Study of health knowledge level of selected male high school students as revealed by the Gates-Strang health knowledge test

John Gilbert Nash

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STUDY OF HEALTH KNOWLEDGE LEVEL
OF SELECTED MALE HIGH SCHOOL STUDENTS AS
REVEALED BY THE GATES-STRANG HEALTH KNOWLEDGE TEST

BY

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B. A. Montana State University, 1954

Presented in partial fulfillment
of the requirements for the degree of
Master of Arts

MONTANA STATE UNIVERSITY
1958

Approved by:

[Signatures]

Chairman, Board of Examiners
Dean, Graduate School

APR 18 1958

Date
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CHAPTER I

THE PROBLEM

History shows that man has made his greatest advancements during periods when he has made the most progress in the promotion of his health. When health has been neglected, civilization has declined and mankind has retrogressed. ¹

At the onset of the second World War, the people of the United States were showing little interest in the physical and mental health of the nation. The population seemed more concerned with making money and with the winning of the war. A number of research studies point out this lack of interest in health. Studies conducted by various governmental agencies, including the armed forces, found that the people were not greatly concerned with their health. ² The armed forces rejected numbers of men and women for poor health conditions, such as alcoholism, underweight, obesity, and anemia.

A research study conducted by the Department of the Interior in 1945 found that 64.5 per cent of 5000 individuals surveyed were living at such a fast pace that they gave health little consideration. Individuals surveyed were found to maintain irregular physical activity and sleep habits, to live in unsanitary environments, to associate with


communicable disease carriers, and to maintain improper heating, ventilation, and lighting in their homes.\(^3\)

Today, with conditions at a more normal pace and with widespread publicity being given to the physical deficiencies discovered by armed forces' physical examinations and by Kraus-Weber tests, people are becoming much more health conscious. This is due, in part, to the many magazine and newspaper articles concerning the health of the people. Radio and television also contribute information to help the people realize the importance of good health. The federal government is taking an active part in promoting the health of the nation. In 1956, for example, the President's Conference on Fitness of American Youth recommended that all programs in health, physical education, and recreation begin with adequate and recurrent health examinations. The Conference recognized that out medical achievements and our health standards are better than at any time in the history of our Nation, but that an urgent need for improvement still exists.\(^4\)

Health authorities believe that school health programs should be revised, recognizing that most of the schools require only a bare minimum of health instruction. Under existing conditions, health teaching is incomplete, and seldom if ever achieves its ultimate goal--


healthy individuals in a healthful school and community.\textsuperscript{5}

The nation may be conscious of and concerned about the status of its health but that is not enough. Its people must obtain sufficient knowledge about health, and must develop proper attitudes concerning it, if they are to achieve health in daily living. Hence, the prime objectives of a health program should be to impart knowledge and to develop attitudes.\textsuperscript{6} People may read about and listen to health facts concerning the various aspects of health, but radio listening, television viewing, and reading are not sufficient to guarantee good health practices. Usable knowledge and compelling attitudes are more important than mere facts and therefore educational instruction is most effective.\textsuperscript{7}

Educational institutions are the major force for disseminating health information and provide the principal region for developing the needed rebirth of health education.\textsuperscript{8} Montana schools are sharing in the new emphasis on health education. In 1950, Governor Bonner appointed a committee to study the school health program in Montana, and this state committee reported that Montana had shown progress in the field

\footnotesize

\textsuperscript{6}Willard W. Patty, Evaluating Health Education Outcomes, Indiana University, 1953, p.2.


of health through effective school health progress.\textsuperscript{9}

Since the health of the nation and of the state depend upon adequate health practices, and health practices depend to a great extent upon health information, determination of the level of student health knowledge becomes important in ascertaining the effectiveness of the school health program in Montana.

**Purpose of the Study.** The purpose of this study was to determine and to analyze the health knowledge level attained by selected high school freshman and sophomore male students as revealed by form E of the Gates-Strang Health Knowledge Test.

**Sub-Problems.** In ascertaining this level, several sub-problems were solved.

1. To compare the scores achieved by the selected students with the norms established for the Gates-Strang test.
   a. Compare the median, $Q_1$, $Q_3$ scores of the entire groups with the norms established.
   b. Compare the medium, $Q_1$, $Q_3$ scores of the selected first class, second class, and third class schools with the national norms.

2. To determine the comprehensiveness of the health knowledge level attained as revealed by the Gates-Strang test.
   a. Identify the major sub-divisions of health knowledge

courses

b. Apply the sub-divisions of health knowledge to the Gates-Strang Health Knowledge Test and analyze the knowledge level attained by students in each sub-division.

Definitions. The following definitions are listed to give the reader an understanding of terms used in this study.

First class school district: one which has a population of eight thousand or more.

Second class school district: one that has a population of one thousand or more and less than eight thousand.

Third class school district: one with a population of less than one thousand. ¹⁰

Health Knowledge: the clear perception of truth or fact through skill from practice in the field of health. ¹¹

Sub-divisions (areas) of a health course: the division of the health information into component parts, such as (a) nutrition, (b) structure and function of the human body, (c) individual health practices, and (d) general health information.

Large city high school: for purposes of this study the large city high schools of the Gates-Strang norms were considered


comparable to the first class schools and the county high schools in Montana.

Small high school: for purposes of this study the small high schools of the Gates-Strang norms were considered to the second and third class schools of Montana.

Five per cent level of confidence: chances are 95 per cent of the scores in a normal distribution lie within plus or minus 2.58 sigma units of the mean. Five per cent of the scores therefore falls outside of this limit.

Limitations. High schools selected for this survey were chosen from the Montana Educational Directory, and include (a) ten first class, (b) ten second class, and (c) ten third class high schools. The schools were chosen by a random sample technique and the thirty schools selected represent a wide geographical area of Montana.

The testing program was limited to ninth and tenth grade students because Montana State Board of Education recommends that the health course be offered during the first two years of high school.\textsuperscript{12}

The Gates-Strang Health Knowledge Test, Form E was used.

The cost of reproducing the Gates-Strang Health Knowledge Test was so great that testing is limited to approximately one thousand students in the thirty selected Montana high schools.

Since names have no bearing upon the results, the students and schools participating in the survey remain anonymous throughout the report.

\textsuperscript{12}Standards and Recommendations for Health, Physical Education, and Recreation in the Accredited High Schools of Montana, Department of Public Instruction, Helena, Montana, 1951.
As far as the author could ascertain, this is the first survey of selected Montana high school male students to determine the level of health knowledge and attainment.

Similar Studies. Cyrus Mayshark's study, "A Health and Safety Attitude Scale for the Seventh Grade," used methods similar to those adopted by the author. The normative survey method was employed, with 677 individuals surveyed. The purpose of the study was to develop a scale to measure the attitudes of seventh grade students toward several selected areas of health and safety. The area breakdown was based on state-adopted health textbooks. The seven selected areas included anatomy and physiology, personal hygiene, foods, emergency health procedures, environmental hygiene diseases, and mental hygiene.¹³

Marie Hinrick's study has similarity in that a standardized test was used, a normative survey developed, and a health-area breakdown employed. The purpose was to determine the health knowledge acquired before entering college as a freshman, and to ascertain the areas with least proficiency and areas with greatest understanding. She concluded that there was some evidence to indicate more vigorous programs of health teaching were needed at all levels of training.¹⁴

Mayshark's and Hinrick's studies are similar to this study in that they employed the normative survey, the health area breakdown, and the standardized test. Mayshark's and Hinrick's studies differ from this


this study in the selection of health areas or sub-divisions, and in the selection of students to be surveyed.

Need For Evaluating Health Knowledge. If a person knows the right thing to do he may do it, while he may do the correct thing only by chance if he does not know the right course to follow. Even though accurate knowledge does not guarantee wise conduct in any phase of living, it is apparent that the school must make every effort possible to provide each student with essential knowledge concerning health, for such knowledge forms the basis for intelligent practice.

Knowledge tests serve as checks on progress of both students and teachers toward this knowledge goal. Health evaluation is both a progress report and an inventory. It tells a story of what is, what should be, and what should not be. Evaluation of health knowledge reveals many things and serves various general purposes. Some authorities in the field of health education, such as Willard W. Patty15, H. H. Remmers and N. L. Gage16 are in general agreement regarding the following:

1. A health education test may be given at the beginning of a course to convince pupils of their need for the course.

2. A test may be given at the first meeting of a course to help the teacher select units of knowledge to be stressed, or to be excluded.

3. A preliminary test together with similar final test may provide a basis for measuring pupil achievement.

4. The teacher may use preliminary and final test differences to test his own teaching efficiency.

15Patty, op. cit., p. 7.

5. The teacher may use tests to diagnose needs of individual pupils and to provide remedial teaching.

6. Supervisors and administrators may use such tests as aids in comparing efficiency of various teachings of health education.

7. The school staff may be interested in comparing local pupil test results with national norms.

An adequate program of evaluation, if it is to fulfill these needs, must consider as integrating the evaluation with all phases of the program, planning the program well in advance, using the best scientific evaluation procedures, using results to redirect learning, preparing personnel to acquire competency in evaluative techniques, keeping cumulative records of findings and interpreting results to all concerned. 17

Need For The Study. This study was undertaken to ascertain the health knowledge level attained by selected male high school students because there was a need to inform health teachers, administrators, health educators and the State Department of Public Instruction concerning the effectiveness of the health instruction in the state of Montana.

Administrators and health teachers need comparisons of Montana schools with national norms to evaluate state health programs and to recommend revisions of those programs.

CHAPTER II

PROCEDURE

Introduction. The material presented in this portion of the study includes the selection of sample to be surveyed, the determining of criteria for selecting a standardized test, the selection of a test for the survey, uses of standardized tests, the division of the selected test into major areas, the administration of the test, and the method of analysis of results to be used for this study.

Selection of the Sample. Selected schools included ten in the first class districts, ten in second class, and ten in third class high school districts. A random sample of all first class schools was completed by placing the name of the schools in a box and drawing ten for use in this study. This procedure was repeated for the second and third class school districts.

The test was given to male students only, since the author had learned from personal contacts with a number of Montana instructors that the majority of the Montana schools provided separate health courses for boys and for girls. Too, the author's health instruction experience had been chiefly with male students.

The Criteria for Selecting a Standardized Test. In determining the type and the kind of procedure to be used in evaluation, certain criteria were used as a guide. The factors receiving consideration were validity, reliability, and objectivity, plus availability of standardized directions, duplicate forms, and national norms. These


TABLE I

THE NUMBER AND PERCENTAGE OF FRESHMAN AND SOPHOMORE MALE STUDENTS COMPLETING THE GATES-STRANG HEALTH KNOWLEDGE TEST IN THE SELECTED HIGH SCHOOLS

<table>
<thead>
<tr>
<th>Schools</th>
<th>Freshman</th>
<th>Sophomore</th>
<th>Per Cent of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>First class schools</td>
<td>106</td>
<td>188</td>
<td>41.40</td>
</tr>
<tr>
<td>Second class schools</td>
<td>121</td>
<td>132</td>
<td>35.63</td>
</tr>
<tr>
<td>Third class schools</td>
<td>72</td>
<td>91</td>
<td>22.95</td>
</tr>
<tr>
<td></td>
<td>299</td>
<td>411</td>
<td></td>
</tr>
<tr>
<td>Total Sample</td>
<td>710</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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factors are described in the sections that follow.

To be valid, a test must constitute a well balanced sampling of all important objectives, subject matter, or fact and information items included in given area. Techniques for establishing a reasonable degree of validity is to depend upon the collective judgment of several qualified people or to use other standard tests as a basis of comparison.¹

Reliability refers to the consistency with which results are obtained. Brownell and Hagman stated:

Retesting, testing comparable groups, and treating the results statistically will yield a measure of group consistency. Two sets of scores obtained from two similar tests covering the same field, if highly similar or correlated, indicate a high degree of reliability.²

Objectivity refers to the extent to which subjective judgment is kept at a minimum. The more standardized the test, the more likely it is to possess objectivity. The greater the objectivity of an evaluative procedure, the more likely reliability will be secured.³

In general, objective type test items fall readily into the two broad categories of "recognition" and "recall." In the recognition type of test item, the pupil must recognize and select the correct answer from a number of answers given in the test item. When carefully prepared, the multiple-choice item can be very thought provoking and excellent in determining whether pupils have achieved the desired health

¹Anderson, op. cit., p. 482.
²Brownell and Hagman, op. cit., p. 341.
³Ibid., p. 342.
knowledge and information which the test covers. ¹

Remmers and Gage ⁵ have listed in rank order of importance the types of objective questions to use in health knowledge testing.

First .............................................................multiple choice
Second ............................................................true and false
Third ..............................................................matching
Fourth ............................................................completion (least used)

Reasonable cost persists as a practical consideration in selecting appraisal techniques. If cost is so great that it places a financial burden upon the user, a less expensive device should be used if available. ⁶

Duplicate forms refer to measurement tools and generally include two or more similar tests which measure the same element or elements. They are valuable when exposure to the original test makes impractical the use of the same test a second time with the same group. ⁷

Norms indicate how a given group has performed on the same evaluative technique. In other words, norms represent standards that show the pattern of results of different individuals in relation to a measurement or appraisal instrument. Norms aid in interpreting the significance of individual performances. ⁸

¹ Remmers and Gage, op. cit., p. 6.
² Ibid., p. 6.
³ Brownell and Hagman, op. cit., p. 342.
⁴ Ibid., p. 343.
The Selection of a Test. The author gleaned the literature and received a number of standardized health tests in an effort to find a test to meet the established criteria. After screening many health knowledge tests, the Gates-Strang Health Knowledge Test Form E was selected as the one most nearly fulfilling the essential criteria.

"The validity of the Gates-Strang Health Knowledge Test," said Trigs, "was determined by statistics, curricular research, and comparisons made with other standardized health knowledge tests."8

Gates-Strang established the reliability of their health knowledge test by administering it to 888 cases, using all three forms of the test for the same pupils in grades 7 to 12. The coefficients of correlation are:

- Form D and F-.76;
- Form D and E-.74;
- Form E and F-.86.9

Each test consists of sixty multiple-choice questions, each providing five choices. Research Methods Applied to Physical Education, and Recreation has said of the Gates-Strang Health Knowledge Test,

No such comparable test exists for assaying physical education instruction. Multiple-choice questions are indicated generally as the more reliable type of test item to employ.10

The author of this study recognizes that there are other standardized health knowledge tests that qualify on the basis of statistical


criteria. They were not acceptable for this particular study because a number of them have no norms available to allow a comparison with the results of the Montana schools, because they require too much time to administer and tabulate, or because they involve excessive cost in purchasing or reproducing the test.

The Gates-Strang test has established norms which allowed a comparison of the Montana schools with these norms. The time limit for the test was thirty minutes. Gates-Strang provided a manual of instructions which included directions for administering the test to individuals or to groups and an answer key for ease in the correction of the tests. The cost of reproducing the test did not place a financial burden on the author of this study.

Values of Using Standardized Tests. Discussing the criteria for test selection, the values of using the standardized were included. The values are listed as:

1. Established validity
2. Established reliability
3. Established objectivity
4. Established norms
5. Administrative economy
6. Reasonable cost

Division of Test into Major Areas. One of the purposes of this study was to derive a means of categorizing the test questions to make possible an analysis of any weakness or strength within specific areas
of general health knowledge.

A number of authorities in health education were consulted in an effort to find common agreement on recommended areas or sub-divisions. Great variance of opinion was found among the authorities with reference to:

1. Areas or sub-divisions within general health area (Ranged: four to twenty-nine different sub-divisions)

2. Terminology

For example: Delbert Oberteuffer's recommended areas and terminology are (a) personal health, (b) community health, (c) safety, (d) social living, (2) sex hygiene, (f) illness and emergency, (g) first aid, and (h) hygiene. The School Health Appraisal Form areas and terminology are: (a) sanitation, (b) dental and physical examinations, (c) communicable and non-communicable diseases, (d) nutrition, and (e) health services. The two examples mentioned will give the reader an indication of the variance in opinion that exists among some authorities.

Using the sub-divisions presented by various authors, the Gates-Strang items were placed under the recommended headings. These classifications showed no uniformity and great inequality in distribution. For example, using areas recommended by G. L. Anderson the following

---


12 School Health Appraisal Form (Studies in School Health Programs. (Boston: Massachusetts Institute of Technology, 1930), p. 19.

distributions were obtained:

<table>
<thead>
<tr>
<th>Areas</th>
<th>Number of questions of the Gates-Strang test to each area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal health</td>
<td>2</td>
</tr>
<tr>
<td>Community health</td>
<td>6</td>
</tr>
<tr>
<td>Mental health</td>
<td>1</td>
</tr>
<tr>
<td>Nutrition</td>
<td>15</td>
</tr>
<tr>
<td>School health services</td>
<td>3</td>
</tr>
<tr>
<td>School health instruction</td>
<td>1</td>
</tr>
<tr>
<td>Safety</td>
<td>1</td>
</tr>
<tr>
<td>First Aid</td>
<td>2</td>
</tr>
</tbody>
</table>

The procedure of listing sub-divisions and placing questions of the Gates-Strang test in their appropriate divisions was completed using categories recommended by several different authorities in health education. The major difficulties encountered were:

1. The distribution in the areas was too varied to allow a comparison. Example: nutrition 15, first aid 2, dental examinations none.

2. Some questions were not amenable to any sub-division listed.

The purpose of this procedure was to arrive at a fairly equal distribution of the Gates-Strang questions in recommended sub-divisions. A valid comparison in areas is possible only if a nearly equal distribution occurs. Use of areas recommended by any one authority was not possible because of the unequal distribution of questions.

To derive a workable area-breakdown it was necessary to combine sub-divisions recommended by various authorities. Common agreement was found in (a) nutrition, (b) structure and function of the human body,
and (c) individual health practice. After all the questions from the Gates-Strang test had been listed under these three classifications a number of items were still not placed and formulation of a new area became necessary. An analysis of the unplaced questions indicated a need for a category to cover such varied areas as family living, disease, health services, community and social living. There being no way to divide or combine these areas to secure equal distribution, a single category called "general health information" was used to cover the sixteen unclassified questions.

The areas and general content finally decided upon were

Nutrition
  Food processing
  Food purchasing
  Food etiquette
  Diet
  Vitamins

Structure and function of the human body
  Physiology of exercise
  Nervous system
  Respiratory system
  Circulatory system
  Skeletal structure

Individual health practice
  Personal hygiene
  First aid and safety
  Mental health
Alcohol and tobacco
Accidents
Rest and sleep
Health examinations
General health information
Family living
Disease and related information
Health services
Community health and sanitation
Social living

The questions of the Gates-Strang test were carefully analyzed to determine the appropriate area for each test question, and distributed among the four selected areas as follows:

a. Nutrition......................15
b. Structure and function of the human body........11
c. Individual health practice.....................18
d. General health information.....................16

To minimize confusion in the placement of certain questions in the various sub-divisions, "individual health practice" dealt basically with single or individual aspects of health while "general health information" was more concerned with community or group aspects of health.

The Administration of the Test. A letter of inquiry was sent to the health instructors of the thirty selected high schools in Montana
asking for their cooperation in this particular study.

A self-addressed post card accompanying the letter requested answers concerning acceptance of the study, proposed testing program, number of tests needed, and interest in the results of the completed study. It was estimated that approximately one thousand tests would be needed to survey the selected schools, if all thirty schools were willing to cooperate; six first class, seven second class, and eight third class schools actually responded to the letters of inquiry, requesting a total of seven hundred and ninety tests. A copy of this letter is included in the appendix, page 47.

Method of analysis. There were sixty questions in the Gates-Strang Test, each question counting one point for a possible score of 60. To determine the score for each student, the number of incorrect responses was subtracted from the possible score of 60. For example, if a student had 10 incorrect answers, 10 would be subtracted from 60 giving a score of 50 for the test.

The range, first quartile, median, and third quartile were determined for each class of schools, since a similar procedure was employed by Gates-Strang in establishing norms for their health knowledge test and comparison of the results from the Montana schools with the Gates-Strang norms necessitated the use of the Gates-Strang procedure.

Mean scores were determined to show the reliability of difference between ninth and tenth grades of the selected Montana high schools.

To determine strength or weakness in selected health areas the following analysis was employed: The number of incorrect responses was determined for each health area, and then divided by the total possible
correct responses to ascertain the percentage of incorrect responses. For example, 60 incorrect responses for nutrition, divided by 100 possible correct responses equals 60 per cent incorrect answers for nutrition. The percentage of incorrect responses for the first, the second, and the third class schools was determined for each of the four areas: nutrition, structure and function of the human body, individual health practice, and general health information.

Summary. Factual data for this study was obtained from selected schools in first, second, and third class school districts in Montana.

Criteria for selecting a standardized test were determined by surveying literature concerning statistical and administrative criteria. The Gates-Strang Health Knowledge Test was selected because it most nearly met the essential criteria.

The author of this study encountered a great deal of difficulty in determining a health-area breakdown because of the difference of opinion among authorities concerning sub-divisions and terminology. Common agreement was evident among authorities in the three areas of nutrition, structure and function of the human body, and individual health practice, but formulation of a new area, called general health information, was needed to cover test questions which could not be fitted into any of the commonly accepted classifications. The purpose of the area breakdown was to obtain a fairly equal distribution of Gates-Strang test questions in areas so weakness or strength within the areas could be determined.

For purposes of analysis, and to compare Montana schools with the
Gates-Strang norms, it was necessary to determine the first quartile, median, and third quartile for the first, the second, and the third class schools.

Mean scores were determined to compare ninth and tenth grades of the first, second, and third class schools to ascertain whether the reliability of difference was sufficient at the one per cent and the five per cent levels of confidence.

Strengths and weaknesses were to be determined by the percentage of incorrect responses for each health instruction area or sub-division.
CHAPTER III

ANALYSIS OF TEST RESULTS BY USING

MEASURES OF CENTRAL TENDENCY

Introduction. The statistical analysis for this study was accomplished by using the same measure of central tendency that was used by Gates-Strang in presenting the norms for their health knowledge test. The measures of central tendency used were median, first quartile, and third quartile. The use of the mean score in this study allowed the author to derive the reliabilities of the differences that might occur between Montana ninth and tenth grade students, and between the different classes of Montana schools.

The determination of the reliability of difference between Montana students and the Gates-Strang test group was not possible because the standard deviation was not available for the Gates-Strang test.

Mean scores were determined to ascertain reliability of difference in comparing Montana first, second and third class schools. The mean could not be used in comparing Montana results with Gates-Strang to determine reliability of difference because mean scores are not available for the Gates-Strange test.

Bar graphs were used to present a visual description of the statistical results of the study.

Comparison With National Norms. By comparing the median scores for Montana first class schools and the median score established by
Gates-Strang for large schools, it was possible to determine the range of score differences by using one measure of central tendency. It is noteworthy that, as shown in Figure 1, ninth and tenth grade median scores for the Montana first class schools are from 6.5 to 8 points higher than the Gates-Strang score for the ninth and tenth grades.

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**FIGURE I**

COMPARISON OF MEDIANS FOR GRADES NINE AND TEN IN MONTANA SCHOOLS OF FIRST CLASS WITH GATES-STRANG NORMS FOR GRADES NINE AND TEN
Figure II represents a comparison of medians between Montana second and third class schools and the Gates-Strang small school median score. The Montana schools again obtained a higher median score than that established by Gates-Strang, with medians from 2.1 to 4.42 points higher than Gates-Strang. The second and third class schools are closer to the established median than the first class schools of Montana.

The total median score for Montana was compared to the median scores of the first, the second, and the third class schools respectively in figure III. The median of the first class schools averaged from 1.35 to 1.44 points higher than those of the 2nd and 3rd class schools, and .93 of a point higher than Montana's total median score.
A comparison of the first and third quartile scores established for Montana schools of the first class with the Gates-Strang norms is shown in Figure IV. Ninth grades in Montana schools of the first class showed a third quartiles which was 8.86 points higher than the third quartile established by Gates-Strang, while tenth grades in the first class schools had a third quartile 9.1 points higher. The first quartile of ninth and tenth grades of the first class schools ranged from 5.3 to 6.23 points higher than the first quartile established by Gates-Strang. The third quartiles of ninth and tenth grades of first class schools range from 8.86 to 9.1 points higher than the third quartile established by Gates-Strang.

<table>
<thead>
<tr>
<th>Total Median Montana</th>
<th>First Class Median</th>
<th>Second Class Median</th>
<th>Third Class Median</th>
</tr>
</thead>
<tbody>
<tr>
<td>39.82</td>
<td>40.75</td>
<td>39.40</td>
<td>39.31</td>
</tr>
</tbody>
</table>

**FIGURE III**

COMPARISON OF MEDIANs FOR ALL MONTANA SCHOOLS AND MONTANA SCHOOLS OF THE FIRST, THE SECOND, AND THE THIRD CLASS
Figure V, page 28, represents the comparison of first and third quartile scores of Montana second and third class schools, grades nine and ten, with the established Gates-Strang first and third quartile score for grades nine and ten. The Montana schools again ranked higher than norms established by Gates-Strang. The third quartile comparison showed the ninth grades higher by 3.98 points for third class schools and 4.19 points higher for the second class schools. The second and the third class schools grade nine range from 2.20 to 4.07 points higher for
the first quartile than grade nine of Gates-Strang. The third quartile comparison shows the tenth grades ranged 4.2 points higher for the third class schools and 5.45 points higher for the third class schools. The comparison of tenth grades for the first quartile show very little variance.

![Figure V](https://example.com/figure-v.png)

**FIGURE V**

**COMPARISON OF Q₁ AND Q₃ IN MONTANA SCHOOLS OF SECOND AND THIRD CLASS WITH Q₁ AND Q₃ GIVEN BY GATES-STRANG**

A comparison of the average first and third quartile scores for all the selected Montana schools with these quartiles for first, second, and third class schools, using a combined score for the ninth and tenth grades, is shown in Figure VI.
Implications of Norm Comparisons. The medians attained by Montana first, second, and third class schools showed that all three classes of schools ranked from 1.3 to 6.7 points higher than the median norms established by Gates-Strang.

The results of the comparisons might indicate a better job of teaching health was being done in 1956 than in the year of 1939 when the Gates-Strang norms were established. The difference might also be attributed to the increased emphasis placed on health factors in high school courses other than health, such as biology and general science.
A comparison of the average median score for all the selected Montana schools and the median scores for the first, second, and third class schools, using a combined score for the ninth and tenth grades, showed little difference between schools.

Figure VI, page 29, compares the first and third quartile scores for the first, second, and third class schools with first and third quartile for all Montana schools. Here again there is little variance in the results, indicating that health instruction in all Montana schools is very similar in course content.

**Mean Scores of Montana Schools.** The mean scores were determined to ascertain whether the reliability of difference was significant on the one per cent or five per cent level of confidence between the ninth and tenth grade male students of the selected first, second, and third class schools of Montana. Figure VII, page 31, represents the mean scores for the ninth and tenth grades of the first, second, and third class schools of Montana.
FIGURE VII

MEAN SCORES FOR THE NINTH AND TENTH GRADES OF THE FIRST, SECOND, AND THIRD CLASS SELECTED HIGH SCHOOLS OF MONTANA

In the first class schools, ninth and tenth grades, the standard error of difference is .97. The actual difference of the mean scores is 2.23. The critical ratio or T is 2.30. The difference in means is easily significant at the one per cent level. Odds are about 97 to 3 that actual difference in ability exists between the tenth grades and the ninth grades in test scores in the 1st class schools.

In the second class schools for ninth and tenth grades the
standard error of difference is .97. The actual difference of the mean scores is 2.14. The critical ratio or T is 2.20. The difference in mean scores is again significant at the five per cent level of confidence and actual difference in ability exists between sophomore and freshman male students in second class schools of Montana.

In the third class schools, ninth and tenth grades, the standard error of the difference of the mean is 1.49. The actual difference of the mean scores is 2.67, the critical ratio cr T is 1.77. Thus the actual difference of ability is not significant on the one per cent level of confidence but nearly significant on the five per cent level of confidence.

These results indicate there was a significant difference in ability between sophomore and freshman male students of the selected first, second, and third class schools of Montana.

Since the author of this study found that freshman and sophomore male students, in some school, were combined to take the same health course, it may be assumed that this difference in health knowledge that exists between freshman and sophomore male students was due to instruction in health factors in subject courses other than health. In schools where students were not combined, the difference could be due to the year of advanced study in health as well as health information contributed by other subject courses.
CHAPTER IV

ANALYSIS OF TEST RESULTS USING HEALTH AREAS

Introduction. One of the purposes of this study was to categorized the test questions to allow an analysis of possible specific weakness or strength within various areas of health knowledge. Incorrect responses could then be determined for each health area, and divided by the total possible correct responses for that area to ascertain the percentage of incorrect responses. The percentage of incorrect responses for the first, second, and third class schools of Montana was determined for the sub-division of nutrition, structure and function of the human body, individual health practice, and general health information.

Comparison within selected areas. The percentage of incorrect responses in the selected health areas for the first class schools of Montana is shown in Figure VIII, page 34. The first class schools had a low percentage of incorrect responses for the health areas of individual health practice and general health information.

In comparing the percentage of the incorrect responses within the subject areas, the students scored thirteen percentage points better in the area of highest scores, general health information, than in the lowest area which was structure and function of the human body.
Figure IX, page 35, represents the percentage of incorrect responses in the selected health areas for the second class high schools of Montana. The second class schools again showed a low percentage of incorrect responses for individual health practice and for general health information. In comparing the percentage of incorrect responses within the sub-divisions, the students scored 14.6 percentage points higher in general health information, their best area, than in structure and function of the human body.
Figure X, page 36, represents the percentage of incorrect responses for the selected health areas in the third class schools of Montana. Note that the same health areas, individual health practice and general health information, again are low in percentage of incorrect responses. In comparing the percentage of incorrect responses within the health areas the students scored 13.5 percentage points better in general health information than in structure and function of the human body.
A combined percentage of incorrect responses in the selected health areas for the first, second, and third class schools is shown in Figure XI, page 37.

Structure and function of the human body and nutrition had a higher percentage of incorrect responses than individual health practice and general health information. In the combined percentage of incorrect responses, the three classes of schools together scored 13.5 percentage points better in general health information than in structure and function of the human body.
Summary. In recording the incorrect responses for the first, second, and third class schools of Montana it is evident that weakness occurred in the sub-divisions of nutrition and of structure and function of the human body. The results appear to indicate that there was a lack of adequate instruction in these specific areas of health education. The results also indicate that the courses of study for the first, second, and third class schools were similar in course content, since the first, second, and third class schools had the same areas of weakness and of strength.

The areas of strength were individual health practice and general
health information. It may be assumed that there was a need for a re-
vision of health instruction in all classes of schools in the state of
Montana to provide for a more complete course in health education.
CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary. The purpose of this study was to determine and to analyze the health knowledge level attained by selected freshman and sophomore male students in Montana high schools as revealed by Form E of the Gates-Strang Health Knowledge Test.

Selection of the Gates-Strang Health Knowledge Test, a standardized test, was based upon statistical and administrative criteria.

To determine strength and weakness in specific phases of health knowledge, a breakdown into areas was necessary. The areas used for this study were (a) nutrition, (b) structure and function of the human body, (c) individual health practice, and (d) general health information.

Data for this study were collected through administering the Gates-Strang Health Knowledge Test to students in selected first, second, and third class schools of Montana, and analyzing the resulting scores. Seven hundred and ten male students from twenty-one first, second, and third class Montana schools were surveyed. A summary of the findings is presented as follows:

1. The scores of the first, second, and third class schools of Montana, when compared to the norms established by Gates-Strang, showed that the selected Montana schools ranked higher. The first class schools ranked highest, then the second class, and then the third class schools.

2. In comparison of test scores made by the selected first,
second, and third class schools, there was no significant
degree of difference among classes of schools.

3. Comparison of mean scores for the ninth and tenth grade stu-
dents of the first, second, and third class schools showed
the tenth grade students achieved a higher score. Mean scores
indicated no significant difference among the first, second,
and third class schools.

4. Analysis of area scores showed that the Montana first, second,
and third class schools were weak in the subject matter areas
of (1) nutrition and (2) structure and function of the human
body. Strength occurred in the sub-divisions of (a) individ-
dual health practice and (b) general health information.

Conclusions. The following conclusions may be drawn from this
study.

1. That the male students in the selected Montana high schools
were receiving training comparable to that of students used
in standardizing the Gates-Strang test.

2. That there was no significant difference in the knowledge
attained by male students in the different classes of schools
of Montana. This indicates that health instruction in these
three classes of schools must have been similar in course
content.

3. That the tenth grade students achieved a higher score at the
five per cent level of confidence than did ninth grade stu-
dents, almost sufficient at the five per cent level of confi-
dence for the third class schools, indicating that maturity
and also health factors stressed in other courses might have had an influence on the level of knowledge attained by tenth grade students.

1. That the first, second, and third class schools all gave evidence of lack of knowledge in subject matter areas of (1) nutrition and (2) structure and function of the human body, while indicating strength in the sub-division of (3) individual health practice and (4) general health information.

5. That, as shown in related reading, little consensus of opinion on terminology and sub-divisions exists among health authorities. This makes it difficult for the average teacher to ascertain what subject matter areas to include in health instruction.

Recommendations. The following recommendations are made concerning health knowledge testing in the state of Montana:

1. That correlations be made with results of newer standardized tests, to determine the relative value of Gates-Strang Health Knowledge Test in today's health education.

2. That the Board of Education of the state of Montana establish a test with an area breakdown and with norms for total scores and for each sub-division. This test should be revised periodically and norms re-established to insure the use of a modern instrument.

3. That the Board of Education of Montana make it mandatory that all students complete at least two separate courses in health
education during four years of high school education.

4. That a similar study be completed to ascertain the health knowledge level of freshman and sophomore female students.
BIBLIOGRAPHY
A. BOOKS


B. PUBLICATIONS OF THE GOVERNMENT, LEARNED SOCIETIES, AND OTHER ORGANIZATIONS


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C. PERIODICALS


D. ENCYCLOPEDIA ARTICLES

Billings, Montana

Health Teacher

Dear Teacher:

As a partial fulfillment of requirements for a Masters Degree at Montana State University, I am making a study of the health knowledge of Freshmen and Sophomore High School boys. In carrying out this project I am seeking to obtain an adequate sample of boys from first, second, and third class district high schools in Montana.

The test being used is the Gates-Strang Health Knowledge Test and is composed of sixty Best Answer (multiple choice) questions. Thirty minutes will be allowed to complete the test. Directions for administering the test will accompany the test.

Would you be willing to cooperate and assist me in this study by applying this test to your freshmen and sophomore boys? It will take approximately one class period of time. You will not need to correct or grade the tests. Names of students, instructors, or schools will not be identified with the results of the tests. I will pay all postage charges for mailing the materials.

Will you please fill out the enclosed (postcard) and return it to me as soon as possible.

I will be greatly appreciative of your assistance in helping me gather the necessary information for my study.

Sincerely yours,

John G. Nash

Enclosure
Self-addressed postcard
POST CARD

I (will, will not) assist in the study by administering the "Gates-Strang Health Knowledge Test" to my freshmen and sophomore boys.

I will need ______ copies of the test.

I (would, would not) like to receive a copy of the results of the study.

Signed _______________________

School _______________________

Signed _______________________

School _______________________
TEST DIRECTIONS TO THE TEACHERS

1. Students are not to begin the test until the instructor has read the directions to the pupils.

2. Students fill in name, sex, date, grade, school, and city.

3. Read aloud, clearly and not rapidly, the directions on the first page of the test forms. Then read each sample question and its five possible answers. Pause for students' responses to the answers of each sample. Be sure each child has marked the sample exercise in proper manner by circling the letter before the correct answer.

4. Then say to the class, "Ready, turn the page and begin with number one. Mark only the one best answer. Do not skip any questions. If you finish before the time is up look over your answers to be sure they are right."

5. Time thirty minutes. If all the class finish before the thirty minutes are up the papers may be collected.
Health Test

Name

Boy or Girl

Name of School

Date

Grade

Town or City

Directions: Here are some questions about health. Five answers are given to each question. Read carefully each question and the five answers. Circle the letter before the best known answer. If you do not know which answer is best, mark one anyway. But if you mark more than one answer to a question, the question will be marked wrong.

Sample Questions

1. We should have fresh air:
   a. All of the time.
   b. In the daytime but not at night.
   c. At night but not during the daytime.
   d. Especially in summer.
   e. When we begin to get a headache.

2. Boys and girls should brush their teeth:
   a. Twice a year.
   b. Once a month.
   c. Twice a day.
   d. Once a week.
   e. Twice a week.

3. After an outdoor picnic one should:
   a. Throw the waste food into a near-by-stream.
   b. Set fire to the papers and leave them to burn up.
c. Spread the left-over food on the ground.

d. Hide the waste food and papers in the bushes.

c. Leave no waste food or papers lying around.

1. For boys and girls, the most healthful of these drinks is
   a. Ginger ale
   b. Tea,
   c. Coffee
   d. Ice-cream soda
   e. Fresh fruit juice.

2. Bobby's eyelids were red and sore. He did what he should when he
   a. Rubbed them with his hands.
   b. Did his schoolwork without telling anyone that his eyes hurt.
   c. Wiped his eyes on the towel his brothers and sisters used.
   d. Read stories after he had gone to bed at night.
   e. Had a doctor care for them as soon as possible.

3. A present that a two-year-old child will enjoy and that is least
   likely to hurt him is
   a. A lively kitten.
   b. A wagon that he can pull.
   c. A toy saw.
   d. A bottle full of small wooden beads to string.
   e. A scrapbook, paste, and scissors.

4. While eating, you should
   a. Talk about your troubles.
   b. Complain about the food you are eating.
   c. Talk about accidents and sick people.
   d. Eat all the time without talking.
   e. Talk about cheerful things.

5. The best result from playing team games is
   a. Making money for the school.
   b. Amusing the crowd.
   c. Winning the championship.
   d. Learning the spirit of fair play.
   e. Keeping boys out of mischief.

6. John was in bed with a cold. His mother very wisely brought him a
   supper of
   a. Hot milk toast and sliced peaches.
   b. Roast pork, potatoes and gravy, cake.
   c. Fried eggs, bacon, pie, cocoa.
   d. Lamb chops, potatoes, buns and jelly, lemonade.
   e. Hot milk toast and chocolate cake.

7. Of the following, the best way for high school students to gain
   accurate health knowledge is by
   a. Going to the movies.
   b. Reading health articles in a magazine such as HYGEIA.
   c. Reading advertisements.
d. Getting information from other boys and girls.

e. Asking storekeepers which foods are the most healthful.

8. You and your friend are taking an all-day hike. You have in all thirty cents to spend for lunch when you stop at noon. The best things to buy are

a. Three ten-cent bars of chocolate.

b. A small steak to fry over a fire.

c. A quart of milk, a box of graham crackers, and two bananas.

d. Two bottles of ginger ale and a bag of cookies.

e. A quart of milk and two chocolate cakes.

9. The best temperature for a room in which one is sitting is around

a. 54 degrees F.

b. 68 degrees F.

c. 75 degrees F.

d. 80 degrees F.

e. 85 degrees F.

10. Of the many kinds of bacteria

a. All are harmful.

b. All are useful.

c. Some are harmful and some are useful.

d. All cause disease.

e. Some cause disease and the rest cure disease.

11. A schoolboy or schoolgirl should give first aid without calling a doctor when a person

a. Has been badly hurt in an accident.

b. Does not know what is going on about him because he is unconscious.

c. Has fits and convulsions.

d. Has a small cut or scratch.

e. Has a severe pain in his head or abdomen.

12. Jane chose a pair of shoes that would be good for her feet. Her new shoes.

a. Had narrow, pointed toes.

b. Were exactly the same length as her feet.

c. Had narrow heels about two inches high.

d. Had a straight inner line.

e. Were a size larger than her feet.

13. Of these occupations, the one having the least danger of serious accidents is

a. Work on a farm.

b. Work with saws.

c. Work in mines.

d. Work at a stamping mill.

e. Work in tunnels under the river.

14. The use of alcoholic beverages in large amounts for a number of years is never the cause of

a. Stomach trouble.

b. Insanity.

c. A red nose.

d. Fatty tissues in place of muscle tissues in the heart.

e. An improvement of health.
15. On a sunny Saturday afternoon the most healthful thing for most high school boys and girls to do is to
   a. Go to the movies.
   b. Play a game of cards.
   c. Study their lessons for Monday.
   d. Play outdoor group games.
   e. Visit together at the corner drugstore.

16. A good thing to do to prevent the nervous system from being over-fatigued is to
   a. Get three hours of sleep before midnight and a total of at least ten hours of sleep every twenty-four hours.
   b. Stay up until eleven or twelve o'clock during school days but sleep late on Sunday morning.
   c. Have the loud-speaker of the radio turned on most of the time.
   d. Take alcoholic beverages and other drinks that are said to "Quiet the nerves."
   e. Experience intense and long-continued emotional enjoyment as often as possible.

17. Alice is thin and pale. Besides rest and some outdoor exercise, she needs
   a. Candy between meals.
   b. Medicine every day.
   c. Meat three times a day.
   d. Milk, bread and butter, vegetables.
   e. A lot of fried potatoes with gravy.

18. Bacteria cannot enter the body through
   a. The mouth.
   b. The nose.
   c. A small scratch.
   d. The unbroken skin.
   e. A hole in the tooth that has reached the pulp chamber.

19. Cabbage that has been cooked one or two hours has
   a. More vitamins than raw cabbage.
   b. Fewer vitamins than raw cabbage.
   c. The same amount of vitamins as raw cabbage.
   d. No vitamins at all.
   e. A better kind of vitamin.

20. Prevention of tuberculosis depends upon
   a. Tuberculin injections.
   c. Taking medicine.
   d. Avoidance of contact with an active case.
   e. Diet of milk and raw eggs.

21. Muscles are fastened to the bone by means of
   a. Joints.
   b. Skin.
   c. Tendons.
   d. Nerves.
   e. Mucous membrane.
22. Jack had to leave school and go to work. He wisely chose work which  
a. Paid him well but was harmful to his health.  
b. Was too hard for him.  
c. Was so easy he could think of other things while he worked.  
d. Left him no time for outdoor games and sports.  
e. Was in a clean, airy place.

23. Sugar, starch, and fat are especially useful for  
a. Giving energy.  
b. Building bone.  
c. Making red blood.  
d. Keeping the body clean inside.  
e. Preventing colds.

24. Many cities make water safe to drink by  
a. Boiling it to kill germs.  
b. Filtering it and treating it with chlorine.  
c. Collecting it from rivers.  
d. Storing it in tanks in a high part of the city.  
e. Treating it with iodine after it has been filtered.

25. Some good foods are not completely digested in the body. The one  
of these five that leaves the largest undigested part is  
a. Rice.  
b. Boiled milk.  
c. White bread.  
d. Cabbage.  
e. Eggs.

26. Of the following, the best foods to supply calcium are  
a. Bread and meat.  
b. Milk and vegetables.  
c. Fruit and green leafy vegetables.  
d. Bread and fruit.  
e. Fish and potato.

27. If someone has been cut deeply so that the blood comes in spurts, you should.  
a. Put pressure on the side of the wound away from the heart.  
b. Tie a bandage tightly with a pad of cloth under it below the cut; twist the bandage still tighter with a stick; do not loosen it for an hour or more.  
c. Tie a bandage tightly on the side of the cut nearest the heart; twist the bandage still tighter with a stick; loosen it every fifteen minutes.  
e. Let him lie down comfortably while you go to the nearest town to find a doctor.

28. The best location for a well in sandy soil is  
a. At the foot of the hill on which the house stands.  
b. Ten feet from barns and toilet.  
c. At a place where the surface water will flow into it.  
d. Beside a river.  
e. On much higher ground than the bar and toilet.
29. Air that is too dry is harmful because it  
   a. Has little oxygen in it.  
   b. Irritates the throat and nose.  
   c. Contains germs.  
   d. Makes the skin feel hot.  
   e. Makes one thirsty.  

30. If you are going to travel in places where typhoid fever is a common disease, the most important and practical thing for you to do is to  
   a. Drink tea instead of water.  
   b. Drink beer and wine instead of water.  
   c. Be inoculated with typhoid-paratyphoid before you go.  
   d. Protect yourself from flies.  
   e. Be vaccinated before you leave home.  

31. Of these lunches the one supplying vitamins A, B, C, D, and G in the largest amounts is  
   a. Macaroni and cheese, ice cream.  
   b. Baked potato, meat, pie.  
   c. Egg sandwiches, chocolate cake.  
   d. Whole wheat bread and peanut butter, cocoa.  
   e. Whole milk, poached egg, sliced oranges.  

32. One reason why green leafy vegetables are healthful is that they contain  
   a. Protein and sodium.  
   b. Starch and sugar.  
   c. Iron and vitamins.  
   d. Fat and potassium.  
   e. Carbohydrates and water.  

33. Smoking tobacco causes the heart to beat  
   a. More weakly.  
   b. More slowly.  
   c. More steadily.  
   d. More irregularly.  
   e. More rapidly.  

34. When the cells of a person's body are not being supplied with all the substances they need, he is said to have  
   a. Tonsillitis.  
   b. Good nutrition.  
   c. Malnutrition.  
   d. Immunity.  
   e. Indigestion.  

35. Iron is found in largest amounts in  
   a. White bread and butter.  
   b. Green vegetables and egg yolk.  
   c. Ice Cream and cake.  
   d. Strawberries and cream.  
   e. Cheese and crackers.
36. A thorough annual health examination for a student.
   a. Can be given in five minutes if the doctor works quickly.
   b. Consists of examination of chest, lungs, and throat.
   c. Can be done by having the pupils pass by the doctor in a line.
   d. Requires time for a confidential talk and a study of the body from head to foot.
   e. Can be obtained only from a private physician.

37. A good scientist
   a. Never gives an opinion of his own.
   b. Keeps his work secret until he has finished it.
   c. Understands every field of science.
   d. Looks for the causes of things that happen in his field of work.
   e. Believes that whatever is discovered now in science laboratories will always be true.

38. The reason why a cold or sore throat sometimes causes an earache is that
   a. There is a pathway from the throat to the inner part of the ear.
   b. Cold germs enter the ears from the outside at the same time that they enter the throat.
   c. The whole body has become chilled.
   d. Bacteria are carried to the ears by the blood.
   e. Many kinds of sickness cause earache.

39. The largest amount of protein is to be found in
   a. Rice, oatmeal, whole-wheat bread.
   b. Milk, fish, eggs.
   c. Carrots, potatoes, turnips.
   d. Apples, bananas, oranges.
   e. Candy, cake, ice cream.

40. Two of the best sources of vitamin B or $B^1$ are
   a. Cereal germs and yeast.
   b. Butter and cream.
   c. Ham and eggs.
   d. White rice and molasses.
   e. Coffee with cream.

41. If your friend and you are out walking and he is bitten by a poisonous snake, you should
   a. First apply a very tight bandage with a knot in it between the bite and the heart; then make the wound bleed, suck out the poison with a heated bottle.
   b. First cut the tiny wound with a sharp knife to make it bleed, then suck out the poison with a heated bottle; then apply a tourniquet between the bite and the heart.
   c. Try to suck the poison out from the wound with your lips.
   d. Apply a bandage with a knot in it very tightly, and do not loosen it for an hour.
   e. Kill the snake and rub some of the fat on the wound.

42. A diet that is best for the brain and nervous system.
   a. Is high in calories.
   b. Is high in vitamins and low in minerals.
   c. Meets the needs of the body as a whole.
   d. Consists of fish and special "brain foods."
   e. Is rich in cream and butter.
43. Scientific men classify alcohol in large quantities as
   a. A protective food.
   b. Poison.
   c. Alkali.
   d. Acid.
   e. Stimulant to reasoning powers.

44. A focus of infection is
   a. A kind of disinfectant.
   b. A part of the body where disease bacteria collect.
   c. A part of the body in which digestion takes place.
   d. A medicine to purify the blood.
   e. A place where garbage and waste paper are thrown.

45. It is wise for all to have a health examination
   a. Every year.
   b. Every two years.
   c. Every three years.
   d. Every four years.
   e. Every five years.

46. The best way for a city to handle its sewage is to
   a. Let each citizen dispose of his wastes in his own way without
      interference.
   b. Let the sewage run into a stream that is flowing away from the
      city down through other towns.
   c. Purify the sewage and use the solid part for fertilizer.
   d. Let the sewage, without any treatment, run over land that will
      later be used for farming.
   e. Let it run untreated into open ditches dug through vacant fields.

47. The kidneys may be most seriously harmed by
   a. Bacteria and alcoholic beverages.
   b. Proteins and fats.
   c. Poor posture and heavy clothing.
   d. A diet of milk and potato.
   e. Playing football and basketball.

48. The oxygen which passes through the thin walls of the lungs and into
    the blood stream is carried to all cells of the body by the
   a. Red blood corpuscles.
   b. White corpuscles.
   c. Calcium in the plasma.
   d. Phosphorus in the corpuscles.
   e. Mucous membrane.

49. Before the undigested part of food is passed out of the body, it
    collects in the
   a. Stomach.
   b. Small intestine.
   c. Large intestine.
   d. Kidneys.
   e. Glands.

50. The richest source of vitamin D is
   a. Olive oil.
   b. Fish-liver oil.
   c. Potatoes.
   d. Spinach.
   e. Cocoa
51. The most common physical defects found in the school children of the United States are those of the
   a. Mind and bones.
   b. Nerves and skin.
   c. Throat and nose.
   d. Eyes and teeth.
   e. Hands and feet.

52. The average number of calories in a half-pint glass of whole milk is
   a. 50 calories.
   b. 75 calories.
   c. 100 calories.
   d. 150 calories.
   e. 250 calories.

53. The digestion of well-chewed starchy food begins in the mouth when it is mixed with
   a. The gastric juice.
   b. The saliva.
   c. Water.
   d. Milk.
   e. A weak acid.

54. A child who has scarlet fever should
   a. Be treated as a person with a serious disease.
   b. Go back to school as soon as he is able to get up.
   c. Ask his friends to come to see him.
   d. Go about as usual if it is a light case.
   e. Go out in the cold in order to become hardy and robust.

55. The muscular walls of the stomach are lined with
   a. Small hairs.
   b. Layers of fat.
   c. Thin bones.
   d. A thick skin like the skin of the hands.
   e. A thin skin like the lining of the throat.

56. A disease of the thyroid gland called goiter is caused by lack of
   a. Calcium.
   b. Iron.
   c. Protein.
   d. Oxygen.
   e. Iodine.

57. The disease called scurvy is prevented and often cured by foods supplying vitamin.
   a. A.
   b. B.
   c. C.
   d. D.
   e. G.

58. The organ chiefly responsible for maintaining the right amount of each essential substance in the blood is the
   a. Liver.
   b. Lungs.
   c. Kidneys.
   d. Intestine.
   e. Brain.
59. The fundamental differences between the sexes found in all societies are
   a. Social.
   b. Physical.
   c. Temperamental.
   d. Intellectual.
   e. Educational.

60. The average amount which the stomach of a grown person can hold is
   a. $\frac{1}{2}$ to 1 pint.
   b. 2 to 3 pints.
   c. 3 to $\frac{1}{2}$ pints.
   d. $\frac{4}{4}$ to 5 pints.
   e. 6 to 7 pints.
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FIRST CLASS SCHOOL, 10TH GRADE, SCORE INTERVALS,
FREQUENCY, STANDARD DEVIATION, STANDARD ERROR OF MEAN AND MEDIAN

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STANDARD DEVIATION = 8.20
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