San Fernando Valley State College

NUTRITION EDUCATION FOR HIGH SCHOOL GIRLS

USING PROGAMED INSTRUCTION

A thesis submitted in partial satisfaction of the requirements for the degree of Master of Science in

Home Economics

by

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Committee Chairman

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ABSTRACT

NUTRITION EDUCATION FOR HIGH SCHOOL GIRLS USING
PROGRAMED INSTRUCTION

by

Jeanne Esterman Polak

This study compared programed instruction to the reading, lecture, discussion method with high school girls enrolled in Foods and Management classes.

A module of programed instruction dealing with protein nutrition was developed and tested in the writer's classes. The program was administered to seventy-three students who served as the experimental treatment group. Eighty-one students were given the same material using reading, assignments, lecture, and discussion. This was the conventional treatment group. Completion time was about the same for both groups.

The posttest, administered to both groups, included a thirty question sub-test on protein nutrition. The scores obtained from the posttest were used to measure the differences between the two groups. Statistical
analysis revealed significant differences between the two groups. The group using the programed material scored significantly higher on the thirty item sub-test than the group who received traditional instruction. These differences were significant at the .01 level. However, scores obtained from the remainder of the posttest were not significantly different for the two groups. This result tended to affirm that the two groups were randomly selected.

The results indicate that exposure of the student to programed instruction may be a better method for learning nutrition.
CHAPTER I

INTRODUCTION

Teenage malnutrition has long been under attack in women's magazines, in the general press, and in the home economics classroom. How much improvement has been achieved by the combined educational efforts of the past decade or so? (13:59)

This is the question asked by "What's New in Home Economics." The answer, according to the United States Department of Agriculture, is not much. In the first nutritional studies done since 1950, the results show that "the American diet is worse today than twenty years ago. . . ." (24:4). Dr. George Briggs, Chairman of the Department of Nutritional Sciences at the University of California, Berkeley, declares that "this picture of our nation's nutrition should shake any complacency, crystallize our thinking, and provide stimulus to progress." (3:40)

Dr. Briggs reports some rather dismal statistics in reference to the American diet. In the first place, there is evidence that the use of milk was greater among lower than higher socio-economic groups. Between 2 per cent and 12 per cent of all the subjects in the United States study
had intakes lower than one-half of the dietary recommended allowances set by the National Research Council for the various vitamins and minerals (3:40).

Other studies conducted within the last ten to twelve years pointed in the direction of what the government is now finding out to be true. In spite of the advancements of our automated, technological society, researchers report that modern-day eating practices have not kept up with our advancements in other sectors of science and industry.

From the Iowa Breakfast Studies (11:503) conducted in 1957, to the present nutrition survey being conducted by the United States Government, it becomes apparent that nutrition practices in the United States are not improving. They are, in fact, getting worse. The Iowa Studies pointed out that two-thirds of all teenage girls skip breakfast and that one-half of all teenage boys skip breakfast. Further, that as a result of this breakfast skipping, work output was less, reaction time was slower, and there was a high incidence of hand tremor. Teachers later reported that class performance was not as good in the breakfast skippers as it was in the other students.

A Purdue University study concluded that 52 percent of all teenagers studied worry about weight, while
58 per cent have dieted. A quick survey in any of the writer's classes will quickly confirm this finding. Anna de Planter Bowes (1:64) writing for Nations Schools, reported that

1. Teenage girls have poor food habits and poorer nutritional status than boys.
2. Anemia is more prevalent among girls than boys.
3. Skipping breakfast was mentioned most frequently as a poor food habit both by boys and girls.
4. Underweight and overweight are more frequent among girls than boys.
5. School nurses and doctors reported that fainting and mid-morning headaches are most common among students who skip breakfast or have an exceptionally poor or inadequate one.

This opinion was editorialized in What's New in Home Economics. When eleven out of twelve teenaged girls take at least one year of home economics, yet reflect so little knowledge and understanding of human nutrition, it is evident that nutrition education programs are frequently failing to meet their objectives (13:59).

The Journal of Nutrition recently reported a review of all the studies done in the United States on vitamin and mineral nutrition for the past twenty years. They reported on the basis of the seven most commonly
reported biochemical indices, between 3 and 24 per cent of
the subjects fell in the "deficiency" range. If the re-
sults of the data were to be extrapolated to the approxi-
mately 200,000,000 population of the United States, about
24,000,000 persons would not meet the one-half Recommended
Daily Dietary Allowance (RDA) in at least one nutrient and
approximately 48,000,000 persons would be deficient for
at least one biochemical index.

Although this same study reported that dietary
differences between the sexes were minimal during the pre-
puberty years, following puberty, both the dietary intake
and biochemical data suggest that diets consumed by fe-
males were generally poorer than those of males for most
of the nutrients studied except ascorbic acid. The
greatest differences between the sexes in the post-puberty
years involved the dietary iron and hemoglobin values. 1
In view of the 1968 revision of the iron RDA for women, 2
the number of women falling below RDA in future studies
on iron intake of women in the child-bearing age will

---

1 RDA for iron in women from ten years to adult-
hood is eighteen milligrams (16:59).

2 Prior to 1968, fifteen milligrams of iron were
indicated as the RDA for females of thirteen and over
(34:294).
undoubtedly be greater than these reported on here.

Evidence that diets in the United States have become worse since 1955 was reported in the preliminary report of the United States Department of Agriculture 1965 survey. Diets containing less than the required number of nutrients appear due to changed food-purchasing patterns of households, particularly in those food products which supply calcium, vitamin A and vitamin C (12:45). However, the Davis, Gershoff, and Gamble review of the individual dietary intake studies published between 1960 and 1968, indicates that in recent years diets have changed for the worse for the nutrients studied.

The ideal solution for combating inadequate eating patterns would be to establish good habits from birth so firmly that deviations would be the exception rather than the rule. Since this solution is idealistic and impractical, other methods have to be devised. Nutrition education has been going on in the classroom for years, but it also goes on outside the classroom whenever food is served, bought, observed, eaten, talked about, read about, and viewed in the media. In short, it goes on continuously.

This ongoing education begins in the home, where it traditionally has been conducted through the mother-daughter transfer of food choices and cooking skills, and
within the family entity itself, where family food customs, meal patterns and food selection are passed from one generation to another. This is the pattern in which youngsters have acquired food information (24:4).

What then happened to diminish the nutritional status of Americans? Our technological society is blamed in part for the decline of the American diet (24:4). The development of prepared and convenience foods make home preparation of food either unnecessary or rudimentary. A child who can drop a coin in a slot or open a cupboard can feed himself. These new products also make food expensive and so they dilute the effectiveness of the marginal budget. The convenience foods tend to diminish both the role of the mother as a preparer and guide and the function of the family meal as a demonstration unit for good usage. Even small children become "self-feeders." Lacking direction, they make bad choices. The de-emphasis on home-making and food preparation has moved the mother out of the home to a job (24:4).

Recommendations to improve this worsening situation have been suggested. Dr. George Man proposes that we should:

1. "Introduce and enlarge nutrition science in the elementary and secondary school curricula."
2. Enforce regulatory control of food advertising claims, including those for vitamins, to conform with scientific fact.

3. Enlarge nutrition education among doctors, nurses, dietitians, and teachers to make them competent educators in this area of health protection." (24:4)

It is the first proposal that is the major concern of nutrition teachers. Of all the questions which perplex nutritionists, the most vexing would seem to be one of how to educate our young people to eat properly. One method which has been proven to be successful in other fields, as well as in the area of nutrition, is programmed instruction.

**Definitions**

Programed self-instruction as a method of teaching verbal material possesses the following characteristics:

1. "A question or problem is presented to the student either by a card or printed sheet or by a film projected on a reading screen.

2. The student records his answer. In some machines he makes a selection from a number of alternative answers; in others he writes out an answer he has constructed.

3. The student obtains a check on the accuracy of his answer as soon as he records it.

4. The timing of the questions and answers is usually under the control of the student, who proceeds at his own pace." (18:87).
5. In some programs the student masks the answers by covering over half the page and uncovering the page when he has written down his own answer. In other types of programs, the problem is stated, the answer is written down, and the answer is revealed when the student turns the page.

**Purpose**

With the overwhelming evidence pointing to poor nutritional intake of many Americans, with particular emphasis on the teenage girl, it has become imperative that something must be done now to improve and update teaching methods of nutrition.

The purpose of this study will attempt to determine whether or not a program of instruction dealing with protein nutrition will be a more effective method of teaching than reading, discussion, and lecture.

**Justification for the Study**

The review of the literature indicated that programed instruction has been an effective teaching device. Compared to other fields, however, little has been done in
the area of nutrition. There were three studies reported in two unpublished Master's theses (31:11) and one doctoral dissertation (36) for junior high school students, one doctoral dissertation designed for Thai college students (21), and one published program designed for student nurses taught at the college level (20). In addition, one computer-assisted instructional program has been published for eleventh and twelfth-grade home economics students (19:153). This program, which is a review of all nutrients, takes the student only seven minutes to do. No other studies were reported for teaching nutrition to senior high school girls using programed instruction.

Hypotheses to be Tested

From the problem of finding more effective methods of meeting the objectives of nutrition education, the following hypotheses will be tested:

\[ H_1: \text{Students who receive programed instruction will score significantly higher on a thirty item sub-test on protein nutrition than students who receive instruction involving lecture, discussion, and reading assignments.} \]
H₀: There is no difference in the amount of learning that takes place between students who use programed instructional materials and students who receive instruction by means of lecture, discussion, and reading assignments.

Assumptions

It was assumed for the purposes of this study that:

1. There was a random selection of students. Classes consisted of a heterogeneous grouping of girls. Students were selected alphabetically from eight classes during two different semesters.

2. There was no difference between the conventional treatment group and the experimental group.

3. Any difference which occurred between the conventional treatment group and the experimental group was due to the teaching method used.
Limitations of the Study

The sample used in this study was limited to girls between the ages of fifteen and eighteen years. All were enrolled in a basic foods course offered at the senior high school level. The majority of the students were home economic majors, while the rest of the sample represented business majors with home economics minors, and a few academic majors.

All of the students in the experimental and conventional groups were from the author's classes to insure better control over material taught and uniform supervision of the programmed instruction.

The students participating in the experiment came from mixed socio-economic backgrounds, ranging from lower middle class to upper middle class. The makeup of the school consists of approximately 87 per cent Anglo students, 10 per cent Mexican-American, and 3 per cent other. This representation is reflected in the sample of students used in this study.

The unit of programmed instruction was limited to teaching and testing in the area of protein nutrition.
CHAPTER II

REVIEW OF THE LITERATURE

A review of the literature will be considered from two aspects: one view will be from the historical development of programed learning; the other, from the amount of research on programed learning in the field of nutrition education.

If programed learning can be defined as a "carefully arranged sequence of information, questions, and exercises designed to engage the student in active participation in the learning process, by reading a unit of information, making a correct answer, and moving to the next item," (35) then Socrates and the Elder Sophists of ancient Greece can be said to number among the first in the use of programed instruction. The Socratic method consisted of asking a series of searching questions to develop insight and understanding of the student in the subject (7:9). Inherent in the Socratic dialogue was the one-to-one, teacher-pupil relationship, which is also part of the programed teaching principle, that is, one student with one machine or one program.
What is different is the development of a science and a technology based on a method employed by the great teachers of the past (18:87).

One such great teacher was Comenius, who anticipated programmed instruction 500 years ago. His original method of teaching Latin and Greek consisted in giving, in parallel columns, useful sentences in the vernacular and the languages to be taught. In some of his books, such as the *Orbis Sensualium Pictus* (1658), pictures are added; this work is, indeed, the first children's picture book (6:100).

In the early part of the twentieth century, probably the first systematic attempt to implement a psychological theory of learning with a mechanism was made by Maria Montessori soon after she initiated her first Casa Dei Bambini in Rome in 1907. The Montessori teaching apparatus anticipated modern concepts of programmed instruction. One such device, for example, consisted of a block of wood with ten holes of different diameters and ten wooden cylinders to fit the holes. This device was dependent on the activity of the young learner for its use. It was necessarily self-corrective with immediate feedback since:
1. A learner could not put a cylinder into too small a hole.

2. If he put one in too large a hole, he would have, at the end of the sequence, a cylinder left over that would not go into the remaining hole (26:190).

Later Thorndike adapted Pavlov's conditional reflex theory to the study of human behavior. Thorndike said that if the connection between stimulus and response was followed by an annoying state of affairs, the strength of the connection decreased. On the other hand, if it was accompanied by success, this served as a reward and was known as reinforcement (30:7).

Even before Sidney Pressey came on the scene with his famed teaching machine, Carleton Washburne in 1919, introduced individualized instruction in the teaching of young school children (10:42). Many of the ideas that he employed are similar to those used in present-day programmed instruction. The material was well written. Objectives were definite. Each pupil corrected his own work. If he made errors, he reread the explanation and proceeded to work the following exercise.

All of the former preceded the man who could be called the grandfather of the teaching machine, Sidney L. Pressey. Pressey, a psychologist at Ohio State University,
exhibited a device anticipating the contemporary teaching machine at the American Psychological Association during the 1925 meetings. This device had four multiple-choice questions and answers in a window, and four keys. If the student thought the second answer was correct, he pressed the second key; if he was right, the next question was turned up. (The questions were on a revolving drum). If the second choice was not the right answer, the initial question remained in the window, and the learner persisted until he found the right one. Meanwhile, a record of all tries was kept automatically (33:536).

Although Pressey's idea did not seem to attract the public's attention at the time of the invention (22:541), there were two unique features of this early device that are still unrealized. First, a simple mechanical arrangement made it possible to lift a lever which reversed the action and transformed the machine into a self-scoring, record-keeping testing device. Secondly, a simple attachment made possible the placing of a reward dial set for any desired goal-score, which, if reached, automatically gave the learner a candy lozenge (33:536). Thus, Pressey's device both taught and tested by providing immediate feedback to the learner as to whether or not he was learning what he was supposed to learn.
Pressey developed a number of other devices and conducted many experiments with auto-instruction during the 1920's and the early 1930's, but their impact on instructional technology was negligible.

During the 1940's and 1950's several military training devices were developed to teach skills by individualized self-instructional methods (33:536). These devices, called phase checks, both taught and tested.

If Pressey was the grandfather of present-day teaching machines, then Burrhus F. Skinner of Harvard University is certainly the father of contemporary programmed instruction. In a 1954 paper entitled, "The Science of Learning and the Art of Teaching," Skinner supplied the first significant impetus to the contemporary programmed instruction movement (33:536). Skinner was the first to demonstrate a simple, practical learning device based on the principle of operant conditioning. Reinforced learning, based on Skinner's own theory, is most effective when students are reinforced immediately for the correct response.

Thus a relatively small unit of information, called a frame, is presented to the learner as a stimulus, writes Paul Saettler. The learner is then required to make a response to this information by completing a statement or
answering a statement about it. By a feedback system, he is informed as to the correctness of his response. If he has been wrong, he may even be told why; if he is correct, his response is reinforced. The learner is next presented with a second frame and the stimulus-response-reinforcement cycle is repeated until a series of hundreds or thousands of frames present a complete program in a logical sequence of information (33:536).

During the decade that followed the introduction of Skinnerian programs, a majority of those produced were Skinnerian or variations, writes Saettler, documenting the progress of program instruction. Skinner's step-by-step approach to programming is known as linear or extrinsic programming, according to Saettler. At about the same time, he continues another approach to programming called intrinsic or branching type of programming was developed by Norman A. Crowder when he was associated with the United States Air Force and engaged in training troubleshooters to find malfunctions in electronic equipment. In this type of program, the student is first presented with a rather large amount of information; he is asked a question designed to reveal whether or not he understands it. Then he is presented with several alternative choices. If his answer is correct, the program instructs the student to move to
the next stop. If his answer is not the correct choice, the student is directed to material which explains why he is wrong. He then returns to the step where the error occurred. Choice of the correct alternative (which may occur the first time, of course) triggers the program to tell him that he is right (33:536). Of his automatic tutoring devices Crowder states that they (the automatic tutoring devices) "require the student to respond to the material presented, and the devices, in turn, modify their behavior (exposing new and different material to the student) until the desired result is obtained."

A more recent contributor to the programmed instructional field is T. F. Gilbert. In addition to the intrinsic and extrinsic programing which already existed, Gilbert developed the concept of mathetic programing. Mathetic programing proceeds from a Gestalt-learning-theory base. In a typical mathetic program the student is presented with the end product of learning -- the whole complex universe to be learned. Thus, for example, in a mathetic bookkeeping course, the student would be presented first with the final expense statement or profit and loss statement that he would be expected to be able to prepare after completing the course of instruction. Typically, the last step in the preparation of the expense statement is pulled
out and is dealt with by the student, who is continually reminded of the context from which it was abstracted and who is encouraged to understand its relation to the other elements in that context. After the last operation is understood, the next to the last operation is abstracted for consideration, again always with attention to its relation to the last element, the preceding element, and the total context (5:413).

Others in the field of programmed instruction have incorporated variations on these several themes in programs of their own making.

**Programed Instruction in Nutrition**

Although the first schoolroom use of programmed instruction dates back to Montessori's Casa Dei Bambini and to later Montessori Schools (33:536), it was not until 1957 that the first sustained use of this type of instruction was begun at the Mystic School in Winchester, Massachusetts, when Douglas Porter conducted, under the sponsorship of the United States Office of Education, a year-long experiment in teaching spelling to second and third graders. The first use of programed instruction in a secondary school was started in 1959, when Eigen and Komoski conducted an experiment in teaching modern mathematics (33:536). The
most common use of programmed materials indicated by the 1962 and 1963 surveys was within large school systems; the programs were tried in most cases with individuals or small groups of students, rather than with entire classes. There also appeared to be more frequent use of programmed materials in junior high schools than in either senior high or elementary schools. About 60 per cent of the program used were in the area of mathematics, followed by 21 per cent in English, 4 per cent in spelling, 4 per cent in foreign language, 3 per cent in science, and 3 per cent in social science. Very little has been used in the area of foods and nutrition, probably due to the lack of available material in this area. As of 1967, an examination of A Bibliography of Presentations and Devices reveals that there were no published programs for foods work at the high school level (20).

Only limited experimental work has been done in the area of nutrition. Some of this work has been done in hospitals and nursing care facilities with patients suffering kidney malfunction to enable them to understand the management of their condition. To reinforce and evaluate learning, programmed instruction is being used with dialysis patients at the Veterans Administration Hospital, Iowa City. Included in this program are chapters on the
dietary aspects of dialysis patients as well as a twenty-eight question, multiple-choice examination to test acquisition of knowledge from the program. To date, the most apparent result from the program is the increased interest in diet shown by patients as well as staff. The programmed instruction is expected to accomplish the following:

1. Give the rationale for dietary control.

2. Acquaint the patient with dietary constituents.

3. Prepare the patient for specific instructions on his individual diet (17:613).

In a study done at the University of Alabama, Sister Paul Andrew Bradley gave twenty-four subjects a questionnaire concerning diabetics before using an Auto-Tutor self-teaching machine which contained programmed information on diabetes. Of the twenty-four that completed the questionnaire, only twelve completed the programmed instruction. This group included eleven women, five men, five children, one teenage boy, and two teenage girls. The subjects then rechecked the questionnaire. Although the small number of subjects limited the value of the study, it was learned from the subjects that the programmed instruction would have been useful to them when they first learned that they were diabetics. All of the subjects agreed that the use
of the machine made the test easier (2).

A similar study was done at the University of Missouri Medical Center. A program of instruction entitled, "Taking Care of Diabetes," was given to patients to test the patient's knowledge of diabetes. Patients were given an objective test of fifty true-false and fifty multiple-choice items as a pretest. The program, "Taking Care of Diabetes," was analyzed to determine the relative emphasis placed on different parts of the program, such as insulin, care of feet, and diet. Then test items were weighted in the same proportion. This test was checked by the dietitians, who criticized the form and the content; then, after it was rewritten, administered to several patients to find out if it was clearly written and approximately how much time it took to complete (27:420).

The patient in the medical center was approached as soon after admission as possible, to test him to find out what he already knew about diabetes, let him see the program on the teaching machine, then give him the posttest to learn how much he had learned, and a reading level test (27:420). Although the results of this testing program were not reported by the authors, they did find among the thirty-three patients who completed the program favorable comments about having something interesting to do to pass
lonely hours. Since the program was not the only method of instruction which patients received in the medical center, and since the programs were also evaluated in twelve nursing homes with the same favorable reactions, it can be concluded that this type of instruction would be well received as a method of instruction.

In the classroom there have been three experiments conducted at the junior high school level and three at the college level. Not all of these have been strictly programs of nutritional instruction; some of them have been nutrition related, however.

In 1964, Reigel (31) developed and experimented with a programed text to teach nutrition at the junior high school level. Students were divided into two groups. Ninth grade home economics students were selected for the experiment. Pretest and posttest scores of twenty-seven pairs of students, matched by I.Q., were compared. The control group was taught with the programed text. No significant difference was found between the experimental group and the control group in mean gain of achievement, between the pretest and posttest scores. The results indicated that programed instruction and the traditional method of instruction were equally effective.
The following year Weber (36) tested her own nutrition program, which was developed for teaching the basic principles of nutrition at the junior high school level. Students were divided into two groups, the control group and the experimental group. The control group had no previous nutrition instruction and did not take the program. These eighty-one students took only the pretest and the posttest, while the experimental group took the program unit as well as the pretest and the posttest. When subjected to statistical analysis, it was found that the mean posttest score of the experimental group was significantly greater than the mean posttest score of the control group. The indications were that the prograted units were effective in teaching basic nutrition as well as depth of understanding evidenced by the subject's performances on questions testing above the knowledge level.

In 1968, Everett (14) developed and evaluated a linear program designed to teach nutrition fundamentals in ninth grade home economics classes. Four groups were randomly assigned to ninth grade classes in home economics at two junior high schools. These four groups were divided into one control group and one experimental group at each of the two schools. Pretest, posttest, spelling, reading comprehension, and I.Q. scores were compiled for seventy-
three students. Groups with 104 and 107 I.Q. were chosen to be the experimental groups. Experienced teachers were asked to teach one control group and one experimental group. Adjusted means of the posttest scores indicated that the experimental groups had higher scores than the control groups. The difference between the experimental group and the control group was significant at the .05 level. No significant difference was found between schools or between posttest scores and previous learning.

In the same year Kanjanasthiti (21) developed and tested a course of programmed instruction to determine if such material could be developed to teach advanced nutrition effectively to a selected group of Thai college students. Upon completion of a pretest, students returned the test papers and the answer sheets to their instructor and were then given a program to complete. Students were allowed to study the program as an outside class assignment for a period of ten days. When the program was completed, students were given a retest in a class period. The same procedure was used for students at Ohio State University so that a comparison could be made between the two groups. The difference in the mean scores on the retest was significant at the 1 per cent level.
Gains were significant for both categories of questions included, those dealing with the recall of facts and principles and those dealing with the application of facts and principles.

The effectiveness of programmed instruction for teaching basic facts and principles of nutrition to Thai college students and the feasibility of translating this type of material from English into Thai were supported by the data obtained.

It would seem from the above summary of the literature that learning was at least equally effective with programmed instruction and, in many instances, more effective than traditional methods of instruction.
CHAPTER III

PROCEDURE

Development of the Program

During the summer of 1967, the writer was employed as a staff dietitian in a county hospital. While reading medical journals and nursing journals, it became apparent that programmed instruction was being used to educate various members of the medical and allied health fields. Why, then, could not it be used to teach nutrition to high school students?

With a methods course in teaching home economics still a fresh memory, two books on programmed instruction which were read as part of this course were vividly recalled. The first book was Explaining Teaching Machines and Programming by David Cram; the second was Preparing Instructional Objectives by Robert Mager. Both of these books had made a deep impression on the writer.

Inspired by what had been written in the journals and the two books, the writer set about writing a program of nutrition instruction which could be used in a high
school class (See Appendix I).

The first step in the development of the program was the selection of the topic. A narrowing of the multiple areas of nutrition was necessary to develop a unit dealing with a single topic. Basic to all human nutrition is an adequate protein intake. A greater portion of the time for instruction is allotted to those foods which supply protein to the diet. Therefore, protein nutrition was the topic selected for development into a unit of programmed instruction.

The program was designed to teach students practical application of nutrition principles. Expressed in measurable terms students would be able to identify a diet adequate in protein as well as those foods which make up the protein portion of the diet. Factual information was verified with Pike and Brown (29).

A linear form of programming, in which information is presented in small sequential units and is appropriate to subject matter in which there is only one correct interpretation, was selected. It was felt that a direct, clearly stated approach would be effective for high school students. This feeling was borne out when the program was run on a trial basis in four different classes to test it for student reaction and mechanical faults. Students were
enthusiastic about using this device and offered many helpful suggestions to improve the program. Six months after the trial run the program was used in this study.

**Development of the Posttest**

At the same time that the program was used in a trial run the posttest was devised and tried out with students who participated in the initial phase of this operation. Since the main objective of the program was for students to be able to identify adequate diets and the foods which make up the protein portion of the diet, thirty questions were developed to measure this behavior. Questions included matching of food items with the correct nutrient, identification of meals that contained complete protein, selection of protein items from other food components, and recognition of the function of protein in human nutrition. The other seventy items in the 100 item test were related to other topics covered in the course.

The tryout phase was useful in eliminating questions that seemed unclear to students and adding questions that more nearly met the intended objectives.

**Hypotheses**

\( H_0: \text{There is no difference in the } \)
amount of learning that takes place between students who use programed instructional materials and students who receive instruction by means of lecture, discussion, and reading assignments.

H₁: Students who receive programed instruction will score significantly higher on a thirty item sub-test on protein nutrition than students who receive instruction involving lecture, discussion, and reading assignments.

RESEARCH DESIGN

Design Paradigm

<table>
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<th>Programed Instruction</th>
<th>R  T₁ → M n = 73</th>
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<td>Conventional Instruction</td>
<td>R  T₂ → M n = 81</td>
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Total Number of Cases 154

Figure 1.

Figure 1 represents the design paradigm where R equals the random number of cases. T₁ equals treatment one, the program; T₂ equals treatment two or the reading
assignment, lecture, discussion, and M equals the posttest. This design used the posttest only approach since, according to Campbell and Stanley (4:195) pretest measures may have a confounding influence on the treatments by affecting the students' "learning sets," thus producing a posttest difference in favor of treated groups. The posttest only approach avoids the possible contamination of reactive pretreatment measures.

Selection of Subjects

The subjects in this study were high school girls enrolled in Foods and Management courses at Canoga Park High School. Subjects were selected by assigning every other student in alphabetical order to the experimental treatment group. The remaining students comprised the conventional treatment group. This method of selection, called systematic sampling or fixed-interval method, according to Rummel (32:79) may be used when there is an available roster of elements from which selection is to be made. Insofar as the roster of elements may be considered random with respect to the field of inquiry, a systematic sample may also be considered random.

Ferguson (15:133) writes that systematic sampling may be used if a list is arranged alphabetically, and
every nth name is chosen in the construction of the sample. In most practical situations such a sample may be viewed as random.

The conventional treatment group was given instruction in protein nutrition by means of reading assignments which covered the same material as the program. This was supplemented by classroom discussion, lecture, and question and answer periods. The experimental group used the program of instruction. To insure uniform instruction, all students were taught by the same teacher. All of the students took the same posttest during their own class time within two to three days after the program was administered.

Two separate rooms were used to divide the students into two groups. Each student received a pamphlet containing the program. They were then given minimal instruction on its use. They were allowed to proceed at their own pace during the fifty-minute class period. All subjects in the experimental group finished the program. The average time for completion of the program was thirty minutes, while it took some almost fifty minutes to complete.

Sample Size

The total number of students taking part in the experimental study was 154. Eighty-one were in the
convventional treatment group, and seventy-three were in the experimental group.

Variables

The posttest scores are the dependent variable while the program and conventional teaching methods serve as the independent variable.

Collection of Data

A posttest (see Appendix II) designed to test the amount of information gained by the students who used the program and the amount of information gained from conventional instruction, was constructed prior to the time that the study was conducted. This was done to test its effectiveness in a trial run. When mechanical deficiencies were worked out, the posttest was used in the study. Out of 100 questions, thirty questions based upon the material relating to the program were incorporated into the final examination. The other seventy questions pertained to other material covered during the semester. The final examination was given two to three days after the students took the program.

Data Analysis

Final scores on the test were divided into three
categories for each group. The first category was total scores, to see if there was any difference in total scores of the two groups.

The second category consisted of scores on questions relating to the programed material to test its effectiveness as a learning device. The third, was scores for the material that did not relate to the program. These scores were analyzed to see if there were any significant differences between the two groups. If scores on questions not relating to the program were not significantly different, then it might be assumed the two groups were randomly assigned.

Each question was assigned a value of one point. A total of 100 points were possible.

In testing the difference between the sample means, a technique was utilized that essentially consists of computing a value of $z$, where

$$ z = \frac{M_1 - M_2}{\sqrt{\left(\frac{SE}{M_1}\right)^2 + \left(\frac{SE}{M_2}\right)^2}} $$

The results are described in appropriate tables. Table 1 indicates the number of cases of mean, standard error of the mean, and standard deviation, and Table 2 shows the difference between the means for each group in each one of the three categories described above.
It was hypothesized before the data were collected that the group using the unit of programed instruction would have better scores on the thirty questions based upon the program than the group that served as the control.

If there were no difference, it would have to be assumed that the program was not a significant factor in learning. In fact, if there were no significant difference between the two groups, it would have to be assumed that in this study programed instruction was no better than more traditional methods of instruction.
CHAPTER IV

STATISTICAL ANALYSIS

This study tested the following hypotheses:

$H_0$: There is no difference in the amount of learning that takes place between students who use programmed instructional materials and students who receive instruction by means of lecture, discussion, and reading assignments.

$H_1$: Students who receive programed instruction will score significantly higher on a thirty item sub-test on protein nutrition than students who receive instruction involving lecture, discussion, and reading assignments.
The two groups were called the conventional treatment group and the experimental group. Comparisons were made on the scores of both groups. The statistical comparisons made were on mean scores, standard deviation, and standard error of the mean. Scores of the thirty item sub-test* were used for comparison as well as the scores on the entire test.

The number of students participating in the study was 154. Eighty-one of these were in the conventional treatment group. The other seventy-three represented the control group.

Table 1 summarizes the data obtained on the two groups.

The test totaled 100 points. To determine the mean, standard error of the mean, and the standard deviation, scores of the non-programed test items were used as well as scores on the programed test items.

**Significance of the Statistics**

Using a one-tailed test of significance, critical ratio of scores for the programed items was 5.35, which was significant beyond the .01 level. The critical ratio

*The thirty items in the sub-test are marked with an asterisk in Appendix II.*
### TABLE 1
Statistical Summary of the Scores of Programed and Non-Programed Items

<table>
<thead>
<tr>
<th></th>
<th>Number of Cases</th>
<th>Number of Items</th>
<th>Standard Deviation</th>
<th>Standard Error of Mean</th>
<th>Mean Scores</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Conventional Treatment Group</strong></td>
<td>81</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Programed Items</td>
<td>30</td>
<td>4.80</td>
<td>.53</td>
<td>18.19</td>
<td></td>
</tr>
<tr>
<td>Non-Programed Items</td>
<td>70</td>
<td>11.01</td>
<td>1.22</td>
<td>38.47</td>
<td></td>
</tr>
<tr>
<td>Total Items</td>
<td>100</td>
<td>14.23</td>
<td>1.58</td>
<td>56.65</td>
<td></td>
</tr>
<tr>
<td><strong>Experimental Group</strong></td>
<td>73</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Programed Items</td>
<td>30</td>
<td>5.21</td>
<td>.61</td>
<td>22.52</td>
<td></td>
</tr>
<tr>
<td>Non-Programed Items</td>
<td>70</td>
<td>10.94</td>
<td>1.28</td>
<td>39.32</td>
<td></td>
</tr>
<tr>
<td>Total Items</td>
<td>100</td>
<td>14.94</td>
<td>1.75</td>
<td>61.84</td>
<td></td>
</tr>
</tbody>
</table>
of the non-programed items was .48. For the total items on the test the critical ratio was 2.20, which was significant at the .05 level. Table 2 summarizes the significance between the means of both the conventional treatment group and the experimental group.

**Discussion of the Results**

The most important result of the statistical analysis is the critical ratio of all the programed items. This was significant beyond the .01 level of confidence. Students who used the programed instruction in protein nutrition made significantly better scores on the programed items than did those students who learned protein nutrition from other methods of instruction. These results were derived over a two-semester period using eight different classes. Therefore, the null hypothesis was rejected. Students who used programed instruction in this study learned more than students who were taught by the conventional methods.

The difference on the total scores between the two groups was significant at the .05 level. Thus, students who used the programed instruction had somewhat better total scores than students who did not use the program. Differences between the two groups on the non-programed
TABLE 2

Critical Ratio

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Programed Items</td>
<td>5.35</td>
</tr>
<tr>
<td>Non-Programed Items</td>
<td>.48</td>
</tr>
<tr>
<td>Total Items</td>
<td>2.20</td>
</tr>
</tbody>
</table>
items were not significant. This would indicate that the
difference on the scores of non-programed items is due to
chance. This supports the contention that the two groups
were randomly assigned and that they can be assumed equal.
Therefore, it appears that the significant difference
between the two groups on the scores of the programed items
was due to the use of the programed instruction and not to
chance.
CHAPTER V

SUMMARY, CONCLUSIONS, AND DISCUSSION

The purpose of this study was to determine if programmed learning (instruction), which has been used in many other fields of instruction in the United States and other countries, was more effective in teaching high school girls nutrition than the usual methods of lecture, discussion, and reading.

A programed unit in basic protein nutrition was developed by the writer for use at the high school level. The program was used in a trial run with forty high school girls to determine if the program were suitable for teaching basic protein nutrition. The trial run was also used to eliminate any mechanical deficiencies inherent in the program.

After this trial period, the program was administered to a group of students randomly selected to participate in the study. Random selection was accomplished by choosing students alphabetically from those enrolled in a high school basic foods class. A total of 154 students participated in the study over a period of
Of these, eighty-one were instructed by means of discussion, reading, and lecture in the classroom. Seventy-three were given the program as the basis for their instruction. The program consisted of sixteen frames. It was administered to all of the students participating in the study by the same teacher during class time. The other students were given instruction in an adjoining room while the experimental group was taking the program.

To insure that all material covered in the program was covered with the conventional treatment group, a reading assignment upon which the program was based was given to these students.

Both groups of students were given the opportunity to ask questions before the posttest was given. The difference in the scores on the posttest was used as a measure of the effectiveness of the program. Three sets of scores were used.

The questions pertaining to the programed items were scored for both groups. The questions pertaining to the non-programed items were scored for both groups and the total scores were tabulated for both groups.

The mean score on questions based on the program for students who were in the conventional treatment group
was 18.19, with a standard deviation of 4.80. The mean score for questions based on the program for students in the experimental group was 22.52, with a standard deviation of 5.21.

To be significant at the .01 level a critical ratio of 2.33 is necessary. An analysis of the test scores revealed that the critical ratio for questions based on the program was 5.35 which is significant beyond the .01 level. The analysis of the non-programed items showed a critical ratio of .48, which was not significant, and therefore occurred by chance.

At the .05 level a critical ratio of 1.65 is needed. Critical ratio for complete scores combining both items on the test was 2.20, which is significant at the .05 level of confidence, but not at the .01 level. From this score it could be concluded that students who took the program did somewhat better on the entire test than did students who did not take the program.

Many of the students who took the program commented on the ease of learning from the program as opposed to a reading assignment or taking notes in lecture and discussion.

Thus, the null hypothesis: $H_0$: There is no
difference in the amount of learning that takes place between students who use programmed instructional materials and students who receive instruction by means of lecture, discussion, and reading assignments is rejected.

Hypothesis $H_1$: Students who receive programmed instruction will score significantly higher on a thirty item sub-test on protein nutrition than students who receive instruction involving lecture, discussion, and reading assignments is accepted.

The writer recognizes a built-in bias towards the use of the program with her students. However, this effect was somewhat diminished by the fact that the teacher administering the program also gave the instruction to the students not using the program. These students all received the same material in class, which may not have been possible if another instructor had been asked to participate in classroom instruction.

To summarize, the effectiveness of programmed instruction for teaching high school girls nutrition was supported by the data obtained from the study.
Implications for Use of Programed Instruction in the Classroom

There are many implications for the use of programed instruction in the high school setting. Those students who have difficulty reading and understanding written material have a predigested form of instruction in a given program. For those who find notetaking and keeping track of their notes difficult, the program is an invaluable way of keeping track of course material. The fact of life for many teachers of home economics is that many students, if not the majority, will not seek academic training beyond the high school level. It follows that the home economics teacher must make the student's time in high school as meaningful as possible. Programed instruction makes possible a form of study which strongly motivates the student right in the classroom.

Recommendations for Further Study

To carry out the possibilities for further study, other areas of nutrition should be investigated experimentally in the classroom. Boys should be included in the studies whenever possible. Another area to be explored is the use of the program with the bilingual student who has difficulty in understanding what is verbalized in the
classroom but who better understands written language.

Another possibility is a study which would involve longer period of time between program and test. Students who used the program could be compared with those who received traditional instruction, to see if the program was effective over longer intervals.

If we as teachers are going to effect changes in the nutrition habits of our students, we have to make some real changes in the way nutrition has been taught in the past. Much of the success in nutrition education depends upon the individual teacher and how well he knows and applies modern principles of learning.

Present understanding makes it clear that children learn for themselves -- that they are not taught. Teachers merely create the conditions from which children learn, and real learning basically implies a change of behavior that results only when children undergo experiences that are vital to them and in which they become genuinely involved (25:19).

This writer believes that program instruction truly involves the student and contributes to a more meaningful form of learning than does textbook teaching.
APPENDICES
APPENDIX I

PROGRAM OF BASIC PROTEIN NUTRITION
PROGRAM OF BASIC PROTEIN NUTRITION

Do exactly as the instructions say
The responses are on the page following the questions. Look at the correct response only after you have made and written your own response. Next, compare your own response with the correct one.

When you work with this program, it is important that you follow the directions in each frame. For example, the directions may say -- fill in the blank, check the box, go back to a previous frame, or, make a correct selection.

A frame is made up of

- information only
- correct responses only
- both information and correct response

Turn the page when you have made your selection and compare your answer with the correct answer.
both information and correct response
For example:

1. Mrs. Holmes is preparing to go marketing. Her shopping list consists of many items. Among the food-stuffs that she will purchase, meat is at the top of her list. Because Mrs. Holmes knows that meat is important, she will spend more money for it than for any other item on the list. When you read about Mrs. Holmes again at the end of this program, you will know why she considers meat so important.

Turn the page to find out the correct answer.
No response required

Don't look back to the previous frames in order to answer the questions unless you are directed to do so. If you do make an error, be sure you understand why you made the error before you go on to the next frame.

You will now begin the program.
2. In her family, Mrs. Holmes has four growing children, a healthy husband, and her mother, who is recovering from surgery. All of these people need the nutrition that meat provides in their diet. Check the answer or answers that give the reasons you think are true.

___ Meat is important to children for growth.
___ Meat is necessary for complete recovery from surgery.
___ Meat is necessary to repair tissues in healthy individuals.
All three responses are true.
3. It is easy to see why it is important to use meat in our diet. It is necessary for growth; it is necessary for rebuilding and repairing body tissues. To understand the reasons for these functions, we must know what meat is made of, and why it acts as it does, in the body. Meat is composed of protein. All body cells are composed of proteins. Meat supplies the proteins the body cells need. Check the statement or statements that you think are true.

___ Protein is necessary for growth.
___ Protein is necessary for repair of body tissues.
___ Protein is necessary for body tissue.
All three responses are true.
4. Read statement number three over again and fill in the blanks in the following statements:

__________________________ is found in all body cells.

__________________________ supplies protein the body needs.
5. It is only through the process of digestion that the body can make use of the proteins found in meat. These proteins, found in all of the tissues of the body, are broken down into amino acids by means of the digestive process. Complete the following statements.

A. Protein cannot be used by the body until it is broken down into __________ ________.

B. The process responsible for breaking down protein into amino acids is known as ________________.

C. One foodstuff which supplies these nutrients is ________________.
A. Amino acids
B. Digestion
C. Meat
6. There are about twenty-two amino acids that make up proteins. Of these, eight must be supplied by food to insure growth, maintenance, and repair in adults. These essential amino acids are contained in foodstuffs made up of animal protein. Complete the following statements:

A. Foodstuffs made up of _______ _________ supply essential amino acids to the body.

B. _______ _________ support growth.

C. _______ _________ build body tissue.

D. _______ _________ keep body tissue in repair.
Animal proteins
7. Meat protein is not the only food source of the essential amino acids. Other sources of the essential amino acids are eggs, fish, poultry and milk. All are from animal sources. Complete the following sentence:

Other sources of animal protein are _______, _______, _______, and _______.
eggs, fish, poultry, and milk.
8. Look back to statement number six and see how many amino acids are considered essential. The protein foods that contain all of the essential amino acids are said to be complete proteins. Reread number seven and list the complete proteins.

____________, __________, __________,
____________, __________.
eggs, meat poultry, fish, milk.
9. Proteins that do not contain all of the essential amino acids are called incomplete. Some examples of food containing incomplete protein are cereal, macaroni, flour, corn, and gelatin. Match each of the following foodstuffs with the type of protein it supplies.

A -- Complete

B -- Incomplete

___ Steak

___ Corn-on-the-cob

___ Molded fruit salad

___ Swordfish

___ Egg salad

___ Corn flakes

___ Spaghetti
10. It is possible to combine an incomplete protein such as cereal with a complete protein such as milk to form a complete protein. Match each foodstuff on the right with the correct foodstuff on the left:

A -- Complete
____ Spaghetti and meat balls
____ Fruited gelatin
____ Tuna salad
____ Cooked oatmeal

B -- Incomplete
11. In order to be sure that we get enough protein in our diet, it is important that we include a source of complete protein at each meal. Check the item in the box on the left that represents a complete protein:

- [ ] orange juice
- [ ] farina
- [ ] toast
- [ ] eggs
- [ ] coffee
eggs
12. Below are two breakfast menus -- A and B. Indicate in the box on the left if one or both contain a complete protein.

A.
- grapefruit
- oatmeal
- toast and butter
- milk

B.
- stewed prunes
- pancakes and syrup
- broiled ham
- coffee
Both are correct.
13. Let us go back to Mrs. Holmes. Her weekly marketing list will be based upon the menus for the coming week. Here are five typical breakfasts for her family. Which ones do not contain a complete protein? Check the ones at the left of the menu.

___ A. Orange slices
   French toast
   syrup
   cocoa

___ B. Grapefruit juice
   cornmeal muffin
   butter and jelly
   tea

___ C. Apple juice
   poached egg on toast
   bacon
   milk

___ D. Half grapefruit
   cinnamon toast
   coffee

___ E. Applesauce
   sweet roll
   coffee
B, D, E.
14. Mrs. Holmes has planned dinner menus as well. From the list below, select dishes that would supply complete protein to Mrs. Holmes' menus:

1. tomato juice
2. cherry cobbler
3. sliced carrots
4. green salad
5. macaroni salad
6. tuna-noodle casserole
7. baked potato
8. spaghetti with clam sauce
9. macaroni and cheese
15. Now you should be able to understand why Mrs. Holmes has placed meat at the top of her shopping list. Also, included in her weekly list will be eggs, bread, cereal, fish, poultry, fruits and vegetables. However, Mrs. Holmes will spend most of her food dollar on foods that supply complete protein to the diet.
APPENDIX II

POSTTEST
PART ONE. Multiple choice -- Write letter of the correct answer.

1. Write the letter of the descriptive phrase which best demonstrates that heat toughens protein.
   a. tender, juicy steak
   b. stringy cheese
   c. firm gelatin mold
   d. soft, cooked egg

2. Which of the following is not a leavening agent?
   a. yeast
   b. steam
   c. air
   d. flour
   e. acid and soda

3. After surgery a dietary increase is necessary in:
   a. butter and margarine
   b. non-dairy products
   c. breads and cereals
   d. meat, milk, and eggs

4. Circle the name of the ripened cheese.
   a. ricotta
   b. neufchatel
   c. cheddar
   d. cottage cheese
   e. cream cheese

5. Which government agency is responsible for meat inspection?
   a. U. S. Department of Agriculture
   b. Federal Trade Commission
   c. Federal Food and Drug Commission
   d. None of these
6. When protein foods are broken down they form a product known as:
   a. enzymes
   b. carbohydrates
   c. amino acids
   d. polyunsaturated fatty acids

7. Milk is important for its contribution of calcium and phosphorous in the diet. A glass of milk should be included in one's meal plan:
   a. twice a day
   b. 3 times a week
   c. 4 times a week
   d. 3 times a day
   e. occasionally

8. Green and yellow vegetables, rich in Vitamin A, should be eaten:
   a. every day
   b. every other day
   c. 3 times a week
   d. 3 times a day
   e. once a week

9. Vitamin A is also contained in:
   a. buttermilk
   b. skim milk
   c. homogenized milk
   d. non-fat milk
   e. none of these

10. Meat and eggs supply the protein our body needs to:
    a. promote vision
    b. repair tissue
    c. lose weight
    d. promote coordination

11. Milk which has been held at a high heat for a short period of time has been:
    a. homogenized
    b. churned
    c. sterilized
    d. pasteurized
    e. certified

12. A reduction diet should be deficient only in:
    a. fat
    b. carbohydrate
    c. calories
    d. protein
    e. water
*13. For optimum health one should have protein foods:

a. as a growing child
d. in old age
b. as a young adult
e. all of the above
c. in middle age
f. none of the above

PART TWO. Match the following list of foods with its leading nutrient.

<table>
<thead>
<tr>
<th>COMPLETE PROTEIN</th>
<th>VITAMIN C</th>
<th>IRON</th>
</tr>
</thead>
<tbody>
<tr>
<td>VITAMIN A</td>
<td>VITAMIN D</td>
<td></td>
</tr>
<tr>
<td>1. Lemonade</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Acorn squash</td>
<td></td>
<td></td>
</tr>
<tr>
<td>*3. Roast beef</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Enriched bread</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Butterfat</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Oleomargarine</td>
<td></td>
<td></td>
</tr>
<tr>
<td>*7. Tuna fish</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Spinach</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Enriched cereal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>*10. Egg white</td>
<td></td>
<td></td>
</tr>
<tr>
<td>*11. Egg yolk</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Carrots</td>
<td></td>
<td></td>
</tr>
<tr>
<td>*13. Shrimp salad</td>
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<td></td>
</tr>
<tr>
<td>*14. Skim milk powder</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. Water soluble</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. Grapefruit juice</td>
<td></td>
<td></td>
</tr>
<tr>
<td>*17. Essential amino acids</td>
<td></td>
<td></td>
</tr>
<tr>
<td>*18. Buttermilk</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19. Destroyed by air</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20. Sliced oranges</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21. Cod liver oil</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22. Tangerines</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23. Whipped cream</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24. Sun light</td>
<td></td>
<td></td>
</tr>
<tr>
<td>*25. Cereal plus milk</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
PART THREE. Matching -- Match the correct letter on the right next to the number on the left.

1. To cook meat in a liquid or a covered pan.
   - h a. meringue
2. To cut across and down and over as in a batter.
   - i b. gluten
3. To cook by immersing in simmering water.
   - j c. sodium aluminum sulfate
4. To cook just under 212° F.
   - l d. mono-sodium glutamate
5. A combination of chocolate and coffee.
   - e e. marinade
6. A tasteless chemical which brings out flavor in foods.
   - f f. seasoned salt and coffee.
7. A combination of seasoning combined with salt.
   - g g. fold
8. A chemical leavening agent.
   - h h. simmer
9. Oil-acid mixture.
   - i i. poach
10. Emulsifying agent.
    - j j. brash
11. A stiffly beaten mixture of egg white and sugar.
    - k k. mocha
12. Protein portion of flour.
    - l l. eggs
13. Incomplete protein.
    - m m. grill
    - n n. gelatin

PART FOUR. True-False -- Mark T or F in front of each statement.

1. Three teaspoons is the same as one tablespoon.
   - F
2. To beat is the same as to stir.
   - F
3. Whipping heavy cream is easier because it has a high butterfat content.
   - F
4. After surgery an increase in protein foods is necessary.
   - T
5. Russian service is an extremely formal type of service.
   - F
6. Enriched cereal supplies high quality protein to the diet.
   - T
7. Pastry and cake flour differ from all-purpose flour in their gluten content and the degree to which they are fine-milled.
   - F
8. There are 3 cups in a pint.
   - T
9. Although milk is a useful food, it is only really important for young people to drink it.
   - F
10. Measuring cups are graded in eighths.
11. Cakes can fall if too much sugar is added.
* 12. Corn-flakes and milk can supply complete protein to the diet.
  13. Long beating is good for muffins.
  14. When baking in glass the oven temperature should be raised 25°F.
* 15. Spaghetti and corn supply complete protein to the diet.
  16. Aluminum reflects heat; therefore, a turkey wrapped in foil will brown slowly.
  17. Red, new potatoes can be substituted whenever baking potatoes are needed.

PART FIVE. Completion

1. When cracked open a fresh egg yolk (is pale yellow, is bright yellow, stands up) while a stale egg (is green, flattens out, has blood spots).
2. (Russian, Buffet) service is best for serving large groups in small areas.
* 3. Protein is a constituent of (some, all, none) body cells.
4. A can marked orange juice contains (75%, 100%, 50%) orange juice.
5. Besides being an expensive source of calcium, evaporated milk is useful because it (whips, stores, blends) easily.
6. The process by which the body breaks down foodstuffs is known as (metabolism, digestion).
7. (Roast, pot roast), (broil, boil), (simmer, grill) are all examples of dry heat cookery.
8. There are (12, 14, 16) T in one cup.
* 9. (Complete, Complex) (protein, carbohydrates) keeps body tissue in repair.
10. Vitamin D is added to foodstuffs to prevent (night blindness, rickets, scurvy).
11. A calorie is a unit of (heat, cold, fat, protein).
* 12. Ten is the number of (lactic acids, amino acids) which are considered essential for growth.
13. Gelatin is an example of protein which is (cold, incomplete, high quality).
14. The laboratory that I enjoyed most this semester was . Why?
* 15. The high quality protein the body needs is supplied by foods such as (meat, bread), (fruit, milk), (fish, corn), (eggs, sour cream).
16. Swiss cheese is sold in 2 different packages; 1 package weighs \( \frac{2}{3} \) lb. for 49¢, the other 1 lb. for 89¢. Which one is the best buy? __________

MULTIPLE CHOICE -- Write the letter of the correct answer.

1. An excellent source of Vitamin A are:
   a. celery stalks  d. summer squash  
   b. cucumbers  e. beets 
   c. yams 

*2. Select the foodstuff that represents incomplete protein.
   a. steak  c. molded fruit salad  
   b. swordfish  d. egg salad 

*3. The type of protein which promotes growth is known as:
   a. cereal protein  c. granular protein  
   b. animal protein  d. blood protein 

*4. Select the meal which offers the best nutritive selection.
   a. orange slices, French toast, cocoa  
   b. grapefruit juice, blueberry muffin, butter, tea 
   c. tomato juice, toast, coffee

*5. Select the lunch menu which provides the most nutritive value.
   a. ham sandwich, apple, milk  
   b. hamburger on bun, iced tea 
   c. vegetable soup, carrot sticks, lemonade
TRUE AND FALSE

_____ 1. A molded cottage cheese salad supplies more high quality protein than a molded fruit salad.

_____ 2. Cooked oatmeal is a better source of high quality protein than cooked spaghetti.

_____ 3. Tuna noodle casserole and tuna salad can be good sources of complete protein.

_____ 4. If a baked potato is cooked properly it will supply high quality protein to the diet.

_____ 5. Poached egg on toast is a better source of complete protein than cornmeal muffin.

*Indicates items that relate to program.


