AN EVALUATION PROGRAM TO MEASURE THE ABILITY OF STUDENTS TO APPLY PRINCIPLES OF NUTRITION

by

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CHAPTER 1

Introduction

"In the destiny of nations, the supreme importance of nutrition has been demonstrated."[1] Great strides have been made in the last decade or two in our scientific knowledge of this relatively new science of nutrition. The illuminative and revealing statistics available on the draftees of World War Number One caused many agencies to coordinate their efforts and expand their programs in a campaign for better health through sound nutrition. Much of this concerted effort was very properly directed toward making better nutrition a reality for families in greatest need. Financial disability is rightfully recognized as one of the determining factors responsible for such shocking statistics, but vying for equal importance is ignorance of nutrition and a failure on the part of those educated in the science to apply what they know.

The number of students of the subject of nutrition has increased from year to year as is evidenced from the increased enrollment in elementary, secondary, and higher institutions offering instruction in the subject.[2] However, when the clarion again sounded the call "To Arms", and shortly after the Selective Service Act went into effect, military authorities were appalled to find that over 40 per cent of our citizenry was undernourished. Studies summarized by

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[1] Paul V. McNutt, "Your Responsibility", Your Defense, (Minneapolis, Minnesota: General Mills, Inc., n.d.), 4.

[2] United States. Bureau of the Census. Statistical Abstracts of the United States, 1941, 132.

Stiebling[3] indicate that millions of people in this country are living on diets below the safety line.

It is apparent that efforts in the field of nutrition education have not met with overwhelming success for malnutrition is now recognized as the Nation's number one health problem as well as the saboteur of man-power.

It would seem then, incumbent upon the professionally trained home economists and nutritionists to unite their efforts as never before with our national leaders and representatives who are directing their energies toward making "America strong by making Americans stronger."

Taba[4] points out that "increasingly, teachers are more concerned with the ability of the children to use facts which they learn rather than with the mere recall of information. Often, however, teachers assume that the possession of information is also an indication of ability to use it. Numerous psychological studies have been conducted to show that this is not the case. .... They may know a good many scientific principles and facts, but be incapable of relating that knowledge to their everyday lives. Thus a direct appraisal of the ability and inclination to use information is needed."

The title of this problem has been stated as an evaluation

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3 Hazel K. Stiebling, Are We Well Fed? A Report on the Diets of Families in the United States. Family Economics Division, Bureau of Home Economics. Miscellaneous Publication No. 430 (Washington: U.S. Department of Agriculture, 1941), 1.

4 Hilda Taba, "Functions of Evaluation", Childhood Education, XV (February 1939), 245.

program for measuring ability to apply principles of nutrition. The study employs data on students enrolled in a general course in nutrition in Marygrove College, Detroit, Michigan, and Saint Joseph's College, Emmitsburg, Maryland, and represents the results of a survey in which an attempt was made to measure:

1. By means of an objective paper-and-pencil test of the true-false, multiple choice, matching and completion type, how much information was gained by the students.
2. The performance of these same students on a second paper-and-pencil objective test designed to measure ability to apply principles in new situations.
3. The degree of correlation, if any, existing between:

   a. knowledge of facts and ability to apply principles;
   b. intelligence and knowledge of facts;
   c. intelligence and ability to apply principles.

The normative-survey method of research was employed by the author since according to Good[5], Barr[6], Caswell[7], and others, this method is a basic type of appraisal for obtaining a description of conditions as they actually exist. A characteristic of this method and all other methods of research is that the answer to the problem under investigation is not found in the data collected, but attention is

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5 Carter V. Good and others, The Methodology of Educational Research, (New York: Appleton-Century, 1938), 286-481.

6 A. S. Barr and others, "A Symposium on the Classification of Educational Research", Journal of Educational Research, XXIII (May 1931), 353-382; XXIV (June 1931), 1-22.

7 Hollis Leland Caswell, "Survey Techniques", Educational Administration and Supervision, XIX (September 1933), 431-441.

focused on needs that might otherwise escape observation, and it is quite possible that assumptions may be made with regard to the facts as disclosed and their apparent causes.

This study makes no attempt to prove that students who do well on an achievement test of factual knowledge will likewise do well in the application of this knowledge, nor was it designed to prove that students of greater intellectual ability are superior in rank in the mastery of either factual knowledge or ability to apply this knowledge.

Further, the author is well aware that tests alone are not the only evidence of a pupil's mental ability, and that there are in the field of measurement many ways of evaluating outcomes of instruction other than the paper-and-pencil test method.

The writer is cognizant of the limitations of the sampling of cases used in this testing program. However, Chadderdon[8] calls attention to the fact that "Undoubtedly, up to a point a larger number of cases may result in a more adequate sampling of the population, but there are studies in which the problem of sampling does not occur and also studies in which a few cases given very careful consideration are more important educationally than those including a larger number of cases treated with less detail."

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8 Hester Chadderdon, "Research Round Table on Home Economics Education", Journal of Home Economics, XXIX (October 1937), 553.

9 Ernest W. Tiegs, Tests and Measurements for The Improvement of Learning, (Boston: Houghton, 1939), 405.

Elsewhere Tiegs[9] says "the size of the school or school system should have no particular influence on the testing program. The same information is needed in all communities and the accidental birthplace of a student should not determine the quality of his instruction."

CHAPTER II

Review of Literature

Educational measurement is not an extraordinary or novel innovation. McCall[1] quoting from a student's theme tells us that "Educational measurement is ancient as a fact, medieval as a process and modern as a science."

The same author[2] quotes the notification given to the graduating class at St. Lawrence College by Owen D. Young, "that the world tests continuously and often when the testee is quite unaware of it, that this testing is so prolonged that the candidate cannot profit by lucky questions, and that the student should test himself often and searchingly, for though he may be justified in fooling others he cannot afford to fool himself."

In traditional schools mastery of information and of skills have been judged to have been the cardinal and almost the sole objective. Modern educators have been placing increasing emphasis on social relationships, interests, critical thinking, and the like. When objectives change, new methods and new techniques of measurement are demanded.[3]

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1 William A. McCall, How To Measure in Education, (New York: Macmillan, 1929), 15.

2 William A. McCall, Measurement, (New York: Macmillan, 1939), 34.

3 J. W. Wrightstone, "New Days, New Goals, New Tests", School Executive, LVIII (June 1939), 13-14.

In defense of the progress of modern education Orata[4] says "In recent years, the trend has been to regard education more as a process of growth and development than as one of mere acquiring of skill and information, and to emphasize the importance of attitudes and appreciation, interests, aims and purposes, emotional stability and control, personal and social adjustment, functional information, application of principles, interpretation of data, social sensitivity, study skills and work habits, creativeness, and like processes.

In treating of the major objectives of modern education, Raths[5] says "One of the major objectives of our schools is to develop in students the ability to use their newly gained facts and generalizations in situations that are new and which, more frequently than not, lie outside the classroom."

According to Spafford[6] "an individual may be said to have acquired a behavior pattern in a form to control intelligently future action when he has become aware of its basic principles, recognizes situations calling for its use and feels strongly concerning its application, satisfied when it has been used and dissatisfied when it has not."

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4 Pedro T. Orata, "Evaluating Evaluation", Journal of Educational Research, XXXIII (May 1940), 641.

5 Louis E. Raths, "Application of Principles", p. 1, Progressive Education Bulletin, No. 5, 1936.

6 Ivol Spafford, Fundamentals in Teaching Home Economics, (New York: Wiley, 1942), 115.

That knowledge or acquisition of facts, is a necessary and indispensable prerequisite to the ability to apply any principle, is a premise acceded to by all right-thinking individuals. But that information should not be an end in itself is well brought out in a discussion by Williamson and Lyle[7] as follows: "The mere acquisition of facts is not education, for education occurs only when a person is changed in some way - when his attitudes, his habits of action, his abilities are changed. .... Information is necessary to understanding but knowledge of certain facts does not insure understanding, since recognition of the full meaning of the facts and of their application to a variety of situations is necessary to understanding."

Progressive teachers desire to know whether their students are growing in these above-mentioned traits, to learn why some students do not show progress along these lines, and to discover some remedial measures to apply. Diagnostic techniques or procedures are necessary if this desire is to be satisfied. According to Chadderdon[8] "the more important testing is going to be done as a result of individual teachers being concerned about the effectiveness of their teaching and the improvement of their ability to measure outcomes."

Neither tests nor evaluation programs can be expected to develop in the students attitudes or skills, but through them the teacher can determine to what degree he has contributed to pupil growth. These

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[7] Maude Williamson and others, Homemaking Education In The High School, (New York: Appleton-Century, 1941), 82.

[8] Hester Chadderdon, "Measurement in Home Economics Education", Practical Home Economics, XIII (October 1935), 289.

techniques have the power of showing how well the student can distinguish between fact and opinion, draw generalizations, determine cause and effect, and judge relevancy of facts.[9]

McCall[10] says "measurement and education are like the twin girls whose hair the mother of many children braided together. Neither of the twins could move unless both moved together."

Tiegs[11] says "evaluation is not an added activity, but an essential part of good teaching procedures which justifies itself on the basis of results."

According to Brown[12] evaluation can be used for each of the following purposes:

"1. To improve instruction so that learning may be more effective.
2. To enable schools to measure their educational efficiency and to discover what changes need to be made in curriculum content and methods of teaching.
3. To furnish students and their parents with information regarding their achievement in the light of their abilities and aptitudes.
4. To provide a basis for guidance - personal, educational, and vocational.
5. To furnish information to higher institutions of learning regarding the capacity and achievement of students who desire to attend them.

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[9] J. C. Aldrich, "Testing or Evaluation", Scholastic, XXXVll (October 28, 1940)

[10] William A McCall, Measurement, (New York: Macmillan, 1939), 19.

[11] Ernest W. Tiegs, Tests and Measurements in the Improvement of Learning, (Boston: Houghton, 1939), 405.

[12] Clara M. Brown, Evaluation and Investigation in Home Economics, New York: Crofts, 1941), 13.

6. To furnish information to prospective employers regarding candidates for jobs.
7. To provide tools for educational research.
8. To enable schools to demonstrate what they are accomplishing in order to justify their demands for adequate financial support."

Tiegs[13] in treating of the function of measurement says "The primary purpose of applying informal, objective tests is not to obtain data upon which to mark pupils; it is rather to obtain the exact status, as far as possible of each pupil with respect to certain ideals, attitudes, skills, and knowledges which constitute the objective of a certain segment of educational experience."

In times past, the techniques for measuring the results of teaching, like the teaching itself, were for the most part constructed and used to test factual knowledge. According to Brown[14] "teachers tended to attach undue importance to the students' ability to reproduce factual information and to give too little consideration to their ability to use what they were learning, either because it was easy to measure knowledge of facts and more difficult to measure understanding and the ability to apply them or because teachers were not aware of the lack of relationship which may exist between the ability to regurgitate facts and the ability to utilize them."

The ability to utilize facts is considered increasingly important, not only by teachers of the many and diverse subjects of

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13 Ernest W. Tiegs, Tests and Measurements for Teachers, (Boston: Houghton, 1931), 243.

14 Clara M. Brown, op. cit., 9.

instruction, but also by numerous leaders outside the field of pedagogy. The critical situation of the United States today with regard to the national health status presents a direct challenge to those who are engaged in teaching the subject of nutrition.

Doctor Sebrell[15], Chief of the Division of Chemotherapy, National Institute of Health, United States Public Health Service, declares that "Problems in nutrition which are urgent today are not especially those of research in physiology and biochemistry - problems in these fields although of the greatest fundamental importance, cannot be regarded as urgent in the face of comditions in the world today .... the problems that I regard as really urgent lie in the field of application of the fundamental knowledge we now possess."

Hambidge[16] draws a very striking parallel with regard to the negligence which exists in the application of knowledge of nutrition for human welfare. "The good farmer pays more attention to the proper feeding of his animals than to any other thing. He reads books about it, takes college courses dealing with the subject, seeks expert advice, watches eagerly for new information, is careful to apply in practice what he learns, and sedulously checks theory against results. Does he pay as much attention to the feeding of his bright-eyed daughter? Does he know nearly as much about the balanced ration needed to turn a promising girl into a fine woman as about the ration needed to turn a

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[15] W. H. Sebrell, "Urgent Problems in Nutrition for National Betterment", American Journal of Public Health, XXXII (January 1942), 15-20.

[16] Gove Hambidge, Your Meals and Your Money, (New York: McGraw-Hill, 1934), 4.

promising heifer into a fine cow? No, many a man would be ashamed to feed his livestock as casually as he feeds his family, if he knew what he was doing."

In comparatively recent times techniques have been developed for testing objectively the ability of students to apply facts, principles and definitions to situations which are new. These instruments of appraisal include rating scales, observational techniques, questionnaires, anecdotal records of pupil activities, interest scales, as well as the more common paper-and-pencil tests.

Raths[17] reports results on students who were examined by the essay test and the new type paper-and-pencil objective test. The students who did well on the essay test in the particular field being tested also did well on the objective test. The correlation between the results of the two tests was found to be about .90.

Price[18] describes devices which she used in a recent study by which she approached the measurement of decision-making ability in three ways, all of which proved helpful as teaching devices as well as evaluation instruments. One phase of this study involved the setting up of decision situations typical of those met by adolescents. For each situation there were listed several possible choices and the reasons which might be used to support these choices. About 1,100

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[17] Louis E. Raths, op. cit., 4.

[18] Hazel H. Price, "Measuring Ability To Make Wise Decisions", Journal of Home Economics, XXXV (June 1943), 349.

high school and college students co-operated in this phase of the study. The significant findings reported on this phase were: the student generally supported her statements by only a little over a half of the relevant facts listed in the test; her ability to see consequences was not closely related to her age or school training; and she frequently seemed willing to sacrifice values important to democracy.

Coon[19] in a discussion of the General College program for developing tests at the University of Minnesota reports the development of tests with "rather high reliability for measuring understanding of relationships and ability to apply principles. However there was found to be practically no correlation between the scores on questions measuring knowledge of art principles and those concerned with ability to apply these principles."

While the number of objective-type tests for measuring the different phases of thinking has been increasing in the field of general education, the number of tests showing application of these same procedures in the field of Home Economics has not yet been significant.

To again quote Brown[20] "When educators become concerned with obtaining evidence regarding students' understanding of the meaning of what they study, their skill in using what they learn, and their interests, attitudes, and emotional balance, it may well be that

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19 Beulah I. Coon, "A Survey of Studies Related To The College Curriculum in Home Economics", Journal of Home Economics, XXIX (March 1937), 155.

20 Clara M. Brown, op. cit., 10.

young people will be far more competent individuals than the majority of them are today and they will be better adjusted and happier people."

CHAPTER III

Presentation of Data

The objectives[1] and the paper-and-pencil tests[2] used in this study were constructed with adherence to the general suggestions of Hawkes[3], Tyler[4], Brown[5], and others. The original drafts of the tests were given to a group of forty college students not engaged in the final study in order to eliminate ambiguities, to determine the difficulty of the test items, and to obtain the reliability of the whole test.

On the basis of the responses of this exploratory group, some items in the tests were eliminated and the wording of others were altered. The revised tests were then administered to thirty-six college students of nutrition and to thirty-six college students who had had no instruction in the subject. Because of the great impetus given to the subject of nutrition in recent times, it was a point of interest to discover how much, if any knowledge of the subject might possibly have been acquired by association with students of nutrition, or by way of the radio, magazines, and newspapers.

In order to eliminate as far as possible the element of

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1 See Appendix p. 1.

2 See Appendix p. 3.

3 Herbert E. Hawkes and others, The Construction and Use of Achievement Examinations, (Boston: Houghton, 1936), 107.

4 Ralph W. Tyler, Constructing Achievement Tests, (Columbus: The Ohio University Press, 1934), 4.

5 Clara M. Brown, Evaluation and Investigation in Home Economics, (New York: Crofts, 1941), 4.

"guessing" by the students who had had no instruction in the subject, the examiner explained to the examinees that they would not be expected to know the correct answers, and to answer only those questions for which they honestly believed they knew the answer.

Test Number 1 was administered one day and Test Number 2 on the day following. The total time allowed for each test was approximately fifty minutes.

Test Number 1 was corrected and the scores obtained by subtracting the number of items incorrectly answered from the total number of test items. As indicated in Table 1 the average score on this test was 85 and the average deviation, 12.

Letter grades were assigned to the scores of Test Number 1 using the following method[6]:

1. Add two times the average deviation to the average. The result will be the lower limit of the "A" group.
2. Add two-thirds of the average deviation to the average. The result will be the lower limit of the "B" group.
3. Subtract two-thirds of the average deviation from the average. The result will be the lower limit of the "C" group.
4. Subtract twice the average deviation from the average. The result will be the lower limit of the "D" group.

The number of cases falling within each grade level is well distributed, as may be seen in Figure 1, p. 18.

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[6] Herbert E. Hawkes and others, op. cit., p. 121.

TABLE 1

SCORES, DEVIATIONS, AVERAGE SCORE, AND AVERAGE DEVIATION OF TEST NUMBER 1

Pupil	Score	Deviation
1	114	29
2	109	24
3	107	22
4	106	21
5	105	20
6	105	20
7	102	17
8	100	15
9	99	14
10	94	9
11	94	9
12	92	7
13	91	6
14	91	6
15	91	6
16	90	5
17	89	4
18	88	3
19	85	0
20	83	2
21	81	4
22	80	5
23	80	5
24	78	7
25	77	8
26	77	8
27	76	9
28	76	9
29	74	11
30	72	13
31	71	14
32	71	14
33	71	14
34	67	18
35	55	30
36	50	35
N = 36	3091	443

3091 ÷ 36 = 85 = Average Score
443 ÷ 36 = 12 = Average Deviation

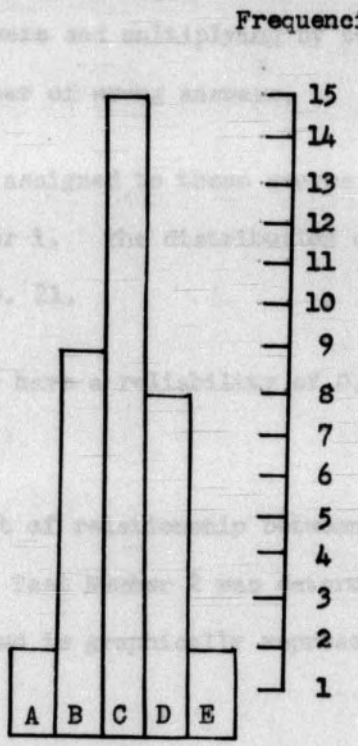

FIGURE 1

DISTRIBUTION OF SCORES FROM TEST NO. 1
SHOWN AS FREQUENCY POLYGON

The reliability obtained on this test was 0.94 as determined by the Split-Halves method and shown in Appendix, Exhibit A. The Spearman-Brown formula was applied for correction.

The scores on Test Number 2 as shown in Table 11 were obtained by counting the right answers and multiplying by two; then subtracting from that product the number of wrong answers.

Letter grades were assigned to these scores by the same method as was used for Test Number 1. The distribution of scores is represented in Figure 2, p. 21.

This test proved to have a reliability of 0.87 as is shown in Appendix, Exhibit B.

The degree or extent of relationship between the scores on Test Number 1 and the scores on Test Number 2 was determined by the use of the Spearman-Rank method and is graphically represented in Appendix, Exhibit C.

Another matter of concern was the relationship between the scores on Test Number 1 and the intelligence, and the scores on Test Number 2 and the intelligence. The percentile rank of the students on the American Council Psychological Examination was used to obtain the intelligence rank. In the Appendix, Exhibits D and E graphically represent this relationship.

The test results of the students who had had no instruction in the subject were subjected to the same treatment as were those of the students of nutrition. As was to be expected, the actual scores on these tests bore no direct relation to the scores obtained by the

TABLE 11

SCORES, DEVIATIONS, AVERAGE SCORE, AND AVERAGE DEVIATION OF TEST NUMBER 2

Pupil	Score	Deviation
1	63	28
2	58	23
3	57	22
4	55	20
5	53	18
6	50	15
7	48	13
8	48	13
9	48	13
10	48	13
11	47	12
12	40	5
13	39	4
14	39	4
15	38	3
16	37	2
17	36	1
18	36	1
19	35	0
20	34	1
21	33	2
22	31	4
23	31	4
24	31	4
25	29	6
26	28	7
27	28	7
28	27	8
29	27	8
30	26	9
31	26	9
32	23	12
33	16	19
34	12	23
35	0	35
36	-2	37
N = 36	1275	405

1275 ÷ 36 = 35 = Average Score
405 ÷ 36 = 11 = Average Deviation

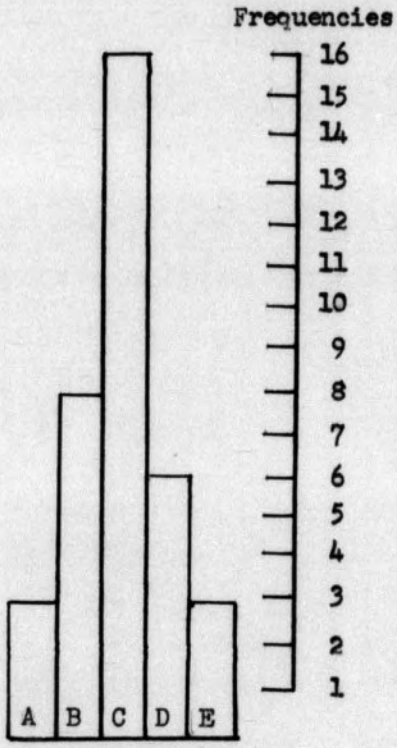

FIGURE 2

DISTRIBUTION OF SCORES FROM TEST NO. 2
SHOWN AS FREQUENCY POLYGON

students of nutrition. The highest score obtained by this group on Test Number 1 was 55; the highest reached in Test Number 2 was 32. Further reference to this data will be found in Chapter IV.

CHAPTER IV

Analysis of Data

An analysis was made of the achievement of the students on the factual knowledge contained in Test Number 1. This data is tabulated in Table 1, p. 17, which lists the students in rank order of their achievement, and shown graphically in Figure 1, p.18.

The percentage distribution of marks obtained after the letter grades were assigned as described in Chapter III, p. 16, was as follows:

Group	No. of cases	%
A	2	6
B	9	25
C	15	41
D	8	22
E	2	6
Total	36	100

It will be noted that the above distribution of scores closely approaches the distribution of the "normal" curve, in which according to Hawkes[1] the proportion of A's should be between 5 and 6 per cent, of B's between 24 and 25 per cent, of C's between 40 and 41 per cent, of D's between 24 and 25 per cent, and of E's between 5 and 6 per cent. The variability within the group is quite marked considering that in the series of well distributed scores, the highest mark achieved was 114 and the lowest, 50. Since the scores are not markedly skewed to the

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[1] Herbert E. Hawkes and others, The Construction and Use of Achievement Examinations, (Boston: Houghton, 1936), 122.

right or to the left, it would seem that the test was neither too difficult nor too easy, but apparently gave ample opportunity for expression to both the better and the poorer student.

A similar analysis of Test Number 2, the data of which is tabulated in Table 11, p. 20, according to the rank order of achievement, and shown graphically in Figure 2, p.21, showed that the percentage distribution of marks obtained after the letter grades were assigned was as follows:

Group	No. of cases	%
A	3	8.3
B	8	22.
C	16	44.4
D	6	17.
E	3	8.3
Total	36	100.0

A comparison of the above distribution with the distribution found on Test Number 1 shows that the number and percentage of cases of A's and E's on Test Number 2 increased 2 per cent; B's and D's decreased 3 and 5 per cent respectively; and as in Test Number 1, the greatest proportion of the students are within the C level.

The rather low coefficient of correlation between the scores of the two tests, estimated by the Spearman-Rank method to be 0.35 and graphically represented in Appendix, Exhibit C, seemed to indicate that the students who achieved high scores on Test Number 1 received correspondingly low scores on Test Number 2. Examination showed for example, that the student who received a score of 102 with a corresponding rank of 30 on Test Number 1, scored 16 with a corresponding rank of 4 on Test Number 2. Similarly, the student with a rank

of 29 on Test Number 1 achieved a rank of only 8.5 on Test Number 2. On the other hand, the student who scored 71 and ranked 5 in Test Number 1, succeeded in scoring 37 with a rank of 21 in Test Number 2, and the student scoring 76 and ranking 9.5 on Test Number 1 attained a score of 48 and a rank of 28.5 on Test Number 2.

The length of the line indicating the degree of decline from a higher score on Test Number 1 to a lower score on Test Number 2 gave rise to the question as to whether the students who ranked high on Test Number 2 wherein reasoning and judgment were exercised in the selection of the answers, might possibly be the students who would rank high in intelligence, and contrariwise for those students who ranked low in Test Number 2.

In Exhibits D and E are represented the percentile rank of the students on the American Council Psychological Examination, and the rank of the scores on Test Number 1 and Test Number 2. These Exhibits indicate almost negligible correlation between intelligence rank and Test Number 1, while a marked degree of correlation exists between the intelligence rank and the rank of the scores on Test Number 2.

In Figure 3 is even more clearly shown that those students who achieved the highest scores in the test of factual knowledge, and to the greatest extent the lowest scores on Test Number 2, were the students who ranked lowest in the group in intelligence. In fact, 55 per cent of the students in the lower half of the intelligence rank, scored high on Test Number 1 and low on Test Number 2. In like manner, 61 per cent of the students in the upper half of the intelligence rank,

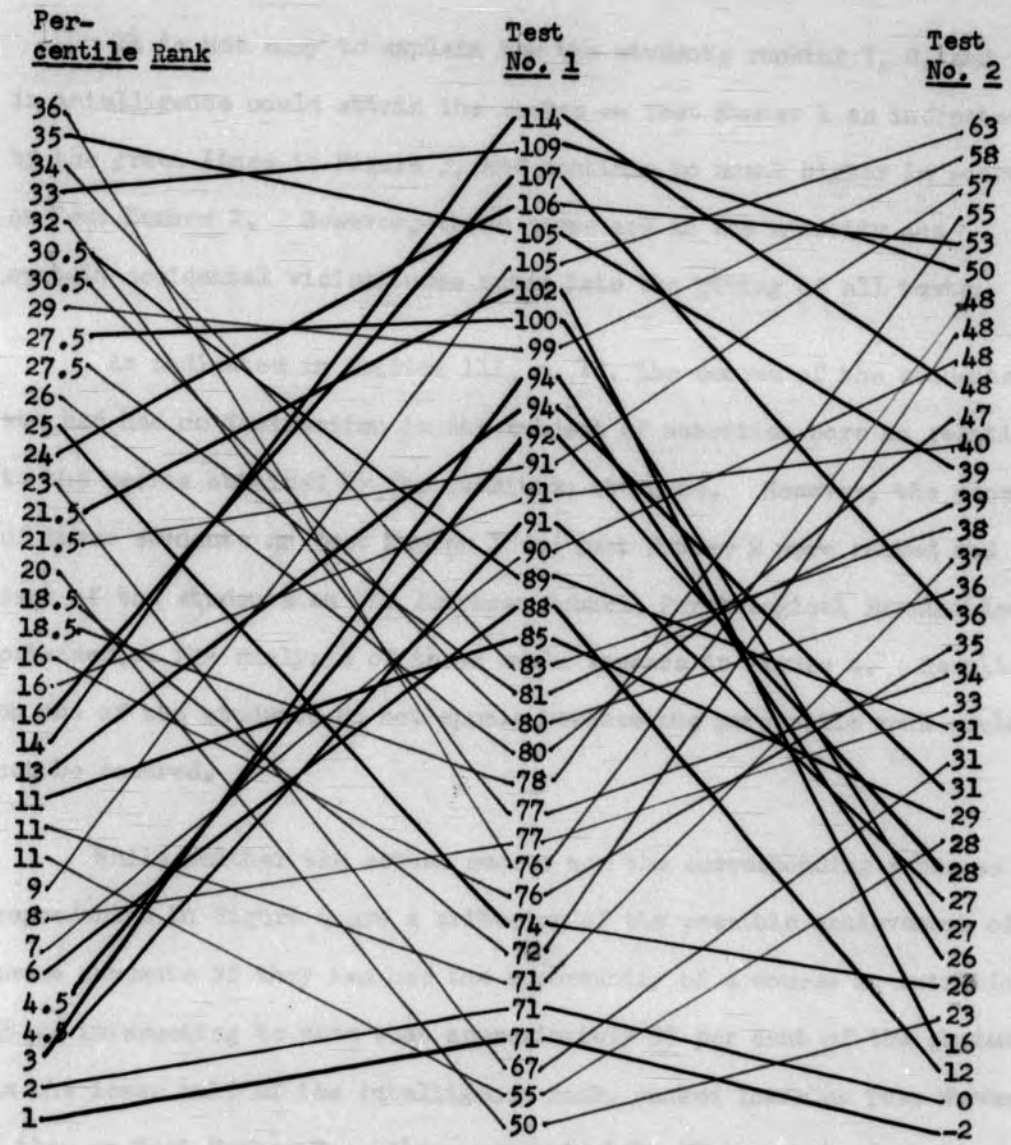


FIGURE 3

CORRELATION BETWEEN INTELLIGENCE AND TEST NO. 1; TEST NO. 1 AND TEST NO. 2; INTELLIGENCE AND TEST NO. 2, OF STUDENTS OF NUTRITION

scored higher on Test Number 2 than on Test Number 1.

It is not easy to explain how the students ranking 7, 8, and 9 in intelligence could attain the scores on Test Number 1 as indicated by the green lines in Figure 3, and continue to mount higher in scores on Test Number 2. However, these cases are in the minority and certain accidental vicissitudes enter into the giving of all tests.

As indicated in Chapter III, p. 19, the scores of the students who had had no instruction in the subject of nutrition bore no relation to the scores obtained by the nutrition students. However, the scores of these students on Test Number 1 and Test Number 2 were ranked and the rank of the students on the American Council Psychological Examination obtained. The analysis of these ranks appears in Figure 4. Results on one of the students do not appear because the percentile rank could not be secured.

While neither the actual scores nor the corresponding ranks as represented in Figure 4 are a criterion of the possible achievement of these students if they had had the opportunity of a course in nutrition, it is interesting to note that approximately 59 per cent of the students in the lower half of the intelligence rank, ranked lower on Test Number 2 than on Test Number 1. Also, approximately 53 per cent of the students in the upper half of the intelligence rank, ranked higher on Test Number 2 than on Test Number 1.

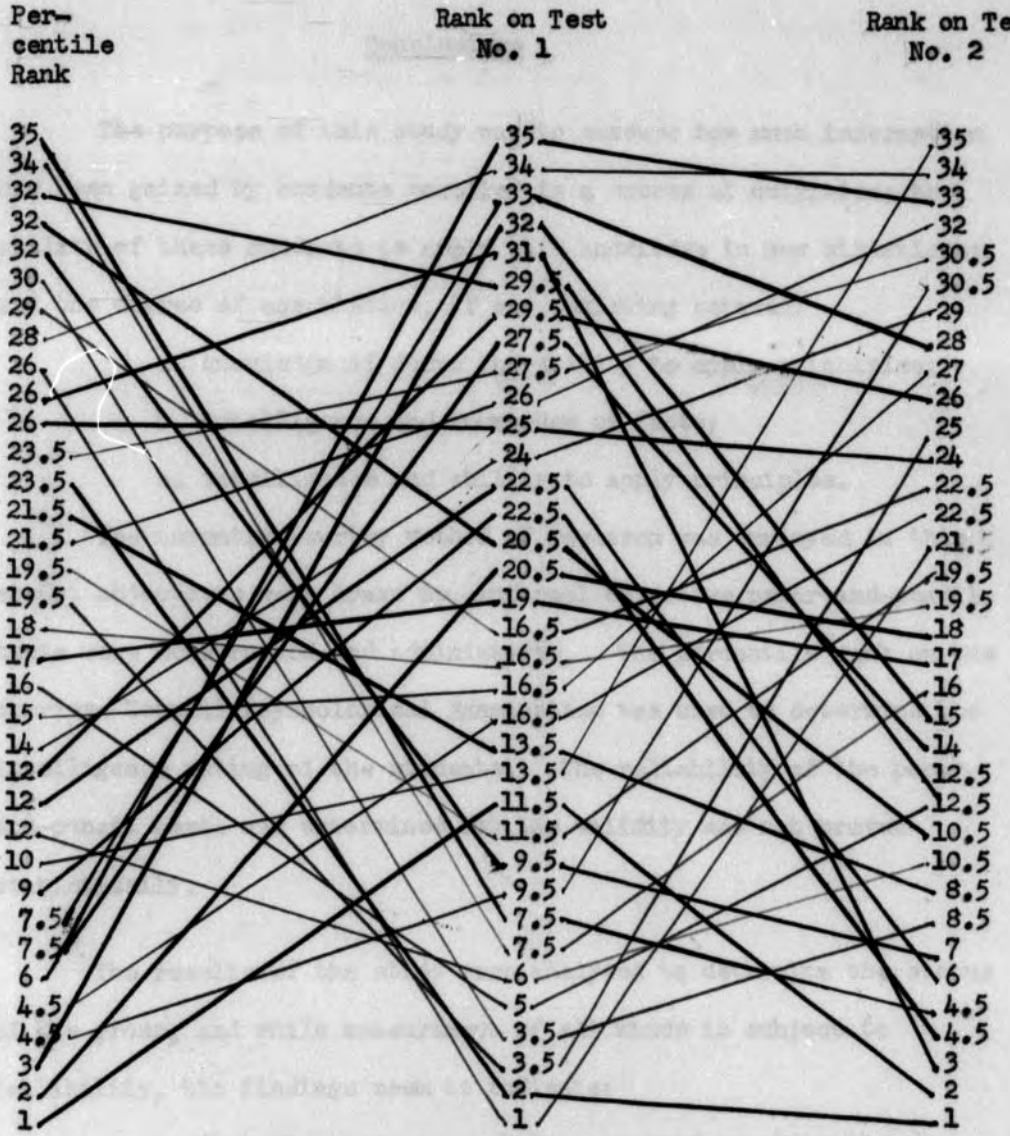


FIGURE 4

CORRELATION BETWEEN INTELLIGENCE AND TEST NO. 1; TEST NO. 1 AND TEST NO. 2: INTELLIGENCE AND TEST NO. 2, OF STUDENTS NOT INSTRUCTED IN NUTRITION

CHAPTER V

Conclusions

The purpose of this study was to measure how much information had been gained by students enrolled in a course of nutrition; the ability of these students to apply this knowledge in new situations; and the degree of correlation, if any, existing between:

a. knowledge of facts and ability to apply principles;

b. intelligence and knowledge of facts;

c. intelligence and ability to apply principles.

The normative-survey method of research was employed in this study, objectives were drawn up, informal objective paper-and-pencil tests were constructed and administered. The percentile rank on the American Council Psychological Examination was used to determine the intelligence rating of the students. The reliability of the paper-and-pencil tests was determined but the validity was not proven statistically.

The results of the study were analyzed to determine the status of the group, and while measurement of all kinds is subject to fallibility, the findings seem to indicate:

1. That the group as a whole possessed considerable factual knowledge of nutrition.
2. That as a group the students showed facility in the application of the principles to new situations.
3. That the success of an individual on a test of factual knowledge is no indication of that individual's ability

to apply her knowledge.

4. That it is quite possible, and more than mere chance, for a student with a lower rank in intelligence to achieve a higher score on a test of factual knowledge, than the student with a higher rank in intelligence.
5. That success in the application of principles of nutrition, as in the application of principles in any other subject, depends to a great extent on intelligence modified by application.

Recommendations

In concluding, the investigator suggests:

1. That further refinement of the objectives and techniques of measurement used in this study be made.
2. That in providing means of making nutrition education more effective, efforts be made to develop in the students the habit of collecting and considering appropriate evidence and information before making decisions.
3. Likewise, that the students be provided with situations for achieving greater facility in formulating and applying significant principles to new problems and situations.
4. That in measuring outcomes of instruction in nutrition, satisfaction should not be had with the mere recall of information by the students individually or as a group, but that a program of measurement be developed which will in some degree determine just how far the individual student is accomplishing that of which she is intellectually capable.

BIBLIOGRAPHY

BOOKS

Bell, Viola Maria. Chemistry Used in Foods and Nutrition Courses. Columbus: The Ohio University Press. 1936. 84 pp.

Bogert, Lotta Jean. Nutrition and Physical Fitness. Philadelphia: W. B. Saunders Company. 1939. 602 pp.

Bogert, Lotta Jean, and Porter, Mame T. Dietetics Simplified. New York: The Macmillan Company, 1940. 742 pp.

Brown, Clara Maude. Evaluation and Investigation in Home Economics. New York: F. S. Crofts and Company. 1941. 461 pp.

Brown, Clara Maude and others. Statistical Techniques Adapted to Home Economics Problems. Minneapolis: Burgess Publishing Company. 1939. 104 pp.

Chaney, Margaret Stella and others. Nutrition. Boston: Houghton Mifflin Company. 1939. 436 pp.

Cooke, Dennis. Minimum Essentials of Statistics. New York: The Macmillan Company. 1936. 271 pp.

Fishbein, Morris. Fads and Quackery in Healing. New York: Covice, Friede. 1932. 384 pp.

Garrett, Henry E. Statistics in Psychology and Education. New York: Longmans, Green and Company. 1926. 317 pp.

Good, Carter Victor and others. The Methodology of Educational Research. New York: D. Appleton-Century Company, Inc. 1938. 890 pp.

Hambidge, Gove. Your Meals and Your Money. New York: McGraw-Hill Book Company, Inc. 1934. 190 pp.

Hawkes, Herbert E. and others. The Construction and Use of Achievement Examinations. Boston: Houghton Mifflin Company. 1936. 497 pp.

Hawley, Estelle Elizabeth and others. The Art and Science of Nutrition. St. Louis: The C. V. Mosby Company. 1941. 484 pp.

Justin, Margaret M and others. Foods. Boston: Houghton Mifflin Company. 1940. 659 pp.

Lamb, Ruth de Forest. American Chamber of Horrors. New York: Farrar and Rinehart, Inc. 1936. 418 pp.

McCall, William Anderson. How To Measure in Education. New York: The Macmillan Company. 1929. 416 pp.

McCall, William Anderson. Measurement. New York: The Macmillan Company. 1939. 535 pp.

McCollum, E. V. and others. Food, Nutrition and Health. Baltimore: Lord Baltimore Press. 1940. 127 pp.

Mendel, Lafayette Benedict. Nutrition: the Chemistry of Life. New Haven: Yale University Press. 1923. 150 pp.

Reeder, Ward G. How To Write A Thesis. Bloomington: Public School Publishing Company. 1930. 216 pp.

Rose, Mary Swartz. The Foundations of Nutrition. New York: The Macmillan Company. 1938. 625 pp.

Rugg, H. O. Statistical Methods Applied to Education. Boston: Houghton Mifflin Company. 1917. 410 pp.

Sherman, Henry Clapp. Chemistry of Food and Nutrition. New York: The Macmillan Company. 1941. 611 pp.

Sherman, Henry Clapp and others. Essentials of Nutrition. New York: The Macmillan Company. 1940. 418 pp.

Silver, Fern. Foods and Nutrition. New York: D. Appleton-Century Company, Inc. 1941. 522 pp.

Spafford, Ivol. A Functioning Program of Home Economics. New York: John Wiley and Sons, Inc. 1940. 469 pp.

_____, Fundamentals in Teaching Home Economics. New York: John Wiley and Sons, Inc. 1942. 490 pp.

Symonds, Percival M. Measurement in Secondary Education. New York: The Macmillan Company. 1930. 588 pp.

Tiegs, Ernest W. Tests and Measurements for The Improvement of Learning. Boston: Houghton Mifflin Company. 1939. 490 pp.

_____, Tests and Measurements for Teachers. Boston: Houghton Mifflin Company. 1931. 470 pp.

Tyler, Ralph Winfred. Constructing Achievement Tests. Columbus: The Ohio University Press. 1934. 102 pp.

Williamson, Maude and others. Homemaking Education in The High School. New York: D. Appleton-Century Company, Inc. 1941. 484 pp.

PERIODICAL ARTICLES

Aldrich, J. C. "Testing or Evaluation", Scholastic. XXXVII (October 28, 1940). 22-23.

Barr, A. S. and others. "A Symposium on the Classification of Educational Research," Journal of Educational Research. XXIII (May 1931). 353-382; (June 1931). 1-22.

Caswell, Hollis Leland. "Survey Techniques," Educational Administration and Supervision. XIX (September 1933). 431-441.

Chadderdon, Hester, "Measurement in Home Economics Education," Practical Home Economics. XIII (October 1935). 289.

_____, "Research Round Table on Home Economics Education," Journal of Home Economics. XXIX (October 1937). 554.

Coon, Beulah I. "A Survey of Studies Related To The College Curriculum in Home Economics," Journal of Home Economics. XXIX (March 1937). 155.

Culley, B. H. "Measuring The Ability To Interpret Data," California Journal of Secondary Education. XIII (March 1938). 152-154.

Harrington, Mary M. "The Dietitian as a Teacher," Journal of the American Dietetic Association. XVIII (September 1942). 586-587.

Matthews, C. O. "Issues in The Construction and Use of Educational Measurements," Journal of Educational Research. XXXIII (February 1940). 452-456.

Merwin, Aileen. "Nutrition and Dietetics in the Student Nurse's Curriculum," Hospital Management. (June 1943). 80-84.

Morgan, Agnes Fay. "How Schools Improve the Nutrition of Pupils," Journal of Home Economics. XXXIV (December 1942). 721-726.

Orata, Pedro T. "Evaluating Evaluation," Journal of Educational Research. XXXIII (May 1940). 641.

Perkins, Frances. "Nutrition is an Economic Problem," Public Health Nursing. XXXIII (October 1941). 587.

Price, Hazel Huston. "Measuring Ability to Make Wise Decisions," Journal of Home Economics. XXXV (June 1943). 349

Rogers, J. F. and others. "Nutrition Education Throughout The School," School Life. XXVI (February 1941).

Rust, Lucille. "Academic Preparation of the Dietitian as a Teacher," Journal of the American Dietetic Association. XVIII (September 1942). 586-587.

Saum, A. L. "Relative Significance of Time As A Factor in Test of Ability at the College Level," Journal of Applied Psychology. XXII (April 1938). 192-210.

Sebrell, W. H. "Urgent Problems in Nutrition for National Betterment," American Journal of Public Health. XXXII (January 1942). 15-20.

Taba, Hilda. "Functions of Evaluation," Childhood Education. XV (February 1939). 245-251.

Traxler, A. E. "Planning and Administering a Testing Program," School Review. XLVIII (April 1940). 253-267.

Van Cleve, N. "Food: facts, fad, and fancy," American Journal of Nursing. XXXVIII (March 1938). 285-287.

Westerman, E. D. "What Is Adequate Nutrition," American Journal of Nursing. XLI (September 1941). 1014-1019.

Wrightstone, J. W. "New Days, New Goals, New Tests," School Executive. LVIII (June 1939). 13-14.

Wood, Ben and others. "Educational Tests and Their Uses," Review of Educational Research. III (February 1933). 19.

BULLETINS

Human Nutrition, Yearbook Separate Number 1668, Reprint of Part 1, Yearbook of Agriculture, 1939. Washington, D.C.: United States Government Printing Office, 1941. 97-1142 pp.

McNutt, Paul V. Your Defense. Minneapolis, Minnesota: General Mills, Inc. n.d. 31 pp.

Raths, Louis E. Application of Principles. Progressive Education Bulletin, No. 5. Columbus: The Ohio University Press, 1936.

Stiebling, Hazel K. Are We Well Fed? A Report on the Diets of Families in the United States. Family Economics Division, Bureau of Home Economics. Miscellaneous Publication No. 430. Washington: U. S. Department of Agriculture, 1941. 28 pp.

United States. Bureau of the Census. Statistical Abstracts of the United States, 1941. 1017 pp.

United States Federal Security Agency. Proceedings of the National Nutrition Conference for Defense. Washington, D.C.: United States Government Printing Office, 1942. 254 pp.

APPENDIX

OBJECTIVES

Test Number 1*
Test Number 2**

Ability to recognize evidences of good nutrition.**

*a. To know the normal functioning of body processes and the manifestations as regards: hair, eyes, skin, subcutaneous fat, muscles, skeletal structure, posture; nervous reactions; mental activity.
*b. To know the mild and marked effects of inadequacies in the diet.
*c. An understanding of the normal weight gains of boys and girls.

Ability to judge when to seek medical advice.**

*a. To understand that knowledge of nutrition is a guide to promoting and sustaining good health and not a license to practice medicine.
*b. To know that the careful attention of a physician may be needed to discover causes of poor nutritional status.
*c. To know the value of a periodic health examination by a physician.
*d. To be familiar with "danger signals" of communicable diseases.
*e. To understand human behavior as related to poor nutritional status.

Ability to judge reliability of printed word and distinguish food fads and facts.**

*a. An understanding of the Federal Food, Drug and Cosmetic Act of 1938. (The provisions related to foods)
*b. An understanding of the importance and responsibility of her purchasing power.
*c. A familiarity with reliable sources of data; state and federal publications.
*d. An understanding of terms used in materials read, in lectures, and in discussions.
*e. A familiarity with the names of authorities on the subject of nutrition.
*f. An understanding of those reactions which bring about the formation of food toxins.

Ability to understand how new findings affect previously accepted standards for good dietaries.**

*a. To know the value of an "open" mind.
*b. To understand that recent scientific findings do not supplant but enhance previously accepted standards.
*c. To be familiar with the highlights in the historical development of the science of nutrition.

Ability to plan individual dietaries for those in normal health from foods available.**

Ability to plan suitable dietaries in common pathological conditions.**

*a. To know how the basal needs of the body are determined.
*b. To know the food value of the different classes of food.
*c. To know the recommended requirements of the different food components.
*d. To know how the energy value of food is measured.
*e. To know the functions, average requirement, and foods supplying needed food components; protein, fat, carbohydrate, vitamins, minerals, water.
*f. To know the hygiene of the digestive tract.
*g. To know how the total food requirements are increased during pregnancy and lactation, and the necessity of maintaining optimal nutrition between pregnancies.
*h. To know how the adequacy of a diet may be determined.
*i. To know the general rules and methods of obtaining optimal nutrition during childhood.
*j. To know the correct prepararion and serving of meals; menu planning; budgeting; marketing.
*k. To understand that thriftful living starts with physical well-being.
*l. To understand the application of chemical principles to cooking.
*m. To be familiar with clinical and sub-clinical findings of the common pathological conditions.

Ability to evaluate the adequacy of family plans for food preservation and conservation as related to economic, social, and educational condition.**

*a. To know what factors influence the securing of adequate food for a household: standards; preparation; money available; wise selection.
*b. To know the methods of preserving the nutritive value of food.
*c. To know the less expensive sources of the necessary food constituents.
*d. To know how to prevent food spoilage by correct methods and care in handling food.
*e. To understand and be familiar with federal and state agencies for obtaining assistance, as surplus commodities.

Ability to read intelligently tables, graphs, and charts.**

*a. An understanding of the mechanics employed in the construction of tables, graphs, and charts.

TEST 1

PART 1

If the statement is true place a circle around the "T"; if false place a circle around the "N".

1. The amount of money spent for food necessarily determines the adequacy of the diet. . . . . T N 1
2. Carbohydrates and proteins are unaffected by fat-splitting enzymes. . . . . T N 2
3. Mental ability is closely allied to physical well-being. T N 3
4. The proper dietary prescription for an underweight condition is only the reverse of that for an overweight condition. . . . . T N 4
5. Many foods are incompatible and care should be exercised in making combinations. . . . . T N 5
6. Proteins increase metabolism more than fats or carbohydrates. . . . . T N 6
7. Raisins are needed by everyone because of their iron content. . . . . T N 7
8. Fish is especially valuable in the diet because of its ability to build brain cells. . . . . T N 8
9. An abundance of meat in the diet produces mental and physical energy and has a rejuvenating effect on the body. . . . . T N 9
10. Physically inferior individuals are always mentally inferior. . . . . T N 10
11. Citrus fruits and tomatoes are our best sources of Vitamin C. . . . . T N 11
12. Highly milled grains should never be used. . . . . T N 12
13. Lobster and ice cream react in the body to form toxins . T N 13
14. Fruits and vegetables constitute our best base-forming foods. . . . . T N 14
15. A vegetarian diet leads to a higher state of health and greater stamina. . . . . T N 15
16. Any article of food not widely advertised cannot be considered very good. . . . . T N 16
17. Insufficient intake of water results in diminished appetite and malnutrition. . . . . T N 17
18. Freezing preserves the good qualities in fruits and vegetables and improves the poor ones. . . . . T N 18
19. Proteins are amphoteric substances. . . . . T N 19
20. Surface area has a greater effect upon basal metabolism than has weight. . . . . T N 20
21. A foodstuff may have a higher coefficient of digestibility when fed as a part of a mixed diet, than when fed alone. . . . . T N 21
22. If properly ingested, the organic foodstuffs release their power to nourish the body immediately. . . . . T N 22
23. Deficiencies in thiamin will effect changes in carbohydrate metabolism. . . . . T N 23

24. One hundred calories of lettuce is just as fattening as one hundred calories of butter. . . . . T N 24
25. An excess of protein in the diet is highly acid-forming and may lead to intestinal putrefaction. . . . T N 25
26. No single function of food can be considered more important than the others. . . . . T N 26
27. The order in which foods are served is merely a matter of convention. . . . . T N 27
28. Tough cuts of meat should be cooked rapidly in moist heat. . . . . T N 28
29. When metabolized in the body, 5 grams of fat will yield 45 calories. . . . . T N 29
30. Oxygen is more abundant in fats than in carbohydrates . T N 30
31. Ketosis results from an incomplete combustion of carbohydrate in the body. . . . . T N 31
32. The flow of hydrochloric acid in the stomach is inhibited when fatty foods are ingested. . . . . T N 32
33. There is no Federal law requiring that United States grades must be used for all food. . . . . T N 33
34. Greater loss of nutrients is encountered in boiling foods than in steaming them. . . . . T N 34
35. Canned foods may be left in the open can without harm to health. . . . . T N 35
36. Consumers are largely responsible for the chaotic conditions of trade and the predicament in which they find themselves today. . . . . T N 36
37. Names of particular brands of foods that meet government specifications may be obtained from the Bureau of Standards. . . . . T N 37
38. Potassium in the cell may be replaced by sodium. . . . T N 38
39. Ascorbic acid, thiamin, riboflavin, and nicotinic acid, all dissolve readily in water. . . . . T N 39
40. The quantity of pyruvic acid formed in the body during normal carbohydrate metabolism, increases as the dietary Vitamin B_1 decreases. . . . . T N 40
41. Beta carotene seems to be about one-half as effective as Vitamin A. . . . . T N 41
42. Normal blood may contain 80 to 120 mg. of glucose per 100 cc. . . . . T N 42

PART 11

In the series of statements below select that word or phrase which you consider the correct answer. Place the letter which corresponds to the correct answer in the right hand margin.

1. The word "enzyme" is used to designate
   a. those substances which influence metabolism; b. extracts normally present in the digestive tract; c. catalysts formed in plant or animal cells. ____ 1

2. Lowered body temperature tends to
   a. decrease metabolism; b. increase metabolism; c. have no effect on metabolic processes. ____ 2

3. The basal metabolism of a child is higher than that of an adult because of
   a. greater stimulus to cellular activity; b. natural build of the child; c. environmental factors which affect rate of growth. ____ 3

4. A thin green leafy vegetable is
   a. high in satiety value; b. high in iron and vitamin A; c. used principally for bulk because of the large quantity that may be eaten. ____ 4

5. Milk products, tomatoes, citrus fruits and green leafy vegetables should be emphasized in all diets because
   a. they are cheap sources of fuel; b. they supply many of the important vitamins; c. they supply great quantities of indispensable amino acids. ____ 5

6. The most economical sources of thiamin are
   a. bread and ready-to-eat grain products; b. mature dry beans and peas; c. leafy green and yellow vegetables. ____ 6

7. The enzymic cleavage of fats in the body is effected by
   a. amalyses; b. lipases; c. proteases. ____ 7

8. The chief difference in the energy value of 100 calorie portions of food is found in
   a. the ash content; b. the protein content; c. the fat and water content. ____ 8

9. There is abundant evidence that the greater percentage of fat stored by the body is manufactured
   a. from the animal fat consumed; b. from the carbohydrate consumed; c. from a combination of lean and fat meat. ____ 9

10. Protection for the consumer against fraudulent advertising is best obtained through
    a. an authoritative fundamental knowledge of nutrition; b. disregarding extravagant and untrue statements of health testimonials; c. the endorsement of physicians. ____ 10

11. A publication concerned with co-operatives, income, and the spending of money
    a. Consumer Union Reports; b. Consumers' Guide; c. Annual Handbook of Buying. ____ 11

12. Greater improvement in buying will result when
    a. definite laws are enacted to restrict advertising deceits; b. there is increased education of the consumer; c. only desirable qualities of goods are offered the consumer. ____ 12

13. The largest and most scientific buyer in the United States is the
    a. Bureau of Agricultural Economics; b. Bureau of Home Economics; c. National Bureau of Standards. ____ 13

14. Food poisoning is caused by
    a. using foods that are below "U. S. Standard"; b. chemically active substances within the food; c. eating food containing pathogenic bacteria. ____ 14

15. Healing cults flourish because
    a. many functional disturbances are the result of mental attitudes and emotional states; b. they usually specialize in illnesses of the nervous system; c. of the harmless, painless, and efficacious remedies advocated. ____ 15

16. The effectiveness of the egg as a leavening agent is dependent upon
    a. the amount of heat applied in the cooking process; b. the acidity of the ingredients with which it is combined; c. the quantity of air incorporated and retained during the cooking process. ____ 16

17. Pasteurized milk is milk that
    a. has been rapidly cooled to a temperature of 50 degrees Fahrenheit or less; b. has been subjected for a period of 30 minutes to a temperature not more than 145 degrees F., and cooled immediately; c. has been brought rapidly to the boiling point and cooled immediately. ____ 17

18. The rate of energy metabolism in every living body
    a. is constant at all times; b. is constant except for periods of food ingestion and exercise; c. differs between individuals and in the same individual from time to time. ____ 18

19. Food proteins best suited for conversion into body proteins are
    a. legumes and grains; b. liver and kidney; c. milk and eggs. ____ 19

20. Normal action of heart muscle is absolutely dependent upon
a. copper-protein compounds; b. calcium salts; c. iron chlorides. ____ 20

21. A non-profit organization designed to test and give information on the merits of materials and devices that may involve hazards to life
a. The National Vigilance Association; b. Better Business Bureau; c. Underwriters' Laboratories, Inc. ____ 21

22. A commercial "Seal of Approval" usually means
a. certain specifications have been met regarding safety, efficiency, dependability; b. the product is of the highest quality; c. the product is the best value for the money expended. ____ 22

23. The botulinus toxin which is produced in certain foods
a. causes nausea and vomiting; b. affects the central nervous system producing paralysis; c. causes painful intestinal reactions. ____ 23

24. Nitrogen may be economically spared in the body
a. by using larger quantities of cheaper cuts of meat; b. by furnishing 50 per cent of energy calories in the form of carbohydrate; c. by using eggs and cheese to greater advantage. ____ 24

PART III

The phrases in Column 1 on the left are closely connected with some of the terms in Column 2. Indicate the proper connections by placing in the parenthesis preceding Column 1, the number of the term with which each phrase is connected. Check each term used to avoid using it a second time.

Section 1

Column 1	Column 2
1. ( ) The carbohydrate of milk	1. Digitalis
2. ( ) Animal starch	2. Ergosterol
3. ( ) The active principle of the thyroid gland	3. Fat
4. ( ) The chemical basis of all living cells	4. Glucose
5. ( ) A precursor of Vitamin D	5. Glycerol
6. ( ) Simple sugar	6. Glycogen
7. ( ) An important vitamin-carrier	7. Insulin
8. ( ) Used to coagulate the solid protein of milk	8. Lactose
9. ( ) A constituent of all fats	9. Lymph
10. ( ) A pancreatic hormone useful in glucose metabolism	10. Protein
	11. Rennin
	12. Thyroxin
	13. Trypsin

Section II

1. ( ) A pernicious influence on the science of nutrition	1. Blood
2. ( ) Economical sources of protein	2. Budget
3. ( ) A device for eliminating expenditures for non-essentials	3. Catabolism
4. ( ) Important sources of mineral elements, vitamins and fiber	4. Fish and eggs
5. ( ) A condition resulting from the extreme lack of calcium	5. Fruits and vegetables
6. ( ) A chemical entity which is necessary for the regeneration of visual purple	6. Grains and legumes
7. ( ) Means of transportation for absorbed carbohydrate to the liver	7. Nutrient equilibrium
8. ( ) The stimulating effect of a foodstuff upon metabolism	8. Nutrition nostrums
9. ( ) The breaking down of living matter	9. Osteomalacia
10. ( ) The medium by which oxygen and food are supplied to the cells	10. Portal vein
	11. Specific dynamic action
	12. Vitamin A
	13. Xerophthalmia

PART 111 (continued)

Column 1 | Column 2

Section 111

1. ( ) A means of increasing the prothrombin content of the blood
2. ( ) A vitamin which is essential for carbohydrate metabolism
3. ( ) An essential unsaturated fatty acid
4. ( ) An influential factor affecting mineral requirement
5. ( ) Vessels used in the absorption of fat
6. ( ) An indigestible polysaccharide
7. ( ) A nutritionally essential amino acid
8. ( ) A deficiency disease marked by spongy condition of the gums
9. ( ) A compound that is necessary for every change which takes place in the body
10. ( ) Blood bicarbonate

1. Alkali reserve
2. Anabolism
3. Appetite
4. Cellulose
5. Leucine
6. Levulose
7. Linolenic
8. Lacteals
9. Pregnancy
10. Scurvy
11. Thiamin
12. Vitamin K
13. Water

Section 1V

1. ( ) Instigator of the classic studies made on the digestive system of Alexis St. Martin
2. ( ) The father of the science of nutrition
3. ( ) Dutch chemist who coined the name "protein"
4. ( ) Famous for determinations made on the nature of pellagra
5. ( ) The first woman to hold a nutrition professorship in any American University
6. ( ) Discovered beriberi to be a deficiency disease
7. ( ) Responsible for development and successful operation of respiration calorimeter
8. ( ) Nationally known biochemist whose research on niacin led to its use in the cure of pellagra
9. ( ) Instigator of the "laws" that govern family expenditure
10. ( ) World-renowned authority on nutrition whose works form the basis of modern nutrition education

1. Atwater
2. Beaumont
3. Bloor
4. Eijkmann
5. Elvehjem
6. Engel
7. Goldberger
8. Hopkins
9. Lavoisier
10. Mulder
11. Pasteur
12. Sherman
13. Rose

PART IV

In the spaces below, write the word or words which will complete the statement correctly.

1. The apparatus used for measuring the fuel value of food is called _____
2. In the utilization of iron for the formation of hemoglobin, one of the most important factors is the presence of _____
3. The mechanical process to which food is subjected in the mouth is called _____
4. When food is ready for absorption in the body the fats are in the form of _____
5. A low intake of niacin eventually leads to a disease called _____
6. The enzyme secreted by the pancreas which converts starch to maltose is called _____
7. For the money expended, no food has the nutritional value of _____
8. The importance of water in the body is exceeded only by that of _____
9. The protein found in the red blood cells is called _____
10. _____ is a disease influenced by calcium imbalance and is characterized by involuntary contractions of the muscles.
11. Proteins are absorbed from the intestinal tract in the form of _____
12. The percentage absorption of carbohydrate food in the body is estimated to be _____ %
13. A pronounced lack of Vitamin C in the diet leads to a deficiency disease known as _____
14. The recovery of appetite is promoted more promptly by _____ than by any other known nutrient.
15. The greatest percentage of iron in the body exists as _____
16. _____ is the jellying substance found in some under-ripe fruits.
17. The most spectacular contribution of recent years to our knowledge of nutrition is the organic nutrients known as _____
18. _____ is a method of cooking by direct contact with heat.
19. The proper functioning and development of the thyroid gland is dependent upon an adequate supply of _____ in the diet.
20. The Health Organization Committee of the League of Nations resolved that the International Unit of Vitamin A should be equivalent to 0.6 grams of _____
21. Fruits owe their caloric value chiefly to their _____ content.
22. The percentage of the total caloric allowance for protein in the diet lies between _____ and _____ %.
23. Enzymes used by the body in the digestion of fats are called _____
24. The Federal enactment forming the basis of most of our food legislation is the _____
25. One gram of pure fat yields _____ calories.

PART IV (continued)

26. The recommended allowance for protein per kilogram of body weight is _____
27. The amount of protein contained in food may be determined by multiplying the nitrogen content by _____
28. An agency which has endeavored to promote the adoption and use of grade standards for food is the _____
29. The hormone liberated by the intestinal mucosa to stimulate the pancreas to greater production of digestive fluid is called _____
30. Involuntary activities taking place within the body are called _____ processes.

TEST 2

In each of the following exercises a problem is given. Below each problem are two lists of statements. The first list contains statements which can be used to answer the problem. Place a check mark ( ) in the parentheses after the statement or statements which answer the problem. The second list contains statements which can be used to explain the right answer. Place a check mark ( ) in the parentheses after the statement or statements which give the reasons for the right answer. Some of the other statements are true but do not explain the right answer; do not check these. In doing these exercises then, you are to place a check mark ( ) in the parentheses after the statements which answer the problem and which give the reasons for the RIGHT answer.

A dietary standard should be regarded

a. As a significant and dogmatic rule by which food requirements can be adequately determined. . . . . 1. ( ) a.
b. As an indication of a practical basis upon which to judge food adequacies. . . . . 2. ( ) b.
c. From a differential and skeptical viewpoint. . . 3. ( ) c.

Check the statement or statements below which give the reason or reasons for your explanation above.

d. In the use of dietary standards discrimination should be exercised in the light of recent scientific advances. . . . . 4. ( ) d.
e. All normal individuals regardless of muscular activity show a striking similarity in their energy needs. . . . . 5. ( ) e.
f. Dietaries and food supplies calculated in terms of a set of standards are scientifically safeguarded from inadequacies. . . . . 6. ( ) f.
g. The findings of investigators differ and usually seem discordant. . . . . 7. ( ) g.
h. The nutritional needs of all individuals can be scientifically grouped and arithmetically expressed. . . . . 8. ( ) h.

The use of weight-height-age charts as standards of normal

a. Is satisfactory when applied to individuals. . . 9. ( ) a.
b. Is unsatisfactory when applied to groups or to individuals. . . . . 10. ( ) b.
c. Is less satisfactory when applied to individuals than to groups. . . . . 11. ( ) c.

Check the statement or statements below which give the reason or reasons for your explanation above.

d. Height and weight may be influenced by factors unrelated to health. . . . . 12. ( ) d.

e. All individuals may be classified according to body build. . . . . 13. ( ) e.
f. Average weights indicate the best in nutritional development. . . . . 14. ( ) f.
g. There is a normal for each individual, but a normal cannot be established for all individuals. 15. ( ) g.
h. In all age groups deviations from average height for weight must be considered normal. . . . . 16. ( ) h.

Strong likes and dislikes for food are
a. Inherited . . . . . 17. ( ) a.
b. Acquired. . . . . 18. ( ) b.
c. Instinctive . . . . . 19. ( ) c.

Check the statement or statements below which give the reason or reasons for your explanation above.
d. They are found so very early in life. . . . . 20. ( ) d.
e. A child's dislike for a food can often be traced to a mother's or a father's dislike for it. . . 21. ( ) e.
f. All flesh-eating animals reject certain types of food. . . . . 22. ( ) f.
g. Infancy and childhood are critical and formative periods in the development of food habits. . . . 23. ( ) g.
h. All flesh-eating animals, by their very nature, select one food in preference to another. . . . 24. ( ) h.

Sub-clinical deficiencies are regarded by the physician as
a. Subordinate to clinical findings or true deficiencies. . . . . 25. ( ) a.
b. As vague symptoms which are frequently confusing to a true picture of the physical status. . . . 26. ( ) b.
c. As deserving of greater consideration than true deficiencies. . . . . 27. ( ) c.

Check the statements below which give the reason or reasons for your explanation above.
d. Everybody knows that serious illnesses always attack a body which is physically sub-normal. . . 28. ( ) d.
e. Sub-clinical deficiencies are uncommon and not frequently seen. . . . . 29. ( ) e.
f. Physical stress or strain easily induce serious deficiency where a potential deficiency exists. . 30. ( ) f.
g. A true deficiency disease may be easily discerned and yields readily to specific treatment.. 31. ( ) g.
h. In sub-clinical deficiencies, diagnosis is difficult, and symptoms may progress from mild to very severe. . . . . 32. ( ) h.

Grains are cooked for a long time mainly

a. To render mastication less difficult. . . . . 33. ( ) a.
b. To render them more digestible. . . . . 34. ( ) b.
c. To develop their flavor. . . . . 35. ( ) c.

Check the statement or statements below which give the reason or reasons for your explanation above.

d. The coating of the starch granule is ruptured. . 36. ( ) d.
e. The ptyalin can work more effectively. . . . . 37. ( ) e.
f. Long slow cooking develops a nut-like flavor. . 38. ( ) f.
g. The cellulose is softened. . . . . 39. ( ) g.
h. They become less irritating to the lining of the stomach. . . . . 40. ( ) h.
i. Cooking converts raw starch into a more soluble form. . . . . 41. ( ) i.
j. Uncooked starch foods have a paste-like flavor. 42. ( ) j.

The energy needs of the body, over and above that required for internal processes, are most greatly affected by

a. Pregnancy . . . . . 43. ( ) a.
b. Muscular work . . . . . 44. ( ) b.
c. Effects of food . . . . . 45. ( ) c.
d. Mental work . . . . . 46. ( ) d.

Check the statement or statements below which give the reason or reasons for your explanation above.

e. The very taking of food raises the energy output. 47. ( ) e.
f. The energy requirement will to a great extent be determined by the amount and character of the exercise taken. . . . . 48. ( ) f.
g. The rise in metabolism after taking protein alone, amounts to 30 to 40 per cent. . . . . 49. ( ) g.
h. After the fourth month of pregnancy there is a more rapid fetal development. . . . . 50. ( ) h.
i. One absorbed in intense mental effort has an extra demand for food. . . . . 51. ( ) i.
j. In physical labor all the body processes are more active. . . . . 52. ( ) j.

Statistics show that during recent years there has been an increase in the consumption of fruit and vegetables in the United States. This is undoubtedly due to

a. The growing interest centered in Victory gardening. . . . . 53. ( ) a.
b. A better understanding of their nutritive value. 54. ( ) b.
c. Greater production of potatoes and peaches. . . 55. ( ) c.

Check the statement or statements below which give the reason or reasons for your explanation above.

d. It is a well known fact that the success of any meal depends upon a wise selection of fruits and vegetables. . . . . 56. ( ) d.

e. Much territory that was formerly idle, is being rapidly converted into fruit and vegetable production centers. . . . . 57. ( ) e.

f. Vegetables and fruits have been found to be of great value because of their mineral and vitamin content. . . . . 58. ( ) f.

g. The Northeastern Vegetable and Potato council has provided for growers to proceed with plantings on the broadest and most intelligent scale possible. . . . . 59. ( ) g.

h. Recent scientific studies have disclosed much information regarding the composition and cookery of fruits and vegetables. . . . . 60. ( ) h.

In the human body the fat of egg yolk, cream, and milk, as compared with hydrogenated fat is

a. Utilized as easily. . . . . 61. ( ) a.

b. Utilized more easily . . . . . 62. ( ) b.

c. Utilized less easily . . . . . 63. ( ) c.

Check the statement or statements below which give the reason or reasons for your explanation above.

d. Excessive amounts of fat tend to retard digestion. . . . . 64. ( ) d.

e. Fats that are liquids at body temperature are more readily digested than are those with higher melting points. . . . . 65. ( ) e.

f. Fats of animal origin are superior to fats of vegetable origin. . . . . 66. ( ) f.

g. Fats in an emulsified form are more easily digested. . . . . 67. ( ) g.

h. Foods with fat occuring in larger particles are more readily attacked by the fat-splitting enzymes. . . . . 68. ( ) h.

The least number of calories would be needed by an individual

a. When studying a French lesson. . . . . 69. ( ) a.

b. When watching a baseball game. . . . . 70. ( ) b.

c. When reading a novel on the divan . . . . . 71. ( ) c.

Check the statement or statements below which give the reason or reasons for your explanation above.

d. Everyone knows that muscular activity is usually the largest variable factor in determining the rate of energy expenditure. . . . . 72. ( ) d.

e. There is little contrast between mental and muscular work. . . . . 73. ( ) e.
f. The number of calories needed by any one individual for mental or muscular work is remarkably constant. . . . . 74. ( ) f.
g. During sedentary work the organism functions on a lower level of energy metabolism. . . . . 75. ( ) g.
h. The more the muscles are inactivated, the greater the decrease in energy exchange. . . . 76. ( ) h.

John X. of Sussex county is a thirteen year old lad whose attendance at school has been extremely irregular. The boy is over-sized for his grade, but appears wan, tired, and irritable. He is looked upon as a "problem" child. From the following statements select the one or ones which best describe your opinion of the case in question.

a. The process of good nutrition is a continuous one and this lad is beyond the age for remedial nutritional measures to take effect. . . . . 77. ( ) a.
b. The evident thiamin deficiency should be supplied by securing the proper foods or concentrates. . . . . 78. ( ) b.
c. The advice and direction of a physician are indispensable for effective corrective measures. 79. ( ) c.
d. John has not had the benefits of a right start in life, and corrective measures will have only a temporary effect. . . . . 80. ( ) d.
e. Everyone knows that in order to off-set anemic conditions a proper balance of iron, calcium, and copper must exist in the body. . . . . 81. ( ) e.

Check the statement or statements below which give the reason or reasons for your explanation above.
f. In addition to stimulating the appetite, thiamin improves the functioning of the nervous system. 82. ( ) f.
g. It is a well known fact that little can be done in adolescence since the program of care should have been begun in the prenatal period. . . . . 83. ( ) g.
h. Effects are always preceeded by causes which should be investigated. . . . . 84. ( ) h.
i. All children in families of low eccnomic status are malnourished. . . . . 85. ( ) i.
j. True and buoyant health is influenced by the acceptance or rejection of vital food constituents. . . . . 86. ( ) j.

Mrs. Ralph Jones of moderate income, is interested in ways and means of reducing her food bills, with no dimunition in the nutritive value of her menus. Check the statements

below which most closely approach the general advice you would offer.

a. Learn to rate foods, for quality and price always run parallel. . . . . 87. ( ) a.
b. Milk and cheese furnish excellent quality proteins at moderate cost. . . . . 88. ( ) b.
c. Ready-cooked foods save time and trouble in planning meals. . . . . 89. ( ) c.
d. Cheaper cuts of meat are as nutritious as more expensive cuts. . . . . 90. ( ) d.
e. Potatoes and root vegetables are usually the least expensive. . . . . 91. ( ) e.
f. Select perishable foods on the basis of quality. . . . . 92. ( ) f.
g. Green and yellow vegetables give the most for the money expended in vitamin and mineral content. . . . . 93. ( ) g.
h. To reduce expenditure, canned foods should be substituted for fresh. . . . . 94. ( ) h.
i. Under economic pressure subsistence gardening is a worthwhile possibility of economy and thrift. . . . . 95. ( ) i.
j. Fresh fruits are always an expensive item and should be used sparingly. . . . . 96. ( ) j.

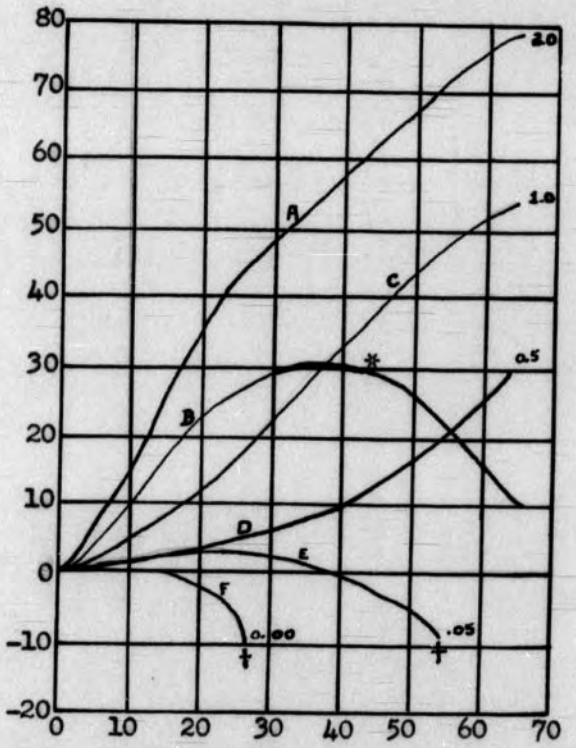
Mrs. Tibbet will not serve fish and milk at the same meal; avoids using aluminum cooking utensils; and supplies liberal quantities of meat in her meals for the energy needs of her family. Select from the following statements the ones you would use in defending or opposing the above ideas.

a. Sea foods with ice cream or milk are toxic. . 97. ( ) a.
b. An aluminum-free diet is almost impossible to prepare under any conditions. . . . . 98. ( ) b.
c. For physical labor, large quantities of meat are required. . . . . 99. ( ) c.
d. The body rids itself of 99.9 per cent of the aluminum it takes in. . . . . 100. ( ) d.
e. Foods which may be eaten separately with safety, may be eaten together. . . . . 101. ( ) e.
f. To use protein for energy, part of it must be converted to carbohydrate. . . . . 102. ( ) f.
g. The darkening of aluminum pans is proof of dangerous chemical reactions. . . . . 103. ( ) g.

Eunice Jackson has felt below par physically for some time and upon examination by the school nurse, is advised to go to a physician as she fears that Eunice has hyperthyroidism. Check the symptoms by which the doctor will determine whether Eunice actually has hyperthyroidism.

a. sluggish bodily and mental processes. . . . . 104. ( ) a.
b. rapid heart rate. . . . . 105. ( ) b.
c. high basal metabolic rate. . . . . 106. ( ) c.
d. overweight. . . . . 107. ( ) d.
e. low basal metabolic rate. . . . . 108. ( ) e.
f. protruding eyes. . . . . 109. ( ) f.
g. poor appetite. . . . . 110. ( ) g.

On the graph below are shown differences in the rate of growth in guinea pigs due to differences in intake of ascorbic acid. The numbers at the left indicate the gain in grams, and the numbers at the bottom indicate the length of time required in days. The numbers at the end of the heavy curved lines running through the graph indicate the amount of ascorbic acid in milligrams fed daily. The letters on the lines are used to designate the individuals animals.



* dose of 1.5 discontinued

a. How many days did E live? . . . . . 111. ( ) a.

b. How many milligrams of ascorbic acid did D receive before the weight increased 10 grams? 112. ( ) b.

c. At the end of thirty days how much more weight had A gained than C? . . . . . 113. ( ) c.

d. How much more ascorbic acid did C receive than E? . . . . . 114. ( ) d.

e. How much weight did B Lose during the twenty days after the dose was discontinued? 115. ( ) e.

f. How many milligrams of ascorbic acid were given to A in thirty days? . . . . . 116. ( ) f.

Pupil	Odd Items	Even Items	Diff.	Diff.^{2}
1	55	51	4	16
2	50	42	8	64
3	46	45	1	1
4	45	46	1	1
5	61	49	12	144
6	56	51	5	25
7	49	44	5	25
8	55	49	6	36
9	56	42	14	196
10	43	33	10	100
11	46	41	5	25
12	49	50	1	1
13	52	50	2	4
14	48	46	2	4
15	34	37	3	9
16	56	50	6	36
17	26	29	3	9
18	44	47	3	9
19	42	49	7	49
20	53	52	1	1
21	40	36	4	16
22	44	44	0	0
23	33	37	4	16
24	34	36	2	4
25	34	32	2	4
26	37	41	4	16
27	37	39	2	4
28	36	41	5	25
29	37	37	0	0
30	37	43	6	36
31	43	39	4	16
32	39	41	2	4
33	38	34	4	16
34	25	25	0	0
35	41	42	1	1
36	46	46	0	0
N = 36				913

$$\rho_{tt} = 1 - \frac{6\Sigma D^2}{N(N^2 - 1)}$$

$$= 1 - \frac{6 \cdot 913}{36(36^2 - 1)} = .89$$

Spearman-Brown formula for correction:

$$\rho_x = \frac{2 \times .89}{1 + .89} = 0.94$$

EXHIBIT A

RELIABILITY OF TEST NUMBER 1 USING SPLIT-HALVES METHOD

Pupil	Odd Items	Even Items	Diff.	Diff.^{2}
1	53	45	8	64
2	55	45	10	100
3	52	45	7	49
4	52	43	9	81
5	50	45	5	25
6	50	49	1	1
7	50	47	3	9
8	48	45	3	9
9	49	43	6	36
10	46	44	2	4
11	47	44	3	9
12	48	43	5	25
13	46	43	3	9
14	49	42	7	49
15	45	43	2	4
16	50	42	8	64
17	49	39	10	100
18	46	44	2	4
19	50	43	7	49
20	44	43	1	1
21	46	36	10	100
22	42	43	1	1
23	42	36	6	36
24	44	38	6	36
25	46	40	6	36
26	42	42	0	0
27	48	39	9	81
28	45	40	5	25
29	49	35	14	196
30	46	38	8	64
31	46	42	4	16
32	45	35	10	100
33	47	38	9	81
34	44	35	9	81
35	39	36	3	9
36	52	39	13	169
N = 36				1723

$$\rho_{11} = 1 - \frac{6\Sigma D^2}{N(N^2 - 1)}$$

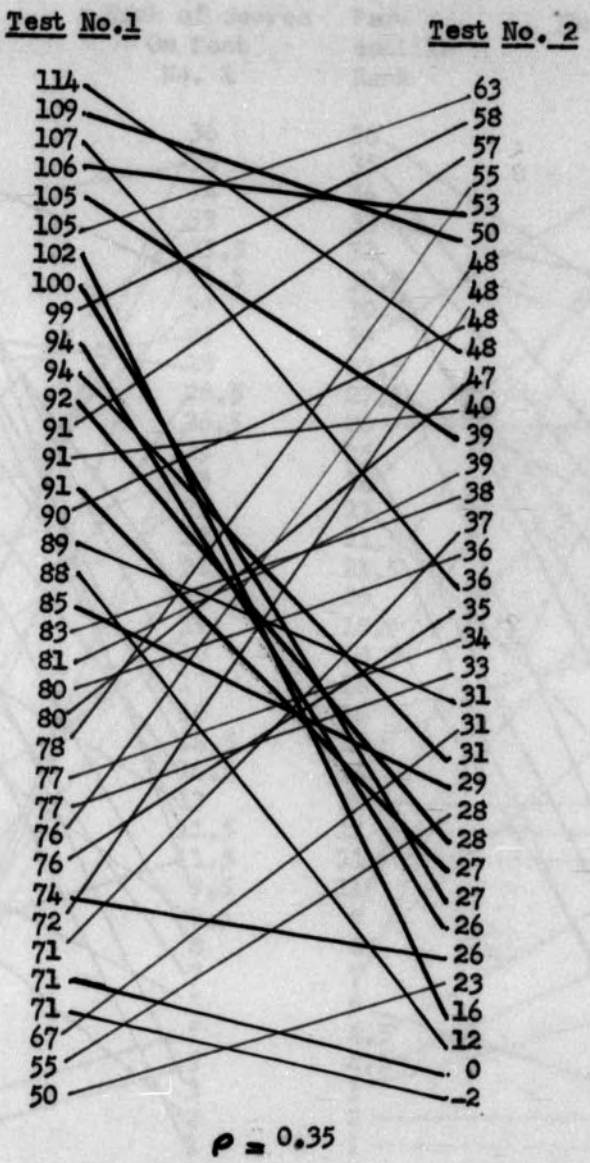
$$= 1 - \frac{6 \cdot 1723}{36(36^2 - 1)} = .78$$

Spearman-Brown formula for correction:

$$\rho_x = \frac{2 \times .78}{1 + .78} = 0.87$$

EXHIBIT B

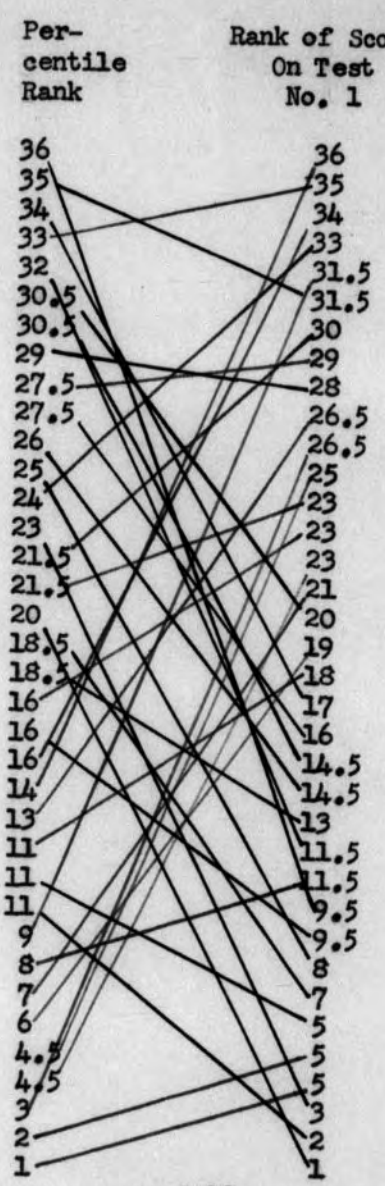
RELIABILITY OF TEST NUMBER 2 USING SPLIT-HALVES METHOD



$\rho = 0.35$

EXHIBIT C

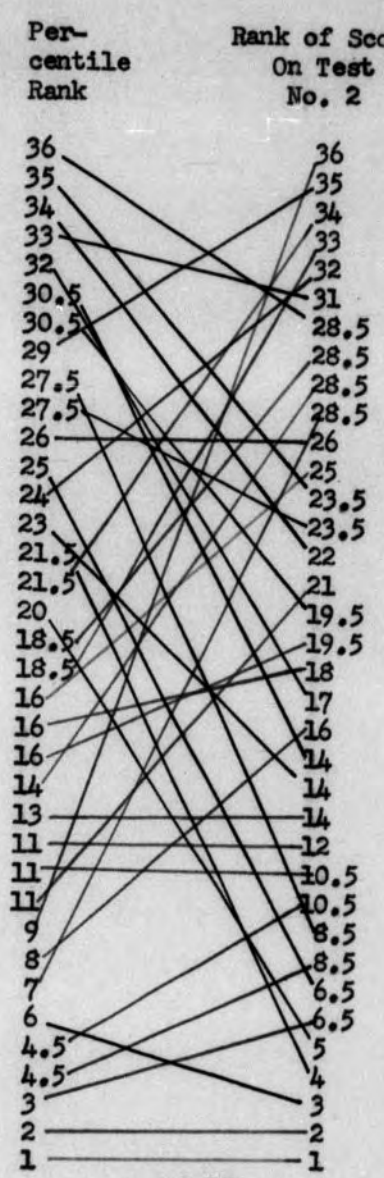
CORRELATION BETWEEN SCORES ON
TEST NO. 1 AND TEST NO. 2



$\rho = 0.12$

EXHIBIT D

CORRELATION BETWEEN INTELLIGENCE RANK AND RANK OF SCORES ON TEST NO. 1



$\rho = 0.49$

EXHIBIT E

CORRELATION BETWEEN INTELLIGENCE RANK AND RANK OF SCORES ON TEST NO. 2