarily various kinds of record-keeping functions. Computer-assisted instruction (CAI) includes computer activities directly involved in delivering curriculum content to the student.

The cost of owning, operating and using a computer has decreased in recent years. Previously a large computer system had to be installed at great expense ($50,000) and the institution was required to pay an hourly user charge. The microcomputer is considerably cheaper ($2,000 to $3,000) (Schwartz & Hanson, 1982). Software for the microcomputer can be developed by individual faculty members, purchased from publishers of nursing media, or borrowed from an educational computer consortium.

Although the cost of computerization has been decreasing, Prichard (1982) warns that the value of a computer and its uses must be carefully weighed against the multiple costs of the hardware, software and programming. Prichard (1982) enumerated many potential uses for the computer related to

the management of educational types of tasks in nursing. Prichard sees the computer as being able to assist in the management of student problems by juggling clinical experiences, evaluating periods of content overload and then spreading content out to avoid student overload, and keeping records of sickness patterns so that major areas of content and clinical experience are not missed by any one student. Prichard also sees the computer as a valuable means for keeping records regarding available resources; for example, arranging room allocation and stock control of available audio-visual equipment.

Other CMI activities in the educational setting for computers are testing and record keeping of student progress. Cavin, Cavin and Lagowski (1980) used computers to give pre-quizzes to students to assess competency for a chemistry course. Oliveri and Sweeney (1980) see the computer as being utilized to analyze test scores and to keep records of student grades. Darley (1983) describes using the computer to keep records of clinical rotations as well as attendance records.

Some CMI functions assist in the use of the computer for instruction. The computer can be programmed to remember student responses during student participation programs (Olander & Merbitz, 1980; Oliveri & Sweeney, 1980). The instructor can use this record of student feedback to evaluate student progress as well as to identify specific flaws in the presentation of the material.

Computers appear to have many advantages for use in nursing education. Perhaps the most important of these is the self-instructional ability of the computer. Many nursing schools are currently using some self-instructional methods and the trend in nursing education is toward increased use of self-instructional methods (Swendson, 1981).

The computer lends itself to self-pacing by the student. The computer can be adapted to individual rates of learning and can accommodate students with diverse abilities and levels of motivation. Students can spend more time on areas of difficulty and move quickly through areas in which they have more background. The computer can also provide remedial or tutorial assistance outside of class (Huckabay, Anderson, Holm & Lee et al., 1979; Cavin et al., 1979; Pazdernik & Walaszek, 1983).

Like other self-instructional tools, the computer can optimize student learning efforts by being available 24 hours a day. The student may learn when she feels motivated to learn and manipulate study time with the computer around pre-existing schedules (Oliveri & Sweeney, 1980).

The computer can be programmed to give immediate feedback to the student regarding responses to questions. Anderson, Kulhavy and Andre (1971) conducted a study using 356 subjects. The study utilized a computer-programmed self-instructional teaching unit in which the content was myocardial infarctions. The study compared learning on a basis of whether or not KCR (knowledge of correct response) was received. Students who received KCR after both correct and incorrect responses learned significantly better than students who did not receive KCR.

Another learning advantage of computers is that computer programs can be designed to be competency based. This means that a student must demonstrate competence over presented material before she can progress to the next level or set of information. Hofstetter, (1978) comparing the acquisition of musical skills among seventeen students, found that students who have been forced to achieve mastery at a lower level before being permitted to learn material at a higher level demonstrated greater mastery over the newer, higher level materials presented.

Students learning by computer-assisted instruction have responded favorably when asked to evaluate the computer as a learning tool. Kulik, Kulik and Cohen (1980), in a meta-analysis of research regarding the effectiveness of computer-based college teaching, found that computers had a small, but positive effect on student attitudes toward the courses. Students stated they liked the course better with the computer. Kulik et al., however, do not address the potentially favorable influence of the halo effect on attitudes toward the treatment process.

One incentive for the use of computers by students is what Levine and Wiener (1975) called the "Pinball Effect". They propose that "CAI is capable of achieving the same effect as a pinball machine by appealing to one's cultural compulsion to beat the machine." (p. 1301) This culturally imposed motivation may increase student interest in the material being presented.

Kirchoff and Holzemer (1979), utilizing a computer program to teach post-op nursing care to nursing students, examined the relationship of students' perception of dullness of the learning material and the amount of learning achieved. In measuring learning at comprehension and application levels, students who perceived the material as less dull learned better than students who perceived the material as more dull. If the computer is able to stimulate interest, it could enhance student learning.

Whether or not the computer stimulates student interest, Pleasance, Townsend and Norman (1983) point out that the computer demands the attention of the student. The computer will not continue until the student presses the space bar, answers the response, or does whatever the computer is requesting. Active student involvement cannot be avoided. Active student involvement may be the key to enhanced student learning.

Computers offer teacher advantages too. Computer programs can be reliable, giving the same material over and over again (Oliveri & Sweeney, 1980). This material is presented in consistent completeness, relieving the instructor of the boredom of presenting the same material repeatedly, and at the same time assuring that the content is complete every time. As the computer assumes some of the role of dispensing information, the instructor is freed to assume the role of a learning facilitator (Norman, 1982).

The computer has been shown to be an effective teaching tool. Kulik et al. (1980), in a meta-analysis of the effectiveness of computer based college teaching, found that the computers raised exam scores by small but significant amounts. They state that exam scores were raised 3%, or about one-quarter standard deviation. Boettcher (1981) compared learning outcomes of 83 BSN students randomly assigned to a CAI group or to a group taught with printed programmed instruction. The content presented was two lessons in psychopharmacological nursing. The results from pretest compared to posttest scores showed no significant difference between the groups in gains of knowledge or application. Pogue (1982) evaluated a computer-based instructional unit to teach newly hired nurses content about cardiac drugs. Twenty-seven nurses were randomly divided into groups, an experimental group taught by computer and a control group taught by the traditional lecture method. Results of pretest and posttest scores, measuring knowledge of the drugs, were not significantly different.

Some computerized nursing education programs have been developed that contain sophisticated branches which divide into many potential programmed responses (Anderson et al., 1971; Bitzer & Bitzer, 1973; Collart, 1973; Donabedian, 1976; Kelly, 1976-1977; Oliveri & Sweeney,

1980). These programs simulate patient situations and are designed to allow the student to ask questions of the computer, as the student would ask questions of a patient. The student can then identify patient problems and nursing actions. The computer is programmed to evaluate student responses and to direct the student toward improving nursing approaches when appropriate. These programs are designed to teach at the upper levels of Bloom's taxonomy. Unfortunately, these programs are complex and multi-branching in design. They are difficult to develop and are limited in their capabilities by the responses anticipated and programmed by the designer (author).

The Lecture in Education

The lecture is a primary vehicle for transmitting information in education. "Although the lecture has lost prestige among educators, it is still the most used mode of delivery in the classroom." (Henson, 1980, p. 115) In the classroom the nursing instructor is involved primarily in lecture and in discussion.

Hayter (1979) believes that

> Students are by no means passive (in lecture) if they are gaining new ideas, associating those ideas with others, developing hunches, evaluating previous functioning and categorizing new concepts according to their own personal storage and retrieval system for future use (p. 275).

Hayter further believes that lecture should not be used for the purpose of transmitting factual information but should be used to help students assimilate new information and to help students see applications for knowledge in nursing.

Another classroom activity associated with lecture is discussion. Huckabay, Cooper and Neal (1977) conducted a learning experiment using 131 staff nurses divided into four groups. The content presented was grief

and mourning. The experimental group viewed a film strip followed by a discussion of the film strip. The second group received the same content via a lecture which was followed by discussion. The third group viewed the film strip but had no discussion. The fourth group received the content via lecture but had no discussion. The subjects expressed enjoyment of learning when it was accompanied by discussion. Evaluation by a written test measuring application of content supported that transfer of learning was best in the lecture-discussion group.

Henson (1980), in a review of the literature, cited that Voth (1975) reported from a review of 91 surveys, covering four decades of research of comparative teaching methods, that no difference in the effectiveness of lecture and other methods of teaching was found. Henson (1980) further cites research (Rowsing, 1975; Ott, 1975; Schoen, 1975) in which learning is improved by combining lecture and other autotutorial modes of instruction. Henson (1980) concludes that as new techniques of instruction continue to emerge, further investigation is needed to discover ways of mixing the lecture with these other delivery systems in order to produce still more effective learning.

Oddi, (1983) in reviewing literature related to the use of lecture as a teaching method for adults, recommends that educators begin to investigate the effectiveness of using different teaching approaches for different learning tasks. Learning at a knowledge level may be effectively achieved outside the classroom, prior to coming to class. In this way classroom time can be spent fostering higher learning tasks.

Myers and Greenwood (1978), in an attempt to increase student participation in the learning process, established an autotutorial component to the fundamentals in nursing curriculum in a baccalaureate program. The auto-

tutorial lab replaced lecture and demonstration sessions previously used to teach the same content (fundamental skills and theory). Student learning was evaluated by comparing the mean class score to the national mean score on the NLN exam scores for the DEFT (Drug administration, Epidemiology, Fluid balance and Techniques) exam. The students who participated in the autotutorial learning component scored higher in comparison to the national mean than the students who learned by lecture and demonstration. However, when the students were compared with the national mean scores for the ON (Nursing Observation and judgment and Natural Science application to patient care) exam, there was no improvement in exam scores.

The nursing instructor has the skill to design curricula and to manipulate learning materials in a manner to assist students to achieve learning goals. In the classroom the nursing instructor can assist students to extend ideas, identify relationships, apply principles and develop solutions to problems. The computer has an incredible memory capacity and can be programmed to respond in an enormous variety of ways. Notice the key word is "programmed". The computer can only offer responses which it has been previously programmed to offer. The computer lacks the ability to make relationships that have not been previously identified, or programmed, for its memory. The computer also lacks the spontaneity and creativity that is necessary to permit individual differences among students as they learn to apply knowledge, analyze relationships, synthesize information, and evaluate patient care while learning to utilize the nursing process.

Conceptual Framework

Learning occurs as a result of exposure of the learner to particular sensory stimulation (also called media) within the environment. Educators attempt to enhance student learning by manipulating the sensory

stimulation within the learning environment to provide a variety of learning experiences for the student as well as to increase student participation in the learning experience. One way teachers have of manipulating the learning environment is through the use of various forms of instructional technology which can be used as an adjunct to the traditional classroom lecture. Instructional technology can be used outside of the classroom for self-instruction, providing flexibility to the learning environment, accommodating different student interests, abilities and learning styles. Students can learn at their own pace and self-instruction can be designed to be competency-based.

The computer is a product of instructional technology which offers many of the advantages of other self-instructional media and is liked by students. The computer requires active student participation in the learning experience. Educational research has shown that students can learn using the computer.

In order for nursing students to utilize the nursing process, learning in nursing must occur at each of Bloom's (1981) described levels. In order to stimulate interest and increase student involvement in the learning experience, nursing instructors are faced with selecting educational media to stimulate learning at a variety of levels.

Research is needed to assist the nursing instructor to choose educational media which will most effectively manipulate the learning environment to enhance student learning. This research study is concerned with the question, "Can computers result in effective learning at a knowledge level?" The purpose of this study is to compare computerized learning with the lecture format in nursing education.

CHAPTER III

METHODS

Purpose

Using experimental design, this study investigated the effectiveness of a computer-programmed self-instructional teaching unit to teach nursing content at a knowledge level in comparison to lecture method. The content presented was knowledge content related to pediatric heart defects. Data were obtained from two groups of students. The control group received the content via the traditional classroom lecture method, while the experimental group received the content via a computer programmed self-instructional teaching unit. The groups were compared on the basis of achievement scores on a written exam.

The independent variable used in this study was the type of instructional method. The dependent variable being tested was the amount of knowledge gained. The following null-hypothesis was tested: The amount of knowledge gained by the students using the computer programmed self-instructional unit will not differ significantly from the amount of knowledge gained by the students attending the lecture session.

For the purposes of this study the terms used in the null-hypothesis were defined as follows:

1. Amount of knowledge gained - refers to the number of correct responses made by each student on an exam designed to test for recall of cognitive aspects of the content.
2. Student - refers to any person enrolled in Maternal Child Nursing, NUR 207, at Lane Community College during Winter Term 1983.

3. Computer programmed self-instructional unit - refers to the use of a machine to transfer specific information in an organized format to students on an individual basis, being capable of repeating the information over and over again with consistent completeness.
4. lecture session - refers to the transfer of information utilizing a nursing instructor face to face with a group of students, capable of responding to students' requests for repetition or clarification of the information as well as divergence to related topics when appropriate.

Setting and Subjects

The sample used in the study was a convenience sample comprised of second-year nursing students enrolled in Maternal Child Nursing at Lane Community College during the Winter Term 1983. There were intially 36 students. The students were randomly divided into two groups of approximately 18 students each. Similarity between the groups was demonstrated by comparing achievement on the pretest exam using Student's t distribution.

No attempt was made to divide the groups on the basis of matching pairs of students with similar age, sex and experience, because of the extremely small sample sizes it would yield. However, demographic data were gathered using an information/evaluation form (Appendix A) after the posttest. The form elicited information regarding age, sex, previous exposure to the content and previous use of computers. These data were gathered for the purpose of describing the subjects used in the study. This information appears in Table 1.

Table 1

Description of Group Membership

Subject Characteristics	Lecture	Computer
Number of subjects	15	18
Mean age	27.3	30.1
Sex:		
Female	10	15
Male	5	3
Previous exposure to content:		
Yes	2	3
No	13	15
Previous use of computer:		
Yes	9	3
No	6	15

Student agreement to participate in the study was obtained by having the students sign a consent form (Appendix B). Only students who agreed to be randomly assigned to either group were included in the study.

In order to randomly divide the students, the name of each student was written on a separate piece of paper. The names were drawn one at a time from a hat. The students whose names were drawn on the odd-numbered draws (first, third, fifth, etc.) were placed in the control (lecture) group. The students whose names were drawn on the even-numbered draws (second, fourth, sixth, etc.) were placed in the experimental (computer) group. Initially there were 36 students who agreed to participate in the study, however 3 students assigned to the lecture (control) group failed to come to class on the day that the content was presented and were subsequently dropped from the study, leaving only 15 students in the control group.

Student confidentiality was protected. Once the students had been randomly assigned to either the control group or the experimental group,

each student was assigned a number. A record of the assigned number was kept in the course grade book. Only the faculty teaching Maternal Child Nursing had access to the grade book. The students used their assigned number for purposes of identification on the exam papers when the written exam was given to evaluate the cognitive achievement of the students during the study.

Development of the Self-instructional Unit

The computer programmed self-instructional teaching unit, entitled Pediatric Heart Defects (Lynch, 1982), was designed to meet pre-existing educational objectives. These educational objectives were taken from the course syllabus for Maternal Child Nursing, NUR 207, Associate Degree Nursing Program, Lane Community College (Appendix C). The objectives were found in a unit entitled "Threats to the Production and Circulation of Blood in the Pediatric Patient". In order to assist the students in both the experimental and the control groups to meet the educational objectives in the unit "Threats to the Production and Circulation of Blood in the Pediatric Patient", required reading was assigned in the students' pediatric textbook (Nursing of Infants and Children, by L. L. Whaley and D. L. Wong, 1979).

The teaching unit had an organizational structure similar to the structure used in the lecture session for the control group. Both the teaching unit and the lecture session began with an overview of the material to be covered. As a matter of review, the normal circulatory pathway through the heart as well as pressure variations within the heart chambers were discussed. Fetal circulation was covered next with a description of blood flow through the foramen ovale and the ductus arteriosus. The concept of classifying heart defects as acyanotic or cyanotic was discussed next.

Three acyanotic heart defects were covered in the following order: atrial septal defect, ventricular septal defect, and patent ductus arteriosus. Two cyanotic heart defects were covered; first, transposition of the great vessels and secondly, tetrology of Fallot. The lecture session ended at this point, but the computer programmed teaching unit had a ten-question review test (Appendix D) followed by an opportunity to request of the computer to repeat any part or all of the self-instructional teaching unit. In an attempt to limit the variables between the two groups, the same ten-question review test was given to the lecture group for use as self-study.

The computer programmed teaching unit was competency-based. Each section of the self-instructional teaching unit (Normal Circulation, Fetal Circulation, Classification of Heart Defects, Atrial Septal Defect, Ventricular Septal Defect, Patent Ductus Arteriosis, Transposition of The Great Vessels and Tetrology of Fallot) was followed with one review question regarding the preceding material. The test question was designed in a multiple-choice format. If the student was unable to answer the question correctly, the preceding section of the computer programmed teaching unit was repeated. The student was required to correctly answer the review question at the end of each section of the self-instructional teaching unit before the computer would advance the teaching unit to the succeeding section. In other words, the student was required to demonstrate competence at the completion of each section of the self-instructional teaching unit in order to complete the entire teaching unit. Students in the control group were provided with the opportunity to interrupt the lecture session at any point to ask questions of the instructor. The instructor did not proceed with the lecture format as long as there were

student questions or nonverbal cues which indicated that the students did not understand the preceding information.

The computer programmed self-instructional teaching unit was self-paced. That is, the computer was programmed to move from one frame to the next only when the student pressed the "space bar." This self-paced control permitted the student to pause at any point during the program to reread the displayed text and to take notes as thoroughly as the student desired. The students in the lecture session were not restricted from tape recording the lecture for later listening at a self-paced speed for notetaking. However, no students chose to tape record the lecture.

The completed computer programmed self-instructional teaching unit was evaluated prior to the study to insure that the content was accurate, that the narrative and the visuals provided a logical flow of information, and that the intended message was clearly presented. The self-instructional teaching unit was evaluated by two pediatric nursing content experts and three nursing students enrolled in Maternal Child Nursing, NUR 207, at Lane Community College during Fall Term 1983. The content was deemed to be accurate.

Design and Procedure

The students were informed of the intended experimental study, and consent for participation was obtained two weeks prior to the scheduled lecture session for Congenital Heart Defects. One week before the scheduled lecture session a written, 20-question pretest examination (Appendix E) was given to all students participating in the study. Also at this time, students were informed of the group in which they would be included.

An attempt was made to prevent contamination between the control group and the experimental group. After the students had been informed

of their inclusion in either the control group or the experimental group, the students in the experimental group were asked by the instructor to refrain from coming to class on the day of the lecture session during which the lecture entitled "Pediatric Heart Defects" would be given. To assure that only members of the control group attend the lecture session, the students attending the lecture session were required to sign in on an attendance record. If any student assigned to the experimental group had attended the lecture session, that student would have been eliminated from the study.

Students assigned to the experimental group were given one week to complete the computer programmed self-instructional teaching unit entitled Pediatric Heart Defects. The teaching unit was available in the Microcomputer Lab on the Lane Community College campus. A list of the names of students in the experimental group was given to the secretary in the Microcomputer Lab. Only students whose names appeared on that list were given the computer disks which contain the computer programmed self-instructional teaching unit. This precaution prevented contamination of the experimental group with students from the control group.

The lecture session lasted one hour. By visual inspection of the computer program sign-in sheet, it appeared that most students spent approximately one hour viewing the computer programmed teaching unit. However, not all students recorded both the "check-in" and the "check-out" time so that complete data related to time taken to view the program are not available for accurate comparison.

The students were evaluated and compared on the basis of achievement on a written examination (Appendix F). The examination was different

from, but parallel in format to, the pretest examination and was administered to all participating students at the same time. The examination was given two weeks after the lecture session. Since the students in the experimental group were given one week in which to complete the computer programmed self-instructional teaching unit, the examination was given within one to two weeks after completion of the teaching unit.

Data Collection

Data were collected using a pretest and a posttest designed to cover cognitive aspects of the content. The pretest (Appendix E) was used to establish similarity between the groups before the treatment, and the posttest (Appendix F) was used to evaluate achievement after the treatment. The tests were designed according to the Table of Specifications (Appendix G) developed to accommodate the percentage of lecture (computer program) time allotted to each area of content. The areas of content were delineated by the cognitive objectives (Appendix C, Cognitive Objective 1-4). The tests were different, but of parallel format and each test had 20 multiple-choice questions, which was considered to be the maximum number of questions appropriate for the time spent in the formal learning situation.

The examinations were evaluated for face validity and for content validity by a panel of experts, using the test construction guidelines identified by Ebel (1979). Two examination construction experts reviewed the technical construction of the questions to assure that: 1) the stem, the stimulus to which the examinee makes a response, clearly identifies the question to be answered; 2) the response choices were clearly stated; 3) the stem and the response choices were grammatically consistent; and 4) the response choices did not provide unintended clues. Three pediatric content experts evaluated the questions to assure that: 1) the questions were

relevant to the objectives; 2) the questions dealt with important, significant ideas, not with incidental details; 3) the responses were logically appropriate and plausible answers to the problem identified in the stem; 4) each question had one and only one response representing the correct answer; and 5) the test items were neither too easy nor too difficult.

Reliability of the pretest and the posttest was determined using Kuder-Richardson formula number twenty to identify the reliability coefficient. KR-20 is useful in determining reliability of a single administration test because KR-20 measures the internal consistency of the test. The KR for the pretest was .428998. The KR for the posttest was .598819. KR-20 will yield a reliability coefficient valued from 0-1. The closer the value is to one, the more reliable the test is considered to be. The Kuder-Richardson formula generally yields a lower reliability coefficient than would be obtained by other methods for measuring the reliability coefficient. This means that the KR-20 provides a minimum estimate of reliability for the test (Borg & Gall, 1979). According to King (1979) "teacher made tests should have a reliability of at least .4 to be of value" (p. 68).

In order to further evaluate the acceptability of the computer programmed self-instructional unit by nursing students, they were asked to express their attitudes toward the computer program or the lecture session, depending on their group membership. The Information/Evaluation Form (Appendix A) designed to gather data which could be used to describe the two groups was also designed to elicit student attitudes. The students were asked if the computer program/lecture was clear, if it was helpful and if they enjoyed it. The students rated their attitudes on a Likert scale ranging from one to five.

Data Analysis

Similarity between the two groups was established by comparing mean pretest scores for the two groups using Student's t-test. Comparison of achievement was done by comparing mean posttest scores, using this t-test. The t-test is appropriate for small sample sizes which meet the following assumptions: the scores form an interval or ratio scale of measurement; the score variances are equal; the scores are normally distributed.

This study used small samples, 15 and 18 students per group. Both exams had 20 questions, graded either right or wrong, providing interval data. The homogeneity of variance assumption was tested using an F test. The pretest scores had an F value of 1.34. The posttest scores had an F value of 1.82. There were no significant differences between the variances, thus the assumption of homogeneity of variance was not violated. The score distributions were slightly negatively skewed, the posttest being slightly more skewed than the pretest (pretest -.185 and posttest -1.366). However, according to Borg and Gall "...even if the assumptions underlying the t-test are violated, the test will still provide in most instances an accurate estimate of significance level for difference between sample means." (Borg & Gall, 1979, p. 455.)

An attempt was made to compare pretest scores and posttest scores from the control (lecture) group and the experimental (computer) group by calculating analysis of covariance. The analysis of covariance would have provided a statistical adjustment of the scores on the posttest, based upon the corresponding scores on the pretest. There would have been two basic adjustments: an adjustment for chance differences on the pretest scores of subjects within each group, and an adjustment for chance differ-

ences between the groups (Udinsky, Osterlind & Lynch, 1981). Significance of the treatment process would have been determined by the relationship that existed between the groups after these initial adjustments had been made (Polit & Hungler, 1983). However, because some students answered all 20 questions correctly on the posttest, a ceiling effect was created, inaccurately representing the actual gains in knowledge by the two groups of students.

Delimitations

The study was delimited by the nature of the population. All subjects were nursing students enrolled in Maternal Child Nursing at Lane Community College, Eugene, Oregon.

1. No attempt was made to select students enrolled in Maternal Child Nursing at other community colleges.
2. No attempt was made to select students enrolled in Maternal Child Nursing in baccalaureate programs.
3. Approximately 33 students participated in the study. These subjects were divided into two groups of 15 and 18.

The use of a convenience sample, as well as the use of a small sample size, contributed to the potential lack of homogeneity between the study groups and, thus, affects the reliability of the results, and limits the extent to which the results can be generalized. However, random assignment improves the chance of homogeneity and t-test of the pretest exam scores showed no significant differences in the knowledge base of the two groups of students prior to the experimental treatment.

Limitations

The following limitations are concerned with instrumentation and procedure.

1. The nursing program at Lane Community College uses modules which delineate content to be covered in each unit of study. The modules are designed with questions which help the student to glean information from the textbook (Nursing Care of Infants and Children, by L. F. Whaley and D. L. Wong, 1979). The modules are to be used in conjunction with traditional classroom lecture and for the purposes of this study were used with the computer programmed self-instructional teaching unit. All students enrolled in Maternal Child Nursing were provided with the textbook and modules for the unit entitled "Threats to the Production and Circulation of Blood in the Pediatric Patient." All examination questions were based on information identified to be covered in educational objectives stated in the modules.
2. During the time of the study, all of the students were together in either the Maternity or the Pediatric unit of the hospital for the students' clinical experience.
3. The lecture session was given by the researcher. This could have biased delivery of the lecture. In order to minimize bias, the instructor utilized the format and outline of the computer program to prepare and deliver the lecture.

CHAPTER IV

RESULTS AND DATA ANALYSIS

The results of the investigation were obtained from a sample consisting of 33 second-year Associate Degree Nursing students. Fifteen students were in the control (lecture) group, and eighteen students were in the experimental (computer) group. The content was presented to the students in the control group using the traditional lecture format, while the students in the experimental group received the content via the computer programmed self-instructional teaching unit.

Both groups took pretest and posttest exams. The pretest was different from, but parallel in format to, the posttest. The pretest was used to establish similarity between the groups and the posttest was used to compare achievement of the groups after the treatment.

Pretest scores are listed in Appendix H. The pretest scores for Group I ranged from a low score of 6 (30%) to a high score of 14 (70%) with a mean score of 10.4 (52%). Group II's pretest scores ranged from a low score of 5 (25%) to a high score of 15 (75%) with a mean score of 9.67 (48%). Inspection of the means, standard deviations and t values (Table 2) reveals that there was no significant difference in the amount of knowledge of the content between the control group and the experimental group at the time of the pretest. The alpha level was set at .05.

Table 2

t-Test Comparison of Pretest Scores of Lecture Group and Computer Group

Group	N	Mean	Standard Deviation	t Value
Lecture	15	10.40	2.38	.81
Computer	18	9.70	2.76	

Posttest scores are also listed in Appendix H. The posttest scores for the lecture group ranged from a low score of 14 (70%) to a high score of 20 (100%) with a mean score of 18.27 (91%). The posttest scores for the computer group ranged from a low score of 14 (70%) to a high score of 20 (100%) with a mean score of 17.83 (89%). Inspection of the means, standard deviations, and t values (Table 3) reveals that there was no significant difference in the amount of knowledge gained between the lecture group and the computer group. The alpha level was set at .05.

Table 3

t-Test Comparison of Posttest Scores of Lecture Group and Computer Group

Group	N	Mean	Standard Deviation	t Value
Lecture	15	18.27	1.48	.69
Computer	18	17.83	2.00	

Acceptability of the computer programmed self-instructional teaching unit by nursing students was further evaluated by having students express their attitudes toward the teaching unit. Using the

Information/Evaluation Form (Appendix A), students in both groups were asked to evaluate their respective teaching methods. Utilizing a Likert scale, the students rated their enjoyment of the teaching method on a scale from "didn't like" (1) to "very enjoyable" (5). The clarity of the presentation was rated from "confusing" (1) "to very clear" (5). The helpfulness of the method for learning was rated from "useless" (1) to "very helpful" (5). The students' attitudes are summarized in Table 4. Using a t-test, there were no significant differences in the student opinions toward the two teaching methods.

Table 4

t-Test Comparison of Student Attitudes Toward Enjoy, Clear and Helpful for Lecture Group and Computer Group

Variable	N	Mean	Standard Deviation	t Value
Enjoy				
Lecture	15	4.13	.64	-.15
Computer	18	4.16	.61	
Clear				
Lecture	15	4.40	.63	.05
Computer	18	4.38	.60	
Helpful				
Lecture	15	4.46	.51	.62
Computer	18	4.33	.68	

Discussion

The students in both the lecture group and the computer group demonstrated gain in knowledge on the posttest. The posttest scores were not significantly different between the groups, supporting the

hypothesis that the amount of knowledge gained by students using the computer-programmed self-instructional unit is not significantly different from the amount of knowledge gained by the students attending the lecture session. The results of this study indicate that the computer can be effectively utilized to teach pediatric heart defects content at a knowledge level compared to lecture method.

The results of this study must be measured recognizing that the evaluation tool was researcher-developed and had a moderately low reliability. However, the low reliability may be the result of having a very homogeneous group, as nursing students would be, and may not mean that the test was not a reliable tool. A group which is very homogeneous will have scores that are clustered, as opposed to spread out. This will create a false low reliability. It is also important to remember that the Kuder-Richardson formula yields a lower reliability coefficient than would be obtained by other methods for measuring the reliability coefficient.

The results of this study reflect the sample used and generalization to other samples is limited by the small sample size and the selective sample used. The researcher made no attempt to measure the effect of the printed modules or availability of the textbook on student learning. There are factors which could have influenced learning. Contamination of method by students sharing information about the content while together in the clinical areas was not prevented. The results of this study confirm work done by Kulik et al. (1980), Boettcher et al. (1981), and Pogue (1982) who also demonstrated similiar results. This study supports the finding that the computer can be utilized as effectively as the lecture method to teach nursing content related to pediatric heart defects at a knowledge level.

In comparing student attitudes toward the lecture and the computer, there were no significant differences in student enjoyment, perception of helpfulness, and clarity of the two teaching methods. In evaluating enjoyment of subjects in a study concerning the treatment modality, it is important to consider that the response may be positive in an attempt to please the researcher and could potentially be a bias found in the study. Also, few students (three) in the computer group have ever used a computer before. The enjoyment of the program may be related to the novelty of using the computer and thus falsely inflate the students' evaluation of enjoyment. However, student attitudes in this study are consistent with student attitudes noted by Kulik et al. (1980) and Levine and Wiener (1975) that students enjoyed learning with a computer programmed instructional unit. This researcher designed the lecture and the computer program in a format similar to the printed modules as well as the textbook. This similarity may account for the clarity of the presentation of the two teaching methods. These factors must be considered when attempting to generalize the results of this study to other self-instructional computer programs.

Neither the lecture nor educational media (computer) have proven to be a superior teaching tool when used independently (Henson, 1980). Huckaby et al. (1977) found that staff nurses learned better and expressed greater enjoyment when lecture and discussion were combined with a form of educational media. Educators must continue to investigate means to combine educational media and the lecture to create the most effective learning experiences for students.

Bloom (1954) identified learning levels to include: knowledge, comprehension, application, analysis, synthesis and evaluation. Use of

the nursing process requires nursing students to learn at all levels of Bloom's taxonomy. Nursing instructors are thus faced with the problem of providing educational media to stimulate learning at a variety of levels. If some learning takes place outside of the classroom, then classroom time can be used to more fully concentrate on the more complex learning needs. In other words, if the student can gain knowledge outside of the classroom, then classroom time can be used to apply, analyze, synthesize and evaluate information necessary in using the nursing process. This means that the nursing instructor can function as a facilitator of learning, and not merely a dispenser of information. The computer is one tool that can be used to teach at a knowledge level outside of the classroom.

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

According to Gagne (1970), the role of the educator is to manipulate the learning environment so that student learning is enhanced. The computer is currently being used by some educators to provide variations in the learning environment. The computer has many capabilities and can be programmed to enhance student learning in a variety of ways. This study examined the use of computerized learning materials used by nursing educators to teach nursing content at a knowledge level to Associate Degree Nursing Students.

The content presented in the study was pediatric heart defects. A sample of 33 Associate Degree Nursing Students was used to gather the data. Using experimental design, the students were randomly divided into two groups: the control group had 15 students who received the content via the traditional classroom lecture method and the experimental group had 18 students who received the content via a computer programmed self-instructional unit.

Prior to the treatment process, the students were given a pretest designed to cover the cognitive aspects of the content. Similiarity between the groups was established using Student's t-test to compare pretest scores. No significant difference in knowledge of the content existed between the groups prior to the treatment process.

After the students received the content, either by lecture, or by computer, the groups were compared on the basis of achievement using a posttest. The posttest was different from, but parallel in format to, the

pretest. Using a t-test to evaluate the posttest scores, the groups showed no significant difference in their scores. Their achievement was statistically the same.

This study supported the position that the computer can be used to teach at a knowledge level. These results are similar to the findings of Kulik et al. (1980), Boettcher et al. (1981), and Pogue (1982), who also found the computer to be an effective teaching tool for teaching at a knowledge level. This does not mean that the computer is only capable of teaching at a knowledge level. The computer has capability of teaching at higher cognitive levels too (Kirchoff & Holzemer, 1979; Boettcher et al., 1981; Bitzer & Bitzer, 1973; Collart, 1973; Donabedian, 1976; Kelly 1976-1971; Oliveri & Sweeney, 1980; Anderson et al., 1971). Unfortunately, the programs designed to teach at the upper levels of Bloom's taxonomy tend to be complex and multi-branching. These are difficult, time-consuming and, consequently, more expensive to develop.

Nurse educators without computer programming skills may choose to utilize computer programmers to assist with the development of complex, multi-branching programs designed to teach nursing problem solving skills. However, the nursing process is complex and not readily understood by non-nursing personnel. Thus, computer programs designed by non-nursing computer programmers may risk inaccurate representation of the nursing process and may consequently inadequately develop nursing problem solving skills in nursing students attempting to use the computer to develop higher level cognitive skills.

As computers become more available, educators need to evaluate the most appropriate use of the computer for teaching. In evaluating new technology for use as a teaching tool, educators must not only consider the

capabilities or potential uses and effectiveness of the teaching tool but how affordable each use of the tool will be. Computer programs that are complex and multi-branching are less affordable and, consequently, are likely to be less available to most educators than the less complex, easier-to-develop computer programs.

The effectiveness of any teaching method is ultimately dependent upon student acceptance of the teaching method. The acceptance of this computer-programmed self-instructional unit was evaluated by comparing student attitudes toward the computer with student attitudes toward the lecture session. Utilizing a questionnaire the students were asked if the computer program/lecture was clear, if it was helpful and if it was enjoyable. The students rated their attitudes toward the computer program or lecture, depending on group membership, using a Likert scale ranging from one to five. Using a t-test to compare student attitudes toward the lecture and the computer, there were no differences in student enjoyment, perception of helpfulness, or clarity of the two educational methods. If student acceptance is similar between the lecture method and the computer programmed self-instructional unit, then the instructor, in manipulating the learning environment, can use the computer for dispensing information to the student, adding variety to the learning environment.

Polit and Hungler (1983) suggest that the halo effect may account for student enjoyment of the computer program. In other words, students responded positively to the question regarding enjoyment simply because the students enjoyed being involved in a research study. Although the halo effect cannot be excluded as a factor influencing student enjoyment, Kulik et al. (1980) and Levine and Wiener (1975) also found that students enjoyed learning material at a knowledge level using a computer program.

Student enjoyment of the computer program may very likely be due to students enjoying any novel approach to learning. Educators need to manipulate the learning environment to enhance student learning. By utilizing a variety of teaching tools, the instructor can provide many novel approaches to learning. The computer can be one of these novel approaches.

To assure availability of a variety of teaching tools, the tools must be affordable by educators. Computer programs designed to teach at a knowledge level are easiest and most affordable to develop and will therefore be most likely to be available for use by educators. The results of this study support previous findings that the computer teaches as effectively as the lecture method.

Conclusions and Recommendations

The results of this study provide some conclusions about the use of computerized learning materials and the lecture method of teaching. The conclusions are as follows:

1. The students were able to achieve some amount of knowledge of the content equally as well with the computer programmed teaching unit as with the traditional lecture method.
2. The students enjoyed the computer program and the lecture.
3. The students thought that the presentation of the lecture and the presentation of the computer program were clear.
4. Both teaching methods were helpful in assisting students to achieve some amount of knowledge.

The implications of the study are that the computer can be used to teach nursing content at a knowledge level and that students enjoy learning with computerized learning material. In order to validate these findings

further, the following recommendations are made:

1. This study could be repeated utilizing groups of students from different Associate Degree Nursing programs.
2. This study could be repeated utilizing groups of students from different degree programs.
3. Further study could be done utilizing different content areas.
4. Further study could be done utilizing a larger number of test questions on both the pretest and the posttest.
5. A similiar study could be done in which the content utilized in the lecture and the computer program was not replicated in the textbook and the student modules.
6. A study could be done using the textbook and the computer program comparing knowledge gained as well as time spent reading the textbook or viewing the program.
7. Student scores on tests related to the research study could be compared to student scores on other tests, to see if individual students are achieving at their usual aptitude during the study.

This study has value for the nurse educator because it provides support for the use of the computer as an alternative teaching method. Nurse educators use a variety of alternative teaching methods to provide interest in the learning environment as well as opportunity for some self-paced, independent learning. The computer, however, has an added educational importance because it introduces students to the idea of computer technology. As hospitals are beginning to implement the use of computers, nurses are being required to use the computer, particularly in communicating with other hospital departments while planning, implementing, and evaluating patient care. Nursing students who have been exposed to the

use of computers in school will likely have an easier transition to the use of computers in the hospital.

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APPENDICES

APPENDIX A

INFORMATION/EVALUATION FORM

LANE COMMUNITY COLLEGE
Associate Degree Nursing
Maternal Child Nursing, NUR 207

HEALTH OCCUPATIONS
M. L. Lynch
Winter 1983

INFORMATION/EVALUATION FORM

Students: To assist in the evaluation process of the computer as a teaching tool, please respond to the following questions.

1. I belonged to the:
   computer group _____
   lecture group _____

2. Have you ever used a computer before?
   Yes _____
   No _____

3. Please give your age, sex, and identify whether or not you are an LPN.
   Age _____ Sex_____ LPN (Yes)_____ (No)_____

4. Please assign a value to the following statements, identifying whether or not you agree with the statement.

   a. The lecture/computer program was enjoyable.

   1 2 3 4 5
   Didn't like It was okay Very enjoyable

   b. The presentation was clear.

   1 2 3 4 5
   Confusing It was okay Very clear

   c. The lecture/computer program was worthwhile; it helped me to learn.

   1 2 3 4 5
   Useless It was okay Very helpful

APPENDIX B

CONSENT FORM

LANE COMMUNITY COLLEGE
Associate Degree Nursing
Maternal Child Nursing, NUR 207

HEALTH OCCUPATIONS
M. L. Lynch
Fall/Winter 1982-83

CONSENT FORM

Lane Community College, in an attempt to evaluate the effectiveness of the microcomputer as a teaching-learning tool, is conducting a research study. The research study will compare knowledge gained by students using a microcomputer program versus knowledge gained by students attending lecture. The content area used will be the same for both groups of students. This content area will be Pediatric Heart Defects.

Students participating in the study will be randomly assigned to either the computer group or the lecture group. Student consent is required for participation in the study. Please indicate your consent for participation in the study by indicating whether or not you agree to be randomly assigned to either the computer group or the lecture group.

_____I agree to be randomly assigned.

_____I do not agree to be randomly assigned.

_____ _____
Signature Date

APPENDIX C

EDUCATIONAL OBJECTIVES

LANE COMMUNITY COLLEGE
Associate Degree Nursing
Maternal Child Nursing, NUR 207

HEALTH OCCUPATIONS
M. L. Lynch
Fall/Winter 1982-83

UNIT X: THREATS TO PRODUCTION AND CIRCULATION OF BLOOD IN THE PEDIATRIC PATIENT

Module 1
Title: Nursing Care of the Child with Heart Disease

Learning Resources:

Required:

Whaley and Wong, Nursing Care of Infants and Children, 1979, pp. 1311, 1315-1330, 1356-63.

Optional:

Shor, Vivian L., "Congenital Cardiac Defects," American Journal of Nursing, Feb. 1978, pp. 255-277 (available from instructor).

Directions to the Learner:

1. Read unit introduction and module objectives.
2. Review anatomy and physiology of the heart.
3. Review anatomy and physiology of fetal circulation.
4. Complete required readings.
5. Accomplish the objectives.

Cognitive Objectives:

Upon completion of this module, the student will be able in an integrated quiz session or in writing to:

1. Identify the anatomical structures and describe the physiology of circulation within the normal heart.

2. Identify the anatomical structures and describe the physiology of circulation within the fetal heart.

3. Define the following types of congenital heart defects:
   3.1 acyanotic
   3.2 cyanotic

4. Define the following heart defects including whether they are cyanotic or acyanotic heart disease.
   4.1 VSD

4.2 ASD
4.3 PDA
4.4 Tetrology of Fallot
4.5 Transposition of the great vessels

5. Identify the signs and symptoms of cardiac disease in infants.

6. Describe the nursing care of the child with congenital heart disease in relation to each of the following needs categories:
   6.1 mobility
   Identify the positions of comfort for the child immediately following a dyspneic or cyanotic spell.
   6.2 safety
      a. Identify the rationale for keeping the child warm and calm after a cyanotic/dyspneic spell.
      b. Identify the rationale for tailoring energy expenditure.
      c. Describe the nursing measures that promote prevention of energy expenditure.
   6.3 nutrition and elimination
      a. Identify the rationale for feeding infants with a cardiac defect frequently.
      b. Describe nursing measures which promote adequate caloric intake in the infant and child with a cardiac defect.
   6.4 relationships
      a. Describe nursing responsibilities for the child with a severe cardiac defect who is anorexic including child and parents.
      b. Describe nursing responsibilities found in the summary of nursing care of the child with congenital heart disease which fosters growth-promoting family relationships.

7. Define the following:
   7.1 rheumatic fever
   7.2 Sydenham's Chorea (St. Vitus' dance)

8. State the disease classification of rheumatic fever and the rationale for that classification.

9. State the major sequela to rheumatic fever.

10. Describe the nursing care of the child with rheumatic fever in relation to each of the following needs categories:
   10.1 mobility
      a. Identify the rationale for giving injections of benzathine penicillin G or procaine penicillin G midlateral thigh only.
      b. Describe the nursing responsibilities which encourage the maintenance of bedrest.
      c. Describe the nursing measures which may be utilized for the relief of discomfort.

10.2 safety
- a. Describe the nursing measures which may be utilized to care for the child with irregular jerking movements.
- b. Describe the nursing measures utilized to minimize the effects of muscle weakness.

10.3 nutrition and elimination
- a. Identify the nursing measures which may be utilized to maintain appropriate nutrition.
- b. Describe the nursing responsibilities in relation to fluid intake.

10.4 relationships
- a. Describe the nursing responsibilities found in the summary of nursing care of the child with rheumatic fever to minimize boredom.
- b. Describe the nursing responsibilities which provide emotional support.

Clinical Objectives:

Upon completion of this module, given an actual or simulated patient situation, the student will be able to:

1. Identify normal circulatory pathway in normal heart and in fetal heart.

2. Recognize the difference between cyanotic and acyanotic congenital heart disease.

3. Care for a child with congenital heart disease by:
   - 3.1 positioning the child in the position of comfort immediately following a dyspneic or cyanotic spell.
   - 3.2 utilizing nursing measures to prevent or tailor energy expenditure.
   - 3.3 promoting adequate intake.
   - 3.4 fostering growth-promoting family relationships.

4. Care for the child with rheumatic heart disease by:
   - 4.1 recognizing the major sequela to rheumatic fever.
   - 4.2 giving penicillin injections safely.
   - 4.3 encourage bedrest as appropriate.
   - 4.4 providing nursing measures for the relief of discomfort.
   - 4.5 maintaining safety measures in caring for the child with chorea or muscle weakness.
   - 4.6 promoting nursing measures to maintain adequate fluid and nutrition.
   - 4.7 utilizing nursing measures to minimize boredom.
   - 4.8 meeting the emotional needs of the child and family.

APPENDIX D

REVIEW QUESTIONS

LANE COMMUNITY COLLEGE
Associate Degree Nursing
Maternal Child Nursing, NUR 207

HEALTH OCCUPATIONS
M. L. Lynch
Fall/Winter 1982-83

Review Questions

1. The two structural deviations in fetal circulation serve what purpose?

   a. decrease the workload of the developing heart
   b. bypass the lungs
   c. equalize pressure between the right side and the left side of the fetal heart
   d. increase blood supply to the brain

2. In the normal heart, pressure is greatest in the left ventricle. As a result you would expect pressure to be greatest in which vessel?

   a. aorta
   b. pulmonary vein
   c. inferior and superior vena cava
   d. pulmonary artery

3. Patent ductus arteriosus causes:

   a. increased blood flow to the lungs
   b. decreased blood flow to the lungs

4. A heart defect is classified as _____ when the altered circulatory pathway does not result in unoxygenated blood being directed to systemic circulation.

   a. cyanotic
   b. acyanotic
   c. embryologic

5. The foramen ovale normally closes after birth as a result of:

   a. increased pressure in the left atrium
   b. increased pressure in the left ventricle
   c. hormonal changes
   d. decreased blood flow to the right atrium

6. Atrial septal defect is the result of:

   a. failure of the ductus arteriosus to close
   b. collapsed lungs
   c. failure of foramen ovale to close
   d. unrepaired ventricular septal defect

7. True or False:
   Cyanotic heart defects have pulmonary congestion as a primary side effect.

   a. true
   b. false

8. Transposition of the great vessels is frequently associated with which of the following defects:

   a. patient ductus arteriosus
   b. ventricular septal defect
   c. atrial septal defect
   d. patient ductus venosis

9. Ventricular septal defect is classified as:

   a. cyanotic
   b. acyanotic

10. Left ventricular hypertrophy is associated with which defect?

   a. atrial septal defect
   b. ventricular septal defect
   c. tetrology of Fallot
   d. transposition of the great vessels

APPENDIX E

PRETEST

LANE COMMUNITY COLLEGE
Associate Degree Nursing
Maternal Child Nursing, NUR 207

HEALTH OCCUPATIONS
M. L. Lynch
Fall/Winter 1982-83

Pretest

Pediatric Heart Defects Exam

DIRECTIONS: Choose the best answer for each of the following questions. Be sure to mark your answer on the answer sheet.

1. Which blood vessel delivers blood from the heart to systemic circulation?

   a. jugular
   b. carotid
   c. vena cava
   d. aorta

2. What is the name of the blood vessel which carries blood from the heart to the lungs?

   a. pulmonary artery
   b. pulmonary vein
   c. aorta
   d. vena cava

3. Blood in the right side of a normal heart is saturated with what percentage of oxygen?

   a. 40%
   b. 60%
   c. 80%
   d. 100%

4. Which chamber of the heart has the lowest pressure?

   a. right atrium
   b. left atrium
   c. right ventricle
   d. left ventricle

5. Structural variations within the fetal heart direct the majority of blood flow to bypass which structure?

   a. spleen
   b. liver
   c. kidneys
   d. lungs

6. Blood within the fetal heart is saturated with what percentage of oxygen?

   a. 40%
   b. 60%
   c. 80%
   d. 100%

7. Where is the ductus arteriosus located?

   a. between the aorta and the pulmonary artery
   b. between the right and the left atrium
   c. between the aorta and the pulmonary vein
   d. between the left and the right ventricles

8. Name the structure that creates a pathway between the right atrium and the left atrium in fetal circulation.

   a. foramen ovale
   b. ductus arteriosus
   c. ductus venosis
   d. atrial septum

9. What criterion is used to classify acyanotic heart defects?

   a. systemic blood bypasses the lungs as it passes through the heart
   b. the structural defect is located intracardiac
   c. the structural defect is located extracardiac
   d. no unoxygenated blood reaches systemic circulation

10. Name the common clinical manifestation(s) resulting from the altered circulatory pathway associated with acyanotic heart defects.

    a. polycythemia
    b. pulmonary congestion
    c. tissue anoxia
    d. all of the above

11. Blood flow through a ventricular septal defect follows which pathway?

    a. right ventricle to pulmonary artery
    b. right ventricle to left ventricle
    c. left ventricle to pulmonary vein
    d. left ventricle to right ventricle

12. Transposition of the great vessels is frequently associated with which of the following defects?

    a. atrial septal defect
    b. ventricular septal defect
    c. patent ductus arteriosus
    d. all of the above

13. Blood flow through a patent ductus arteriosus follows which pathway?

    a. pulmonary vein to aorta
    b. left atrium to right atrium
    c. aorta to pulmonary artery
    d. right atrium to left atrium

14. Failure of the foramen ovale to close after birth results in which heart defect?

    a. tetrology of Fallot
    b. atrial septal defect
    c. ventricular septal defect
    d. patent ductus arteriosus

15. Which of the following defects is <u>not</u> associated with Tetrology of Fallot?

    a. patent ductus arteriosus
    b. ventricular septal defect
    c. pulmonary stenosis
    d. right ventricular hypertrophy

QUESTIONS 16-20: Classify the following heart defects according to whether they are cyanotic or acyanotic.

    a. cyanotic
    b. acyanotic

16. transposition of the Great Vessels
17. atrial septal defect
18. patient ductus arteriosus
19. ventricular septal defect
20. tetrology of Fallot

APPENDIX F

POSTTEST

LANE COMMUNITY COLLEGE
Associate Degree Nursing
Maternal Child Nursing, NUR 207

HEALTH OCCUPATIONS
M. L. Lynch
Fall/Winter 1982-83

Posttest

Pediatric Heart Defects Exam

DIRECTIONS: Choose the best answer for each of the following questions. Be sure to mark your answer on the answer sheet.

1. Which blood vessel delivers blood from systemic circulation to the heart?

   a. vena cava
   b. aorta
   c. carotid
   d. jugular

2. What is the name of the blood vessel which carries blood from the lungs to the heart?

   a. pulmonary artery
   b. pulmonary vein
   c. aorta
   d. vena cava

3. Blood in the left side of a normal heart is saturated with what percentage of oxygen?

   a. 40%
   b. 60%
   c. 80%
   d. 100%

4. Which chamber of the heart has the highest pressure?

   a. right atrium
   b. left atrium
   c. right ventricle
   d. left ventricle

5. Why do structural variations within the fetal heart direct the majority of circulating blood to bypass the lungs?

   a. the developing fetus has lower oxygen requirements
   b. to decrease the workload of the heart
   c. the fetal lungs are collapsed
   d. to increase blood supply to the brain

6. The fetus receives blood from the mother which is saturated with what percentage of oxygen?

   a. 40%
   b. 60%
   c. 80%
   d. 100%

7. Where is the foramen ovale located?

   a. between the right atrium and the left atrium
   b. between the aorta and the pulmonary vein
   c. between the right ventricle and the left ventricle
   d. between the pulmonary artery and the aorta

8. Name the structure that connects the aorta and the pulmonary artery in fetal circulation.

   a. foramen ovale
   b. aortic bifurcation
   c. ductus arteriosus
   d. ductus venosus

9. What criterion is used to classify cyanotic heart defects?

   a. the structural defect is located extracardiac
   b. systemic blood bypasses the lungs as it passes through the heart
   c. no unoxygenated blood reaches systemic circulation
   d. the structural defect is located intracardiac

10. Name a common clinical manifestation resulting from the altered circulatory pathway associated with cyanotic heart defects.

   a. shortness of breath
   b. tissue anoxia
   c. pulmonary congestion
   d. all of the above

11. Which of the following circulatory manifestations is associated with ventricular septal defect?

   a. blood from the right atrium is shunted to the left ventricle
   b. blood from the left ventricle is shunted to the right ventricle
   c. blood from the right ventricle is shunted to the left ventricle
   d. blood from the right ventricle is shunted to the aorta

12. Transposition of the Great Vessels results in which of the following blood flow patterns?

    a. from left ventricle to pulmonary vein
    b. from left atrium to right atrium
    c. from right ventricle to aorta
    d. from right atrium to left ventricle

13. Blood flow through an atrial septal defect follows which pathway?

    a. left atrium to right atrium
    b. right atrium to left atrium
    c. right atrium to pulmonary artery
    d. pulmonary artery to left atrium

14. Failure of the ductus arteriosus to close after birth results in which heart defect?

    a. atrial septal defect
    b. ventricular septal defect
    c. tetrology of Fallot
    d. patent ductus arteriosus

15. Which of the following defects is <u>not</u> associated with Tetrology of Fallot?

    a. dextroposition of the aorta
    b. pulmonary stenosis
    c. atrial septal defect
    d. ventricular septal defect

QUESTIONS 16-20: Classify the following heart defects according to whether oxygenated or unoxygenated blood is directed from the heart to the systemic circulation.

    a. oxygenated blood is directed from the heart to systemic circulation
    b. unoxygenated blood is directed from the heart to systemic circulation

16. transposition of the great vessels
17. atrial septal defect
18. patent ductus arteriosus
19. ventricular septal defect
20. tetrology of Fallot

APPENDIX G

TABLE OF SPECIFICATIONS

LANE COMMUNITY COLLEGE
Associate Degree Nursing
Maternal Child Nursing, NUR 207

HEALTH OCCUPATIONS
M. L. Lynch
Fall/Winter 1982-83

Table A

Table of Specifications

Cognitive Objective	Percentage of Emphasis	Number of Items
1. Identify the anatomical structures and describe the physiology of circulation within the normal heart.	20%	4
2. Identify the anatomical structures and describe the physiology of circulation within the fetal heart.	20%	4
3. Define the following types of congenital heart defects: 3.1 acyanotic 3.2 cyanotic	10%	2
4. Define the following heart defects including whether they are cyanotic or acyanotic heart disease. 4.1 VSD 4.2 ASD 4.3 PDA 4.4 Tetrology of Fallot 4.5 Transposition of the great vessels	50%	10
TOTAL		20 questions

APPENDIX H

PRETEST AND POSTTEST SCORES

Table A

Pretest and Posttest Scores

	Group I - Lecture			Group II - Computer	
Student #	Pretest	Posttest	Student #	Pretest	Posttest
3881	10	19	5693	9	16
7735	11	19	3610	11	19
6980	12	14	5075	12	19
1194	8	20	2200	8	19
1832	6	19	0223	13	14
7268	14	19	7652	15	18
3625	12	19	4812	11	19
6591	11	17	0657	8	19
1803	12	18	7514	11	18
4488	7	18	6113	8	18
0129	6	18	6455	9	19
0774	11	20	0591	8	20
2062	10	17	7901	5	19
1234	13	19	8248	6	14
3897	11	18	5620	10	19
			6689	10	17
			3300	14	14
N	15	15	1084	6	20
			N	18	18
Means	10.4	18.27		9.67	17.83
SD	2.38	1.48		2.76	2.0

A COMPARISON OF KNOWLEDGE GAINED USING A COMPUTERIZED SELF-INSTRUCTION VERSUS LECTURE METHOD TO TEACH PEDIATRIC HEART DEFECTS TO ASSOCIATE DEGREE NURSING STUDENTS

AN ABSTRACT

by Mary Lou Lynch

This study examined the use of the computer versus lecture method for teaching nursing content related to Pediatric Heart Defects at a knowledge level. A convenience sample of 33 Associate Degree Nursing Students was randomly divided into two groups. Fifteen students in the control group who received the content by lecture method and the eighteen in the experimental group received the content by a computer programmed self-instructional unit.

Prior to the treatment process, all students were pretested over the content. Using Student's t-test to compare pretest scores, no significant difference in knowledge of the content was found. After the students received the content, the groups were compared on the basis of achievement using a posttest. Using a t-test to compare posttest scores, the groups showed no significant difference in their scores, their achievement was statistically the same.

Acceptability of the computer programmed self-instructional unit by nursing students was evaluated by comparing student attitudes toward the computer with student attitudes toward the lecture session. Using a Likert scale, the students were asked if the computer program/lecture was clear, helpful and enjoyable. A t-test was used to compare student attitudes toward the lecture and the computer, there were no differences in student enjoyment, perception of helpfulness or clarity of the two educational methods.