The effectiveness of programmed instruction in teaching nutrition to associate degree nursing students in a junior college
by Peggy Sue Stanfield

A thesis submitted to the Graduate Faculty in partial ful-fullment of the requirements for the degree of MASTER OF SCIENCE in Home Economics
Montana State University
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Abstract:
The purpose of this study was to investigate the effectiveness of Programmed Instruction (PI) in teaching nutrition to beginning nursing students in a junior college.

Freshman nursing students from the 1971 and 1972 classes were subjects for the study. One group received instruction in basic nutrition by the lecture method. The second group used a Programmed Instruction book in basic nutrition with reinforcement discussion.

The instrument used to test each group was the National League for Nursing Normal Nutrition test. This test is divided into two sections. Part 1, which is 40 per cent of the test questions, deals with theory, part 2 which is 60 per cent of the test, is application.

Correlations were run on the available data for each group of students, which included A.C.T. scores, age, nutrition pretest, nursing aptitude pretest, and the N.L.N. test in a Normal Nutrition, parts 1, 2, and total. Two factor analysis of variance was run between A.C.T. scores and N.L.N. test scores. Analysis of covariance was used to adjust for the difference in mean pretest scores of the two groups.

Those students given PI had significantly higher scores for the theory section of the N.L.N. No significant difference was found for the scores in the application section. In neither group were differences in age related to performance. High scores on the A.C.T. and a nutrition pretest were correlated with high scores on the N.L.N. combined sections. PI, as an adjunct to lecture, was liked by the students.

It is recommended that PI be used to reinforce learning of the theory and to give the instructor more time to emphasize the application aspects of nutrition. Further studies should include a larger target population.

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Signature Peggy Sue Stanfield

Date March 14, 1974

# THE EFFECTIVENESS OF PROGRAMMED INSTRUCTION IN TEACHING NUTRITION TO ASSOCIATE DEGREE NURSING STUDENTS IN A JUNIOR COLLEGE

by

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A thesis submitted to the Graduate Faculty in partial fulfullment of the requirements for the degree

of

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in

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# ABSTRACT

The purpose of this study was to investigate the effectiveness of Programmed Instruction (PI) in teaching nutrition to beginning nursing students in a junior college.

Freshman nursing students from the 1971 and 1972 classes were subjects for the study. One group received instruction in basic nutrition by the lecture method. The second group used a Programmed Instruction book in basic nutrition with reinforcement discussion. The instrument used to test each group was the National League for Nursing Normal Nutrition test. This test is divided into two sections. Part 1, which is 40 per cent of the test questions, deals with theory, part 2 which is 60 per cent of the test, is application.

Correlations were run on the available data for each group of students, which included A.C.T. scores, age, nutrition pretest, nursing aptitude pretest, and the N.L.N. test in a Normal Nutrition, parts 1, 2, and total. Two factor analysis of variance was run between A.C.T. scores and N.L.N. test scores. Analysis of covariance was used to adjust for the difference in mean pretest scores of the two groups.

Those students given PI had significantly higher scores for the theory section of the N.L.N. No significant difference was found for the scores in the application section. In neither group were differences in age related to performance. High scores on the A.C.T. and a nutrition pretest were correlated with high scores on the N.L.N. combined sections. PI, as an adjunct to lecture, was liked by the students.

It is recommended that PI be used to reinforce learning of the theory and to give the instructor more time to emphasize the application aspects of nutrition. Further studies should include a larger target population.

# CHAPTER I

## INTRODUCTION

From the time of Aristotle and Socrates, the lecture method has been used as the accepted method of teaching (1, p. 25). The reasons were obvious: there were few people who could read, and very little of the written word. There was no such thing as textbooks. The scholar sat at the foot of the master and memorized the words of wisdom that emanated from him.

Many changes in education have occurred since these early beginnings. Education for all has become a way of life. Teachers are scarce and classes are large. The classes are open to students with a wide range of education and background. Almost everyone can, or is expected to, read and write. Textbooks are available for every discipline.

Because of these factors, many and varied methods of instruction are being explored. The lecture method is still considered a valid procedure when disseminating new or ill-defined material to large groups of students (2), but variations or supplements of this method are in common use. Among these are team teaching, programmed instruction, films, video tape, closed circuit television, and audio-tutorial instruction (3; 4, p. 142; 5, p. 123; 6, p. 66; 7).

### Need and Importance of the Study

Educational programs in community and junior colleges are moving in new directions (8). An era of creating and developing curricula

and programs to fit the needs and abilities of these students has begun.

The White House Conference on Foods and Nutrition in 1969 (9) focused sharp attention on inadequate nutrition training of physicians, dentists, nurses and other allied health professions. One of the educational goals to be reached was the development of new programs in this area, and the strengthening of existing programs. As a result, the hundreds of junior colleges involved in developing health programs have been concerned with the nutrition component of their programs (10,p.177). Both Home Economics and Nursing are involved in implementing these necessary changes.

A study establishing national goals and guidelines for research in Home Economics identified the major goals which would enlarge and strengthen the base of research in Home Economics (11,p.20). It also identified problem areas related to these goals which were in need of investigation. One of the problem areas so identified was effective teaching strategies and reinforcement for increasing the learning abilities in home and community situations.

A five year Nutrition-Nursing education project was done at the Medical College of Georgia. Its purpose was to develop a meaningful nutrition component of nursing education (12). One of the three major recommendations made as a result of this study was that nutrition educators should develop and recommend instructional aids and

methodology for student learning.

Among current teaching methods, programmed instruction (PI) has been used successfully in teaching nutrition with university level students (13, 14); however, PI used to teach typing to lower ability senior high school students has not been successful (15). The characteristics of the present-day junior college student are discussed later in the paper (16, p. 81), but it appears that the abilities of the two-year nursing student are somewhere between those of the above cited studies.

The rise in student enrollment in junior colleges has been paralleled by a rise in interest in health programs (3). Therefore, when a new nursing program opened at the College of Southern Idaho in Twin Falls in 1971, the numbers of students wishing to enroll far exceeded clinical facilities and qualified instructors. PI, since it has been successful with some students, seemed a practical approach to help alleviate some problems arising from the nutrition component of the nursing curriculum. It was believed that it might provide an efficient means of disseminating nutrition information.

## Purpose of the Study

To the author's knowledge, PI in nutrition for two-year nursing students has not been tested and evaluated.

The purpose of this study was to investigate the effectiveness of PI in teaching nutrition to nursing students in a junior college.

## Definition of Terms

A.C.T. American College Test: The A.C.T. program has provided predictive research to participating institutions since 1961. A component of these services is the computation of a least squares regression equation for predicting GPA from a linear combination of the four scores of English, Math, Social Studies and Natural Sciences on the A.C.T. and several high school scores (17).

A.D. Associate Degree: A two-year academic program at a junior or community college. Used in the context of the nursing student, its successful completion, coupled with passing state board examinations, permits them to become Registered Nurses (RN).

G.P.A. Grade Point Average: A numerical average assigned to grades a student has received in course work. An A is designated by 4.0, B by 3.0, C by 2.0, and D by 1.0.

L.P.N. Licensed Practical Nurse: A one-year vocational course, taught either at a medical facility or at a junior college. The successful completion of the course, coupled with passing practical nurse state board examinations permits these students to become Licensed Practical Nurses. They work under the supervision of the R.N.

Nutrition Pretest. The test used by the investigator to obtain some information of the nutrition knowledge possessed by the student prior to the instruction he would receive in his nutrition class (See Appendix A).

N.L.N. National League for Nursing: The N.L.N. tests are standardized tests compiled and administered by the National League for Nursing. The tests are divided into specific course contents, a complete test being administered for each area the student has studied. The N.L.N. test in Nutrition, while one complete test, is divided into two parts: part 1, normal nutrition and part 2, nutrition in health, which is the application of the first part. Instructors may request a test in any area taught, following completion of that unit by the student, up to the time of the state board examinations.

P.I. Programmed Instruction: In this study, PI refers to the use of printed programs of instruction. PI is sometimes self-paced by the student, or may be paced by the instructor. The program may be the total instruction the student receives, or varying amounts of reinforcement discussion and lecture may be used to supplement it.

## Hypotheses

1. There will be no significant difference in part 1 of the N.L.N. normal nutrition scores of students who use PI as a supplement to classroom instruction, when their scores are compared to those who receive only lecture.

2. There will be no significant difference in part 2 of the N.L.N. normal nutrition scores of students who use PI as a supplement to classroom lecture, when their scores are compared to those who receive only lecture.

3. There will be no significant difference in the combined totals of the N.L.N. normal nutrition scores of students who use PI as a supplement to classroom instruction, when their scores are compared to those who receive only lecture.

## Limitations

1. This programmed learning study was limited to one school of nursing, therefore the findings cannot be applied to a universal population.

2. The comparison of the two methods of instruction was made using the 1971 class as the baseline and the 1972 class as the test group. This factor of a different population may have an effect on the results.

# CHAPTER II

## REVIEW OF LITERATURE

Man has long been interested in the best way of transferring knowledge. This has led to a variety of theories as to how this could be accomplished and a variety of techniques to facilitate the process. PI is one of the techniques recently employed.

As civilized people broke away from superstition, they turned to philosophy to find the meanings of life. Eventually, the philosophers turned to science for facts to guide their thinking, and scientific methods for study were established (1, p. 275). Educational psychology came into prominence. The main school of psychological thought as it pertained to education was called transfer of training. This theory stated that when knowledge or skill was acquired in one subject, it was easier to acquire mastery over other subjects. Acquired mental capacities spread to other situations in which there had been little or no practice.

Experimentation with the results of the lecture method began about 1860 (1, p. 281). By 1901, Thorndike and Woodward presented evidence that transfer of knowledge, when it did occur, was not due to the development of any particular faculties or function. Knowledge of principles helped in the transfer of subject matter. Also, most experiments showed that amounts of transfer were greater with the young and very intelligent pupils, or when materials used in training and

testing were similar.

## Present Methodology for Transfer of Knowledge

In the early years of American secondary education, only a small select minority of young people attended secondary schools (1, p. 281). Today, laws provide for education for all, and the secondary school population tends to be heterogeneous.

The effect of the difference in these populations on the transfer of knowledge is debatable. Thorndike (1, p. 281) postulated that the select minority who previously attended school could transfer knowledge more readily than the present enrollment of less capable students. Skaggs (8) stated that today's student has greater potential for learning than any generation thus far produced. He based his conclusions on the fact that the student has had greater exposure to more knowledge than did the student of a generation ago.

This controversy has led to an exploration of many different methods of teaching. Change and experimentation have been the key words (1, p. 291). Additional factors have been the severe shortage of teachers and classrooms, rising costs, the deviation from established norms of the college preparation of many students, and the growing demand for education for all (1; 18, p. 6; 19). Another trend has been the demand of students to have a share in planning relevant learning experiences (20, p. 35).

As a result of these trends and issues, the last decade has produced new instructional methods, among which is PI. Other developments have been computer assisted teaching and self-study programs (2). Many of the new instructional methods have two characteristics not common to materials developed prior to 1960; they are self-instructing and self-correcting (21, p. 15).

Education accountability became a common term (20, p. 280). Many curriculum evaluation studies were made. These included what the teacher was trying to do, how he did it, and whether he achieved the desired results.

## Programmed Instruction

### Beginnings of PI

The roots of PI lie mainly in educational psychology, and date back to the work of Pressey in 1926 (22, p. 125). However, the first programmed book to appear in print was English 2600, by Blumenthal in 1960 (23).

Most of the work in PI has been done in England, although the United States is the home of programmed learning (23). In the United States PI and teaching machines were developed explicitly for education: films, tapes, and television were developed for the entertainment industry and later adapted to education (22, p. 125).

Effectiveness of PI

Many studies on the effectiveness of PI have been reported in the Journal of Aplet[1]. Some which are pertinent to this study are presented here.

Articles of PI cluster into three groups: (1) surveys, which optimistically describe PI as highly efficient; (2) programming experiments, which are primarily extensive studies of learning using different response modes, step sizes, and sequences; and (3) field studies, which are global comparisons of the results of PI and the lecture method (24). The comparisons most frequently occur when there is a wish to demonstrate the effectiveness of new techniques of PI (25).

Hartley (26) cited forty-one studies on the basis of test results alone, in which PI was judged superior when compared to lecture. His conclusions were that, though there were significant differences between methods, the groups had learned different things, and the test scores could not be significantly compared, since the pretest-post-test regressions were significantly different. Both sets of students in every experiment had increased their knowledge.

A study by Moore (27) reported a series of experiments in which PI was used with elementary, high school, and university level students. A group teaching machine, designed by M. Sine, was used by the

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[1]The Journal of the Association of Programmed Learning and Educational Technology, 33 Queen Anne St., London, England

experimental group, with the pace being set by the instructor. The control group used self-paced booklets. In most of the work done with PI, self-paced modes have been used, and this factor cited as contributing to the effectiveness of the technique. This assumed that self-pacing was the "best" rate for the students. However, Moore concluded, on the basis of his results, that external pacing was best for some students. It saved time, because many students had unadaptable natural working rates and the students' choice of work rate might not be his most efficient.

Noble (28) found a high significant correlation between intelligence (IQ) and achievement when PI for English studies was used with a group of grade school students. Good reading ability was also a predictor of successful performance in using PI. His study also suggested that introverts do better with written programs: those with poorer personality adjustments found freedom from the anxiety of social classroom conditions when using PI. The non-anxious extrovert benefitted least from PI.

Educators are in disagreement as to what amount of reinforcement gives the best retention when the student is using PI. Bergland (29) studied an eighth grade physics class and used varied amounts of discussion reinforcement. The first group received continuous reinforcement, the second group received 50 per cent reinforcement, and the third group received only 25 per cent reinforcement. No significant differences

between reinforcement conditions were found in the post-test and retention tests.

Three studies of the effectiveness of PI in the United States seem to be applicable to the present study. Two of these were concerned with nutrition teaching at the university level. The third was concerned with typing skills, but surveyed a population such as might enter a junior college.

In 1970, a study was done with a group of collegiate nursing students (13). PI was used with a unit on protein metabolism. There was no reinforcement of the self-paced printed program. The students participating in the study scored significantly higher in the post-tests than those who had not used PI, but who had been taught by the lecture method.

In 1971, Guthrie and Studdiford (14) designed and tested a programmed instruction book for basic nutrition. The aspects of normal nutrition, including basic meal patterns were covered. The subjects were freshmen college students enrolled in a class in nutrition. Classroom lectures were used to supplement the use of the program. It was a successful procedure. The students using PI scored significantly higher on the final test than those who used lecture method only. The students generally were in favor of PI.

In 1972, proficiency at typing tasks was tested and compared using PI versus lecture and demonstration (15). A group of "low

ability" students in first and second year typing classes was used in this study. Low ability students referred to disadvantaged high school students, averaging C or less in their GPA. The tests showed that students could type faster when learning by demonstration and lecture, but when their typing was graded for form errors, PI was more effective. In addition, the level of "work quality" after only one year of PI was higher than after two years of lecture and demonstration. The teachers, however, evaluated the program as not suitable for low ability students; they had to spend much extra time re-teaching the programmed content, and the students had a very negative attitude toward it.

## Role of the Junior College

### Enrollment

The Carnegie Commission on Higher Education (16) recommended that a comprehensive community college be within commuting distance of every potential student by 1980. Community and junior colleges during the last decade have had an increase in enrollment of almost 300 per cent (16). They now enroll almost two million students, about one in four enrolled in higher education (30).

### Junior College Students

The typical junior college student is unsure of himself and his future. He has a high school record that bars him from entering a four-year college. Colleges in many states do not accept students with

less than a 3.0 GPA. He cannot afford to go away to school and is not likely to transfer to a four-year program, though he states that he is interested (16). The junior college has been breaking through the traditional academic calendar to provide special instruction to these students: individualized instruction, formal courses with programmed instruction, and tutorial assistance (31).

Junior College Curriculum

University graduates with a Ph.D degree are unable to find jobs in the universities and four-year colleges and are moving into the junior college market. This trend may be one that will tend to conventionalize the junior college academic format (16). Since the community college was organized to meet the specific needs of the students they serve, it is debatable whether these colleges should be so formalized.

The public junior college wavers in its curriculum choices: should it emphasize a transfer curriculum with elitist connotations, or a terminal and technical program (32, p. 3)? The Higher Education Act of 1965 favored the second alternative. Work-study programs, which allow the student to gain practical experience in the field in which he is studying, were recommended for junior college students. Theory and practice were seen as being relevant for these students (32, p. 6).

Nursing Curriculum

Some of the current problems for instructors teaching nursing have been the rise in student enrollment, the diversity of student background, and the crowded nursing curriculum (12). The great need to impart both motor skills and theory simultaneously to the student in the shortest time possible has influenced them to utilize many teaching techniques (4, pp. 142-227). Of great importance is the use of programmed texts. So extensive are these materials that the American Journal of Nursing has published a series of booklets of programmed materials (5).

Nutrition in Nursing

The nutrition instructor for nursing students faces the same current problems as does the nursing instructor. In addition, nursing students have not been motivated to learn nutrition. They consider the courses in natural sciences more difficult and less stimulating than those in the humanities, social sciences, or education (33). This view could be attributed to the fact that they consider nutrition a study of things rather than people.

Graduate nurses at all staff levels have reported negative reactions to their educational experience in nutrition (12). They frequently practice with inaccurate and outdated information (34). They have not retained the information which they learned, as evidenced by a lack of changed behavior in their own food habits (35). All these

factors have had a negative effect on the nutritional status of the patient (34).

Some authors (36; 10, p. 88) suggested that nutrition teachers are to blame for these negative reactions. It was suggested that nutrition teachers update their teaching methods.

PI might be beneficial in the teaching of nutrition to nursing students, as it is believed to be one solution for the relief of routine sessions. This approach could enable the instructor to utilize her time in the clinical area and outpatient clinics (2). These areas are important aspects of the students' experience, since they allow students to apply the learned theory to actual persons. This practical situation could provide the needed motivation for the student to learn, practice, and teach good nutrition to others.

> People learn only what they feel will be useful to them, and retain only that which they believe they need or shall need (37, p. 284).

The need for changes in teaching methods, and the indications that PI may be a successful method of teaching nutrition, provided the author with the motivation to pursue this study.

# CHAPTER III

# PROCEDURES

## Population

### Description

The population of this study consisted of the entering freshman students in the 1971 and 1972 Associate Degree Program in Nursing at the College of Southern Idaho, Twin Falls, Idaho. They were the first two classes to enter the program, as it was a newly established department in the college.

The research was carried out with each class during the first semester of the freshman year. Although each class started with forty (40) students, for various reasons, the 1971 class lost eleven (11) students by the end of the term, and the 1972 class lost six (6) students by the end of the term.

The students for the nursing classes were chosen by a non-nursing faculty committee, composed of the directors of nursing from the hospital facilities within the community, and members of the Science Department at the college. The director of the Nursing Department attended the selection committee meetings, and could make recommendations, but could not vote. The committee members remained the same during 1971 and 1972. The criteria for selection of each student remained the same for both classes.

## Selection of Students for the Nursing Curriculum

### Criteria

The criteria for selection of students included A.C.T. scores, grades received in prior education (high school or college), possible training prior to application for admission to nursing, and grades from the previous summer courses taken at the College of Southern Idaho. The prerequisite courses included English, Chemistry, Psychology and a humanities course of their choice.

Also included were a nursing aptitude test, evaluation of letters of intent from the students and three letters of recommendation (former employers, when applicable).

These criteria were conditioned by size of the clinical facilities available in the community, the availability of qualified instructors, and the need to keep the classes of a size suitable to these factors. These criteria were considered an objective method of determining who should be admitted to the nursing program.

### Final Selection of the Committee

Those students who scored highest in the criteria were the final choices of the selection committee. The age factor considered was a 55 year maximum for entering training. Marital status was not a factor. The homogeneity of the two groups rested with the method of selection.

## Characteristics of the Test Groups

Group number one, the control group, consisted of the students of the 1971 freshman nursing class. Group number two, the experimental group, consisted of the students of the 1972 freshman nursing class.

## Method of Collecting Data

Each group of students took the same nutrition pretest (Appendix A), prior to instruction, to test for some knowledge of nutrition principles. The test was constructed and graded by the investigator.

The same textbook[2] was used by both groups: the material covered was pages 3 through 303. Appropriate quizzes, a midterm, and a final exam were given to each group.

Group number one, the control group, was taught by the conventional lecture method; they received a total of twenty-two hours of lecture.

Group number two, the experimental group, was instructed to purchase, for their use with the text, the programmed instruction book.[3] This book contained information on the nutrients and basic meal planning. It was used as a supplement to their regular textbook. The students were instructed to fill in the frames of their book prior to coming to

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[2]S. R. Williams, Nutrition and Diet Therapy. St. Louis: C. V. Mosby Co., 1969.

[3]H. A. Guthrie and K. S. Braddock. Programmed Nutrition. St. Louis: C. V. Mosby Co., 1971.

class, that unit which was being taught in class at that time. Thirty minutes of each class period was devoted to clarification of the answers in their programmed book, as well as relating it to their text material. The remaining thirty minutes was lecture; thus, group number one received twenty-two hours of lecture, while group number two received eleven hours of reinforcement discussion and eleven hours of lecture.

In order to test retention of material learned in the first semester, the National League for Nursing (N.L.N.) test in normal nutrition was not administered until the end of the second semester. This was four and one-half months after completion, by each group, of the basic course. This test, which was in two parts, tested for knowledge of nutrients in part one (forty-eight questions) and application of this information (nutrition in health, seventy-one questions) in part two. Total points for both sections of the test was 119. The test had a two-hour time limit and was computer graded.

The N.L.N. test in nutrition was chosen to be the instrument for testing the students in this study for several reasons:

1. This test was considered a valid test instrument: it is used nationally in schools of nursing, and periodically updated.

2. Nursing students are strongly urged to take the battery of N.L.N. tests to determine their readiness to take their state board examinations.

3. The test questions are of similar construction and content to the state boards: familiarity with the state board format is helpful to the student.

4. Because it is in specific units, the results of the test points out individual weaknesses, giving the student a chance to re-study, if needed, before he takes the state boards. In this manner, it reinforces learning.

5. The percentile rankings of the student are compared with the rank of every other student across the nation who takes the test at the same time. All baccalaureate, associate degree, and diploma schools take the same test. Therefore, the student (and his instructor) can compare his rank with all other students.

6. High scores on the N.L.N. tests increase the student's confidence in his ability to pass the state boards.

For these reasons, the student is motivated to perform well on the N.L.N. test. This achievement has brought her closer to becoming a Registered Nurse.

## Analysis of Data

It seemed possible that certain factors could influence N.L.N. scores, irrespective of the method of teaching. Therefore, A.C.T. scores, nutrition pretest scores, nursing aptitude pretest scores, and age were analyzed for the total test population. The scores for the N.L.N. exam, parts 1, 2, and total, could then be compared between

group one, the control group, and group two, the experimental group, taking into account these factors. It seemed desirable to group the A.C.T. test scores into high (105-80), medium (79-55), and low (54-25) ranges, and the ages of the students into high (55-43), medium (42-30), and low (29-17).

Method of Analysis

1. Correlation, which describes the degree of relation between variables (38, p. 96) was applied to all data listed below.

2. Analysis of variance, to determine the significance between the means (38, pp. 208-241) was used for the students' ages and A.C.T. scores.

3. Analysis of covariance was used to adjust for the effects of uncontrolled variables (38, pp. 288-289). The nutrition pretest and the parts of the N.L.N. test were analyzed for covariance with both methods of instruction.

Evaluation of PI by Students

At the end of the 1972 semester, those students who had used the PI book were asked to evaluate it. They were given a structured evaluation form which had been prepared by the investigator. Student reactions to the use of PI will be discussed in Chapter IV.

# CHAPTER IV

## RESULTS AND DISCUSSION

The purpose of this study was to investigate the effectiveness of programmed instruction (PI) in teaching nutrition to nursing students in a junior college.

### Correlation of Scores

The method of selection for both groups of students was based upon criteria which included A.C.T. and nursing aptitude pretest scores. Other data which might influence the results of the PI instruction were the nutrition pretest scores and age of the student. These were therefore correlated with $N.L.N._t$, $N.L.N._1$, and $N.L.N._2$ before the effects of PI were analyzed.

#### $N.L.N._t$

These scores were related to the other variables in the study as follows:

1. When $N.L.N._1$ scores were high, $N.L.N._t$ scores were also high.
2. When $N.L.N._2$ scores were high, $N.L.N._t$ scores were also high.
3. When A.C.T. scores were high, $N.L.N._t$ scores were also high.
4. When the nutrition pretest was high, $N.L.N._t$ scores were also high.
5. When the nursing aptitude pretest scores were high, $N.L.N._t$ scores were high.

6. Older students scored higher on N.L.N.$_t$ than younger students.

N.L.N.$_1$ (Table 1)

1. When N.L.N.$_2$ scores were high, N.L.N.$_1$ scores were high.

2. When A.C.T. scores were high, N.L.N.$_1$ scores were high.

3. When nutrition pretest scores were high, N.L.N.$_1$ scores were high.

4. The nursing aptitude pretest was unrelated to the N.L.N.$_1$ scores.

5. Age of the student was unrelated to the N.L.N.$_1$ scores.

Table 1

CORRELATION COEFFICIENTS AMONG A.C.T., N.L.N.$_1$, N.L.N.$_2$, N.L.N.$_t$, NUTRITION PRETEST, AGE AND NURSING APTITUDE PRETEST

| N=62 | NLN$_1$ | NLN$_2$ | NLN TOTAL | NUTRITION PRETEST | AGE | NURSING APT. PRETEST |
|---|---|---|---|---|---|---|
| A.C.T. | .305* | .273* | .326* | .023 | -.264* | .633*** |
| N.L.N.$_1$ | | .633*** | .491*** | .813*** | .139 | .099 |
| N.L.N.$_2$ | | | .597*** | .864*** | .462*** | .331** |
| N.L.N.$_t$ | | | | .489*** | .337** | .289* |
| NUTR. PRETEST | | | | | .365** | .289* |
| AGE | | | | | | -.037 |

| | P | r |
|---|---|---|
| * | .05 | .254 |
| ** | .01 | .330 |
| *** | .001 | .414 |

When $P < 0.05$, the probability that the results occurred by chance are less than five out of a hundred. When $P < 0.01$, the probability that

the results occurred by chance are less than one out of a hundred. When $P < .001$, the probability that the results occurred by chance are less than one out of a hundred.

N.L.N.$_2$

1. When A.C.T. scores were high, N.L.N.$_2$ scores were high.

2. When nutrition pretest scores were high, N.L.N.$_2$ scores were high.

3. When nursing aptitude pretest scores were high, N.L.N.$_2$ scores were high.

4. Older students scored higher on N.L.N.$_2$ than younger students.

A.C.T. Scores

1. When nutrition pretest scores were high, A.C.T. scores were high.

2. When nursing aptitude pretest scores were high, A.C.T. scores were high.

3. Age and A.C.T. scores were negatively correlated, thus high scores were associated with the younger students and low A.C.T. scores associated with the older students.

Nutrition Pretest Scores

1. When nursing aptitude pretest scores were high, nutrition pretest scores were high.

2. Older students scored higher on the nutrition pretest than

did the younger students.

Variables which were not significantly correlated were $N.L.N._1$ and age, $N.L.N._1$ and nursing aptitude test, A.C.T. and nutrition pretest, and age and nursing aptitude test.

## Analysis of Covariance

As can be seen from Table 1, $N.L.N._1$ and $N.L.N._2$ were most highly correlated with the nutrition pretest. The nutrition pretest was chosen as the covariant in the analyses of covariance summarized in Tables 2, 3 and 4. Analyses of covariance was used to adjust for the difference in mean nutrition pretest scores of the two groups.

### $N.L.N._1$ scores

Part one of the $N.L.N._1$ exam was composed of questions related to nutrition theory. One would expect that the PI book would reinforce learning of theory, and this was indeed supported by the data as shown in Table 2.

Table 2

RESULTS OF ANALYSES OF COVARIANCE BETWEEN THE TEST SCORES OF PI STUDENTS AND LECTURE STUDENTS ON THE NUTRITION TEST PART 1 (THEORY)

| | N | MEAN OF PRETEST | MEAN OF $N.L.N._1$ | ADJUSTED MEAN $N.L.N._1$ |
|---|---|---|---|---|
| LECTURE | 28 | 11.57 | 19.46 | 18.85 |
| PI | 33 | 10.27 | 23.18 | 23.69 |

$F=6.049$ Significant at $P < 0.05$

N.L.N.$_2$ scores

Part two of the N.L.N. exam was composed of questions that required application of theory. While the PI book did not contain material which directly related to application, one would expect that a thorough understanding of theory would be transferred to application. There should be a difference between the two groups in the N.L.N.$_2$ (application of theory). Such a supposition is consistent with the work of Thorndike and Woodward (1,p.281). The data do not support this expectation. (Table 3.) There was no significant difference in the scores of the two groups of students on the N.L.N., part two.

Table 3

RESULTS OF ANALYSES OF COVARIANCE BETWEEN THE TEST SCORES OF PI STUDENTS AND LECTURE STUDENTS ON THE N.L.N. NUTRITION TEST PART 2 (Application)

| | N | MEAN OF PRETEST | MEAN OF N.L.N.$_2$ | ADJUSTED MEAN N.L.N.$_2$ |
|---|---|---|---|---|
| LECTURE | 28 | 11.57 | 45.00 | 42.91 |
| PI | 33 | 10.27 | 40.60 | 41.61 |

F= .4792 Not significant at $P < .05$ level.

N.L.N.$_t$ scores

The N.L.N. total score was a weighting of N.L.N.$_1$ and N.L.N.$_2$ scores: 60% of the total was application and 40% was theory. There

appeared to be no significant differences in the scores of the two groups in the total N.L.N. scores. The relationship of the method of teaching to the final scores of students on the N.L.N. test showed no significant difference.

Table 4

RESULTS OF THE ANALYSES OF COVARIANCE BETWEEN THE TEST SCORES OF PI STUDENTS AND LECTURE STUDENTS ON THE N.L.N. NUTRITION TEST TOTALS (Parts 1 and 2)

| | N | MEAN OF PRETEST | MEAN OF $N.L.N._2$ | ADJUSTED MEAN $N.L.N._2$ |
|---|---|---|---|---|
| LECTURE | 28 | 11.57 | 64.46 | 62.77 |
| PI | 33 | 10.27 | 63.78 | 65.22 |

F=.5041 Not significant at $P < 0.05$ level.

## Analysis of Variance

In order to compare N.L.N. total scores between the two methods, while adjusting for differences in A.C.T. scores, two factor analysis of variance was run.

Within each method, students were placed into three groups indicating high (1), medium (2) and low (3) scores. High range of the A.C.T. was 105-80, medium was 79-55 and low was 54-25.

### $N.L.N._t$ and A.C.T.

The information from Table 5 indicates that the students who had high A.C.T. scores performed differently on the N.L.N. exam. Students

who had high A.C.T. scores achieved higher scores with either method of instruction. This is not surprising, since N.L.N. total scores and A.C.T. were positively correlated. (Table 1 - r=.326.) These students were able to retain information better than those who score low on A.C.T.

Table 5

TWO FACTOR ANALYIS OF VARIANCE BETWEEN STUDENT A.C.T SCORES AND N.L.N. TOTAL SCORES

| | D.f | MEAN SQUARES | F |
|---|---|---|---|
| METHOD | 1 | 376.615723 | 2.840 |
| A.C.T | 2 | 810.595703 | 6.113* |
| METHOD x A.C.T | 2 | 177.071167 | 1.335 |
| REMAINDER | 40 | 132.597656 | |

* Significant at $P < 0.05$ level.

N.L.N. and age

In order to compare N.L.N. total scores between the two methods while adjusting for differences in age, two factor analysis of variance was run. (Table 6)

Within each method students were placed in three groups according to age range. Number 1, or high range, was between age 55-43, number 2 or medium was 42-30 and number 3 or low, was 29-17 years.

The age of the student is not significant in relation to the effectiveness of the type of instruction used.

Table 6

TWO FACTOR ANALYSIS OF VARIANCE BETWEEN STUDENTS' AGE AND N.L.N. TOTAL SCORES

| | D.f | MEAN SQUARES | f |
|---|---|---|---|
| Method | 1 | 48.883667 | .270 |
| Age | 2 | 407.441162 | 2.250 |
| Method x Age | 2 | 2.813779 | .016 |
| Remainder | 55 | 181.120667 | |

Age and experience factors

Group 1, the group who received the lecture method, had many older students. Fifteen were Licensed Practical Nurses (L.P.N.) while group 2 was a younger group, having only two L.P.N.'s. The first group had experience in applying the nutrition they had learned in L.P.N. classes prior to entering RN training, since their average years of practice was nine years. This factor showed up in the N.L.N.$_2$ exam; the collective scores from this class were 3.5 points higher than the scores of group 2. The scores from the 13 non-L.P.N. faction of the class averaged only 40.1 as compared to the L.P.N. scores of 44.1. In group 2 the average score of the two L.P.N.'s in the class was 45, while the 31 non-L.P.N. members averaged 40.4. When comparing L.P.N.'s and non-L.P.N.'s between groups 1 and 2 it appeared that the differences were slight: the group 2, non-L.P.N.'s averaged .9 better than group 1.

Application of principles

Better scores on nursing aptitude tests appear not to be related to performance scores in nutrition theory ($N.L.N._1$), but are positively correlated in relation to application ($N.L.N._2$). The characteristics which indicate that a student is suited for nursing seem to appear when situations are introduced. Learning the theory behind application does not seem to be important until the nurse is faced with the situation.

Since only small differences can be noted in the scoring, it would appear that nutrition teachers need to emphasize application of principles. While human nutrition is a constantly changing field and the instructor needs to keep the class current by keeping it informed of new developments, she must also find a way to motivate the class to apply principles. It appears that nursing students, having demonstrated ability to do college level work by passing the A.C.T. tests, do no better than the layman when it comes to problems of application.

It was shown by the White House conference on Food and Nutrition (9) that good nutrition practices were not a part of the life style of the majority of Americans, even though much information has been made available to them. Perhaps it is this lack of ability to transfer learning that has hindered efforts both of the educator and those whom they teach.

Application of theory into practice is more difficult to teach,

and requires more of the teacher's time. PI may be part of the answer to freeing the teacher's time that she may give additional effort to teach the student how to apply theory.

It appears to this investigator that students majoring in Foods and Nutrition should learn as much about the techniques of teaching application as they learn about principles. It may be necessary to incorporate this facet of nutrition education into their curriculum, so that they may become more effective in changing the nutrition practices of the public whom they teach.

## Student Response to PI

As an aid to determining if the student responded well to PI as a teaching method, a structured evaluation form was provided the students who had used the PI book. Guthrie and Studdiford (14) co-author of the PI book used a similar evaluation with the students enrolled in a freshman nutrition course.

Since graduate nurses have reported negative reactions to their educational experience in nutrition (12), and since it has been suggested that nutrition teachers update their teaching methods (10, 36), the student response was a necessary part of the study. If the use of PI produced positive reactions, then this updated method of teaching would be of value.

Table 7

STUDENT RESPONSES TO PI BOOK IN NORMAL NUTRITION

| | | % Yes | % No |
|---|---|---|---|
| 1. | Does it contain enough information for nursing students? | 73 | 27 |
| 2. | Could it be used alone as a text? | 21 | 79 |
| 3. | Could it be used as a self study without supplemental classes? | 25 | 75 |
| 4. | Does it facilitate retention of nutrition information? | 94 | 6 |
| 5. | Are you able to apply the information to clinical situations? | 76 | 24 |
| 6. | Would you classify the book as | | |
| | a. interesting and useful | 67 | -- |
| | b. useful but not interesting | 29 | -- |
| | c. not useful to me | 0 | -- |
| | d. boring and repetitious | 3 | -- |
| 7. | Would you recommend it for other students? | 91 | 9 |
| 8. | Would you use a PI book for diet therapy? | 85 | 15 |
| 9. | Did it help you as a study guide? | 97 | 3 |

While the students were in favor of continuing the use of PI, they did not believe it could be used as the text, or in a self study program without supplemental classes.

They stated that it helped them retain nutrition information, and that they were able to apply what they had learned to the clinical area. However, the data do not bear this out, as they were unable to apply it with significant results to the hypothetical situations in the N.L.N. exam. (Tables 2 and 3.)

The one student who thought PI was boring and repetitious also

commented that it was "spoonfed" nutrition. This bears out Garner's (38) observation that the more capable student often reacts negatively to PI because he finds it redundant. This was an exceptionally capable student.

# CHAPTER V

## SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

### Summary

In order to evaluate the effectiveness of PI in teaching nutrition to nursing students in a junior college, a study was undertaken to compare PI with the lecture method of teaching. Freshmen nursing students from the 1971 and 1972 classes were subjects for the study. One group received instruction in normal nutrition by the lecture method only. The second group used a PI book in normal nutrition with reinforcement discussion. The instrument used to test each group was the National League for Nursing Normal Nutrition test. This test is divided into two parts. Part 1, which is 40 per cent of the test questions, deals with theory, part 2, which is 60 per cent of the test, is application.

Correlations were run on certain data from all students since these might have an influence on the results of PI instruction. These data included A.C.T. scores, age, nutrition pretest, and nursing aptitude pretest in reference to the N.L.N. test in Normal Nutrition, parts 1, 2, and total. Two factor analysis of variance was run between A.C.T. scores and N.L.N. test scores. Analysis of covariance was used to adjust for the difference in mean pretest scores of the two groups.

Those students given PI had significantly higher scores for the theory section of the N.L.N. No significant difference was found for

the scores in the application section. In neither group were differences in age related to performance. High scores on the A.C.T. and a nutrition pretest were correlated with high scores on the N.L.N. combined sections. PI, as an adjunct to lecture, was liked by the students.

## Conclusions

The evaluation of the effectiveness of PI in teaching nutrition to nursing students in a junior college produced the following conclusions:

1. The students who used PI as a supplement to classroom lecture scored significantly higher on part one of the N.L.N. test than did the students who received lecture only. $N.L.N._1$ was the theory section of the exam, and the PI book was correlated to theory. The $N.L.N._1$ and $N.L.N._2$ scores were positively correlated, which suggests that a relationship existed between the learning of theory and its application. However, on part two of the N.L.N. exam, which was application of theory, the students who had used PI did not show a significant difference in scores. Since the N.L.N. total scores were weighted 60 per cent for application and 40 per cent for theory, total scores for each group did not differ significantly due to method of instruction.

2. Students who had high A.C.T. scores achieved higher N.L.N. test scores with either method of instruction. These students were

able to retain and use information better than those who had low A.C.T. scores.

3. The age of the student was not significant in relation to the type of instruction used. Age did influence the scores achieved in the nutrition pretest, the older students scoring higher than the younger on the pretest. This was probably due to the fact that many older students had previous experience as L.P.N.s.

4. Students appear to like PI, as indicated by their response to it, when it is not the only type of instruction they receive. This instructor also liked the combination of lecture and PI.

## Recommendations

Though both groups ranked high in the national averages, the group who used PI did not rank higher than the lecture group. It might be concluded that the transference of theory to application was poor with these students. One is concerned that our present concepts of transfer of knowledge may be unrealistic for the present junior college student. Desirable behavior modifications for which educators strive may not be realized because transfer of knowledge does not occur as expected. It is recommended that further study be done with these aspects, using a variety of teaching methods.

The author would further recommend that similar studies in nutrition education be done with other groups of students at the junior

college level since they represent a heterogeneous segment of the population. Nutrition education is very adaptable to application of principles from theory and would further our knowledge of how best to educate the public in sound nutrition practices.

The use of PI is recommended to other nutrition instructors. Because the student is responsible for his learning with the use of PI, it frees the instructor from some routine class hours. This might allow her to discover better methods of transfer of knowledge that would encourage application of theory.

A fourth recommendation for nursing students that seems appropriate at this time would be to use the time that is gained through the use of PI to emphasize the concepts of application of principles to actual practice. This may involve the teacher and the student in clinical and outpatient cases, which in itself appears to be a good teaching method. The proportion of nursing students to the number of nutrition teachers and the size of facilities may present a problem, but it seems pertinent to the education of the student, as well as the public, that this be considered and surmounted.

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# APPENDIX

COLLEGE OF SOUTHERN IDAHO
Nursing Department

NUTRITION PRETEST

True or false:
(A statement must be completely correct to be marked true)

1. Pasteurization kills all disease producing bacteria found in milk.
2. Cocoa and chocolate have as much food value as tea.
3. Vitamin A is found in oranges.
4. Starches are found in cake.
5. Vitamin $B_1$ is found in pork.
6. Egg yolk is high in protein.
7. Calcium is necessary for blood clotting.
8. Fats contain essential fatty acids.
9. Starches turn to fat in the body.
10. Organically grown foods are higher in nutrients than all others.

Choose the one best statement to answer question.

1. A well balanced basic diet contains which of the following food groups?
   a. Milk, meat, vegetables, fruits, cereals, bread.
   b. Fruit, potatoes, milk, butter, sugar, meat.
   c. Meat, vegetables, dessert, soup, bread, cheese.
2. Which combination given below is essential for good bone structure?
   a. Calcium, potassium, vitamin D.
   b. Calcium, phosphorus, vitamin D.
   c. Calcium, iron, vitamin C.

3. One rule to follow if you wish to eat an adequate diet is:

   a. Eat a wide variety of foods.
   b. Eat foods that are high in protein.
   c. Eat only fresh fruits and vegetables.

4. If a friend told you she had stopped eating breakfast in an effort to lose weight your best reply would be:

   a. "At least have a cup of coffee."
   b. "Breakfast is important and should not be skipped. Omit your lunch instead."
   c. "Better consult your doctor. If you need to lose weight, he can give you a diet outline which includes breakfast, to meet your needs."

5. If you are unable to brush your teeth after lunch, which would you eat last for mouth hygiene?

   a. Cookie
   b. Milk
   c. Raw carrot

6. If you had unusual difficulty seeing in a darkened theatre, which food would you increase in your diet?

   a. milk
   b. meat
   c. yellow vegetables

7. A friend of yours is taking mineral oil for regularity and asks your opinion of this. You might best reply:

   a. "This is a good idea."
   b. "This is a poor idea. You should eat more roughage."
   c. "Mineral oil causes incomplete vitamin absorption, you will get a vitamin deficiency if you continue."

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