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# An Evaluation of a Health Project in a Primary Grade

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# AN EVALUATION OF A HEALTH PROJECT IN A PRIMARY GRADE

Submitted by

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# CHAPTER I

## THE PROBLEM AND ITS SCOPE

### Introduction to the Problem

One of the more recent emphases in curriculum, stressed by the administrative office of the Omaha School System, is health education. In an already well-filled school program, there exists little time to add work in new areas of education. Yet the need remains.

### The Problem

The problem of this study is to prove whether time spent in focusingattention upon health education, and giving it a major emphasis in the curriculum, is commensurate with the following results: first, the improvement of the physical status of the individual child; and second, the improvement of specific group standards of health in relation to communicable diseases, dental care, and medical examinations.

### Explanation of Terms

In this problem, the teaching of health is considered as a twofold device: the responsibility of imparting to the children factual material about health, and the development of an acute awareness, on the part of the teacher, of the individual health needs and physical status of each child. The results are to be considered not only

from what factual health material the child had assimilated, but also from his early formation of good health habits, and his earnest desire for a body that will function efficiently.

## Scope

Since a graduate study must confine itself to a limited field, this experiment has eliminated many interesting problems. The chief concern of this study has been with the solution of whether the school could: (1) improve the physical status of the individual child, and (2) improve his conformity toward specific group standards of health in relation to communicable diseases, dental care and medical examinations.

These two health problems were selected because their investigation might lead to a clearer understanding of the individual child and his acceptance by the social group.

The study was confined to primary pupils of a single classroom who were enrolled for the entire school year. All transient pupils for whom a complete test score was unobtainable were eliminated. The experiment was extended over a period of two school years.

## Limitations of the Study

The writer realizes that there are many limitations to this study. The intelligence tests used were group tests and therefore do not offer the reliability possible

with individual mental tests. The inability to secure an achievement score for the non-readers at the beginning of the experiment was unfortunate. Had there been standardized tests of physical fitness available for young children the reliability of such a test would have been established. Then, too, one must remember that the sampling in this experiment was small, due to the fact that it was carried on in a single classroom, and from that group the abnormally high transient element had to be eliminated. Outside influences that are always present in the health picture of the child are impossible to evaluate. Notwithstanding all of these limitations it is hoped that this study may bring to light some of the worthy objectives that a school may attain through the promotion of a practical health program for primary children.

This study seems to be a pioneer in its field. Careful research has disclosed no physical fitness tests for younger children. Since standardized tests were not available it was necessary to devise original tests. Such tests are subject to errors, as any test would be upon first usage.

## Need for the Study

> "In a country where three-quarters of the school children examined have physical defects of one kind or another, where seven-tenths of the industrial workers under inspection suffer from physical ailments, and where in one year one-fifth of the young men applying for Army and Navy service were rejected because of physical weaknesses, the

> health of the youth is apparently an item of no mean significance. If such conditions exist among the young, when vitality is at its height, the health picture of the whole population is one which cannot be too carefully scrutinized."[1]

The preceding quotation gives a mathematical conception of the part health plays in our society in general. Let us now examine this from a monetary standpoint. Dr. Dublin[2], Third Vice President and Statistician of the Metropolitan Life Insurance Company, published a series of tables entitled "Money Value of a Man". He based his study on a family having an average income of $2500 annually. The cost of raising a child to the age of eighteen was considered as $7500, at which time he was considered self-supporting. The future probable earnings of this individual, minus his upkeep, were $29,000. If this individual was disabled, or died in childhood, his country not only lost the cost of his upkeep, but also the potential net future earnings of that individual.

Many educators consider education in health as the most important objective of a school. The White House Conference report of 1930 brings this out clearly in the following statement, "The school program must be arranged to protect and improve the physical, mental and emotional health of every child, and to preserve that most sacred thing to every child--his personality--and allow him the

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1. Rainey, Homer P., How Fare American Youth, p. 61-62.

2. N. E. A. and A. M. A., Health Education, National Education Association, p. 23-24.

fullest opportunity to develop his best self."[3] The American Association of School Administrators considered health important enough to warrant making it the subject of their Twentieth Yearbook, Health in Schools, The greatest portion of the Tenth Yearbook, Guidance in the Elementary School, by the California Elementary School Principals' Association[4] is devoted to the health work of the California schools. Bess Lee Gambrill, Associate Professor, Elementary Education at Yale University, in an article written for this Tenth Yearbook, considers the first task of the school, and every teacher in the school, as the development in the individual child of a strong, disease-resisting body, with nervous reserves which may serve him in future years under the stresses and strains of a complex, rapidly changing modern society.

Local Situation

In view of the national picture regarding health, let us look at the problem presented to the Omaha classroom teacher as she tries to carry out the policies stressed by the administration. The most logical person to whom the teacher can turn for assistance in a health program is the school nurse. There are, at the present time in

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3. White House Conference of 1930 on Child Health and Protection, Addresses and Abstracts of Committee Reports, p. 170.

4. California Elementary School Principals' Association, Guidance in the Elementary School, p. 12.

Omaha, nineteen school nurses under the direction of Miss Grace Pinkney, Supervisor of Nurses. Each nurse cares for approximately 1500 to 2000 children. The schools each nurse serves are distributed in various districts, so the number of home visitations will be equally divided. With the school nurse carrying this large a case load, it seems very logical that the teacher will need to screen her children to be able to receive the greatest benefits from the services of the school nurse. A classroom teacher who is constantly aware of the physical condition of her children can do much more to prevent the spread of epidemics than can a school nurse who probably will have contact with the school only once a week. A teacher has a great advantage in knowing the normal, healthy personality and appearance of her children. She will find it a distinct advantage to her own daily average attendance to be very strict about immediate exclusions for colds and skin eruptions. Through constant vigilance she can safeguard the health of her group.

For the last four years the Omaha schools have had no free dental clinic. The lack of dentists during the war was the cause of this service being discontinued. This service was in complete accord with the needs and wishes of the community, since it was originally started by the local dental society. The School Board is now willing to restore this service, if a man can be found who will take over the work. This position may be

difficult to fill, because the money the School Board will be able to pay will probably not compare favorably with the money such a man could make in private practice. Due to this present lack, the momentum for dental care falls more heavily upon the classroom teacher.

The Omaha Schools have no regular physician. Many people feel this service is more satisfactorily handled by private physicians and clinics supported by the community rather than the School Board. Services of a physician could, however, be made available to the children of Omaha through a child guidance clinic, where people could pay to the extent of their ability. The reorganization of the City Health Department may be able to bring this about. This reorganization ordinance was passed unanimously by the City Council on October 9, 1945.[5] Such a clinic with its doctor, psychologist, psychiatrist, and case workers would be of invaluable assistance to the Omaha teachers who, through their professional support, could hasten the accomplishment of such an organization.

Knowing there is no child guidance clinic, no school dentist, and realizing the magnitude of the load of the nurse, the serious needs of the children of Omaha make it impossible for the conscientious teacher to do other than add time and effort in the teaching of health.

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5. World Herald, October 10, 1945, p. 1.

# CHAPTER II

## PREVIOUS HEALTH STUDIES

Many health studies have been made of both national and local scope. The studies located were not classroom projects, but rather inquiries regarding the success of a school health project, community enterprise, or national situation. The following studies are a few of the more well known investigations summarized briefly.

### The White House Conference of 1930

The White House Conference of 1930 on Child Health and Protection was the third of its kind to be called. The first had been called by President Roosevelt in 1909. Due to the stimulus of this conference the Children's Bureau of the Department of Labor was organized in 1912. The first conference concerned the dependent child. The second White House Conference was called in 1919 at the request of President Wilson. It dealt with the child in special need of protection. The influence of both of these preceding two conferences have had a far-reaching effect upon legislative protection of children. The third conference was called by President Hoover in July of 1929, and assembled in November of 1930. Ray Lyman Wilbur, Secretary of the Interior, served as chairman of the conference. In preparation for the conference 1200 experts, working on 150 committees, assembled facts to

present to the conference. They were divided into four sections as follows: Medical Service, Public Health and Administration, Education and Training, and The Handicapped. At the closing session of the conference nineteen points embodied in the recommendations of the committees were presented. They went on record as The Children's Charter. They took into consideration the spiritual and moral training of the child, his personality, home, birth and prenatal care, health protection, health instruction, dwelling place, school, community, education, training, safety, physical handicaps, delinquencies, standard of living, recreation, organizations, and public health services.

The White House Conference[1] of 1930 had proved invaluable as a survey of prevailing conditions in regard to the health picture of the children of the nation as a whole. The Children's Charter that grew out of this voluminous collection of data was a motivating factor in the future planning of many communities in regard to the health needs of children. American's children should be healthier if more communities would make use of these valuable suggestions discussed at the White House Conference.

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1. The White House Conference of 1930 on Child Health and Protection.

School Health Research Monographs

The American Child Health Association, as a result of the needs presented in a study of a health survey of eighty-six schools, and at the suggestion of their president, Mr. Herbert Hoover, fostered a series of five School Health Research Monographs. The monographs were produced in a three-year period beginning in 1929 and ending in 1932. The fifth and sixth grade classes of seventy cities throughout the country were used in this study.

The first of these monographs was entitled Health Education Tests.[2] Objective tests with complete directions for administration and scoring were given to determine the health attitudes and mental ability of the children. There proved to be no sectional differences in achievement on the tests. The factor that produced the greatest difference in achievement was intelligence. Economic status, age, cleanliness and greade were of slight importance.

The type of test used in this monograph was of little value to the writer of this study, since the stress was given to attitudes rather than measurements of physical abilities. The questionalbe issue in a test of attitudes would be the element of transfer. Knowledge of health as a subject does not necessarily imply its personal application by the child. Considering this weakness of

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2. Franzen, Raymond, Health Education Tests, American Child Health Association.

health attitude tests, the writer chose physical fitness tests as a measuring instrument in this study.

The second monograph, Physical Measures of Growth and Nutrition,[3] dealt with the physical examinations of these children, Items considered were: height, weight, skeletal dimensions, muscular dimensions, skin, hair, subcutaneous tissue and muscle quality. Great disagreement was found in rating of the various physicians. Most of the physicians failed to make proper allowance for skeletal dimensions. The correlation of height with weight was not nearly as high as the correlation of weight with other skeletal combinations such as chest or hip measurements. Therefore, great errors may be made in using height and weight tables as indices of malnutrition. The three important elements that need to be considered in nutrition are muscle size, body build, and the amount of subcutaneous tissue. The development between the ages $9\frac{1}{2}$ and $10\frac{1}{2}$ was greater than that of any other year between $7\frac{1}{2}$ and $12\frac{1}{2}$. The male lag in development came between $10\frac{1}{2}$ and $12\frac{1}{2}$. The variability between $8\frac{1}{2}$ and $9\frac{1}{2}$ was the least. In general the female was more variable than the male in all measured traits.

This second monograph pointed to two significant facts: (1) that physical examinations depend largely upon the personal judgement of the examining physician, and

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3. Franzen, Raymond, Physical Measures of Growth and Nutrition, American Child Health Association.

(2) that height and weight indices of determining physical well-being are not inviolate standards. The original plan was to use a physician's examination together with height and weight records to determine the physical status of children in the experiment. However, after a careful study of the second monograph, it was decided that such records would be opinionated and therefore were not used. Height and Weight records were used along with seven other physical fitness tests, and consequently did not assume an overly-important role in determining the physical status of the child.

The questions at issue in the third monograph, Public Health Aspects of Dental Decay in Children,[4] were: (1) Do dental caries appear as a product of inheritance or very early environmental factors, or do they appear in some periodic manner? (2) Is liability to caries a function of the tooth or the organism? (3) Do fillings have an effect upon the progress of dental caries? (4) Do uncorrected enamel defects have an effect upon the development of dental caries?

Some interesting conclusions were drawn from this study. Decay seemed to be periodic. It seemed to be a function of the individual organism rather than the tooth. The chances of further development of caries in any one tooth were smaller when previous decay had been corrected,

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4. Franzen, Raymond, Public Health Aspects of Dental Decay in Children, American Child Health Association.

but this correction had no effect upon the proportion of decay that might appear in the other teeth. Filling deciduous teeth had no apparent effect upon the subsequent or contemporary decay of permanent teeth. Pits or fissures in the enamel did not tend to cause dental caries. The opposite appeared true, inasmuch as first molars with no enamel defects were more liable to caries than those with pits and fissures.

Considering the findings in this illuminating monograph, the writer saw fit to stress the preservation of temporary teeth as guides for correct position and alignment of permanent teeth. At no time was the implication made that the correction of decay in temporary teeth would lead to replacement by permanent teeth with fewer dental caries. The importance of the six year molar was pointed out in conferences with the parents of children needing repair of such teeth.

The fourth monograph in this series was entitled Influence of Social and Economic Factors on the Health of the School Child.[5] The tests used in the previous monographs were considered along with such factors as cleanliness, rent appraisal, economic rating, cultural status, and age. The two sectional differences that appeared were; pediculosis found more frequently in the Northeast, and dental caries also more prominent in this area. Socio-economic factors had a marked influence upon psychological

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5. Franzen, Raymond, Influence of Social and Economic Factors on the Health of the School Child, American Child Health Association.

health tests and other measures of health behavior. Nail biting seemed to be more frequent among those of better economic and social background, but ear defects and dental caries were more frequently corrected among this class. Vision defects were uncorrected as frequently among one group as another. The quality of home care had a great influence upon adequate musculature and subcutaneous tissue.

Two of the findings of this monograph were comparable to the local situation encountered in this study. The only case of nail biting noted in the two-year experiment occured with a boy of good economic and social background; whereas the neglected cases of dental caries were more numerous among the children of poorer economic and social backgrounds.

An Evaluation of School Health Procedures,[6] the fifth and last of these monographs, attempted to evaluate the procedures used in the schools, the socio-economic status of the units studied, and the achievement in the terms of the children influenced by these programs. It was found that the teacher had knowledge of only a small proportion of the children needing professional attention. Since she was in such a favorable position for referring cases for examination, the study recommended instruction and

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6. Franzen, Raymond, An Evaluation of School Health Procedures, American Child Health Association.

supervision of the teacher by the health supervisors, nurses and medical examiners. There should be a closer working relationship established between the nurse and the teacher. The teacher should be a participant in physical examinations and nurse inspections. If the examining physician were relieved of detail history work, his time could be used to a better advantage. A nurse could be better fortified for home visitations by human interest material provided by the teacher.

Since much of the material presented in this monograph concerned the duties of a school physician, it was not applicable to the Omaha school situation. The statistical proof of the inability of a great many teachers to determine the health needs of the children was an alarming condition that should present a challenge to the teachers of Omaha. Local school nurses, when questioned about human interest material that could be made available to them by classroom teachers, felt that such material would help to insure better relations in difficult situations arising from home visitations.

## The Astoria Study

The Astoria School Health Study was initiated in 1936 and concluded in 1940. It was conducted principally in the Astoria Health District, one of the thirty districts into which New York City has been divided for administrative purposes by the Department of Health. The major objective of this study was to create better health

services for the school children. The study consisted of three distinct phases in its four years of work. The first phase was the analysis of the difficulties of the school health program. The second phase was the experimentation with methods of solving the difficulties. The last phase was the period when its field laboratory became the teaching center of the Health Department for the school health work.

An administrative health officer would be able to use this study to a good advantage in considering possible approaches of revision in revitalizing a school health department. This study would hold little value for the teacher, since it was a general study of a system rather than an evaluation of classroom instruction in health.

"No attempt was made to evaluate classroom instruction in health."[7]

The Michigan Community Health Project

The Michigan Community Health Project was launched in 1930 under the auspices of the W. K. Kellogg Foundation. The study was made in the rural area around Battle Creek. The objectives were taken from those set forth in the Children's Charter of the White House Conference on Child Health and Protection. The policy adopted was that of

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7. Nyswander, Dorothy B., Solving School Health Problems, The Astoria Demonstration Study, The Commonwealth Fund.

helping the community organize and use its own resources, rather than one of substitution. Community groups were organized, and these leaders were instrumental in instituting the changes. The spirit of progress permeated into all community groups. Doctors, dentists, school administrators, school board members, teachers, school custodians, librarians, parent groups, churches, dairymen, recreational groups, and farm youth organizations all expressed a desire to participate in this educational program. Grants were given by the Kellogg Foundation to establish health departments in the seven counties. Children were cared for by private physicians and dentists, but the cost of the care of the indigent was assumed by the Foundation upon the recommendation of the attending physician or dentist. New machinery was needed to carry on such an extensive program. By pooling community resources all services could be made available to many at a lowered cost. By training people to have more regular care the cost to the individual was lowered, and more people could afford to pay for their own care. During the first years of the experiment all of the school children received medical examinations. Later the pre-school children and infants were examined.

New needs continually arose from such a program. Modernized school equipment and buildings were financed by the Foundation if the expense was too great for the community. A new book was purchased for every five old books turned in, and traveling libraries were established.

New courses were offered at all available universities. Hospitals were built. Camps were financed by the Foundation. Foundation scholarships were given to farm children who could not afford to continue their education. A special short course was initiated for these out-of-school farm youths at Michigan State College during the slack farm months. Loans were provided 4-H Clubs as a borrowing capital for farm youths.

This project has made great strides and will undoubtedly keep moving forward. Many projects supported by the Foundation are now self-supporting.[8]

The reader will note that the striking impression received from this study was its pulsating spirit of progress. This small Michigan community with meager facilities had, through interested planning, achieved a goal envied by much larger and better-equipped localities. The expenditure of money was relatively small. At the present time it might be wise for communities planning post-war improvements to study the reasons for the success of this Michigan project. They might note that the plans of this community grew from within, rather than as a result of being superimposed upon the society.

Community Organization

In a committee report of the Public Health Education

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8. Trustees of the Kellogg Foundation, W. K. Kellogg Foundation the First Eleven Years 1930-1941, The Lakeside Press.

Section and the Health Officers Section of the American Public Health Association, several plans of community organization were studied. They were grouped under three classifications: (1) programs initiated under school leadership; (2) programs initiated under health department leadership; and (3) programs initiated by joint activity of school, health department and, sometimes, private agencies.

The first example of programs initiated under school leadership was that of Bullock County, Georgia. Dr. M. S. Pittman, president of the Georgia Teachers College, initiated the "zone plan" for this community. Three zones, under the leadership of a supervisor, elected teacher committees to formulate policies and plans for carrying them forward. The first problem attacked was that of hookworm. As a result, infection was reduced among school children from 60% in 1936 to 27.7% in 1940. In solving their second problem of soil pollution, the aid of parents, health department and W. P. A. was solicited. In a period of four years 3500 pit privies had been erected by the patrons furnishing the lumber; the health department providing the plans; and the W. P. A. providing the labor. From this beginning originated an organized county health department with four full-time people and an adequate budget financed by the State and County. Other results were: higher percentage of immunization, hot lunches, nutrition projects, septic tanks, rat proofing, screening, malaria control and pasteurization of milk. Two other

examples were used for programs initiated under school leadership. They were at Appomattox County, Virginia, and Rockbridge County, Virginia.

The second group of studies was based upon programs initiated by the leadership of the health department. The four examples were: Santa Barbara County, California; San Joaquin Local Health District, California; Jefferson County, Alabama; and Calhoun County, Michigan.

The San Joaquin County Program is typical of this group. The health department includes rural territory and cities. It levies taxes for its own support. Records from the Health Centers show that approximately one-fourth of all pre-school children have been under regular observation from birth. Well-baby conferences are held at the Health Centers with about 62% of the babies attending. Private physicians assist for a fee paid by the health department. Examination of school children also takes place here, since more diagnostic tests can be made than at the school. Children are referred for examination by their teachers. Psychiatric social workers are employed to do educational testing, and make home visits. Psychiatrists from state hospitals are consulted when the need arises.

Programs initiated under joint sponsorship were inaugurated at Cottage Grove and Eugene, Oregon; Washington County, Tennessee; and Hartford, Connecticut. One of the most carefully planned of the joint programs was the Hartford plan. It was developed through the efforts of

the Hartford Tuberculosis and Health Society and the Hartford Board of Health. Group education was developed by lectures, audio-visual aids and leaders' institutes. Since the project has been started many more agencies have been included.[9]

After studying all of the plans of organization presented, the conclusion drawn was that the type of organization was of secondary importance. The primary factor in the success of all of these plans seemed to be the interest that motivated these organizations. In the reorganization of the Omaha Health Department it will be interesting to observe whether the main objective will be concentrated upon organization or upon achievement.

National Education Association Policies

In setting down a declaration of policy for the effective relationship between education and other public social services, six points are brought out that specifically refer to the health service department.

> "That the school assume full responsibility for health instruction and health inventories of pupils.
>
> That school authorities recognize a definite obligation to provide a hygienic school environment and regimen as well as health supervision of teachers and employees.
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> That medical diagnosis and treatment for school

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9. Committee on Community Organization for Health Education, Community Organization for Health Education, The Technology Press.

> children, with certain emergency exceptions, be provided by agencies other than public schools.
>
> That the school expand its adjustment program through the development of a system of cumulative records and use of socially trained attendance workers, guidance counselors, and the child guidance clinic.
>
> That the material wants of the indigent school children be supplied by agencies other than public schools.
>
> That school authorities stimulate community action leading to the establishment of appropriate agencies for removing social, economic or physical handicaps that affect the education of children."[10]

The declaration of policy of the National Education Association was conservative in its views concerning the place of the school toward a health program. This would be a natural reaction of a national body reflecting the policy of any socialized society that has emerged from established precedent. However, some of these policies are far more liberal than those of the Omaha schools. The second, fourth and sixth declarations point to a distinct lack in the Omaha health picture.

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10. Educational Policies Commission, Social Services and the Schools, National Education Association.

# CHAPTER III

## METHOD OF PRESENTATION

### Choosing a Plan

In this study an attempt has been made to set up a controlled experiment to prove or disprove the merits of an extensive health program in a primary grade. Many plans of carrying out this experiment were considered. The ideal plan would have been to have a control group and an experimental group within the same room. Such a plan was impractical and impossible due, first, to the fact that there was no way in which an experimental group could be isolated for teaching purposes, and second, that no national norms were available for this age child for the physical fitness tests which were used to determine the physical growth of the group. The other alternative was to test a room for a year, placing no unusual stress on health work during which time necessary norms would be established. This would be followed the next year by an intensified health program administered to the new group. Extenuating circumstances made it necessary to adopt the second alternative.

The control group constituted the room tested for the first year of the experiment when no unusual stress had been given to health work. The experimental group consisted of the second year class where an intensified health program was instituted. The two stable elements

of comparability throughout the experiment were mental ability and achievement. Tables IX and XI point out the comparability of the control and experimental groups in mental ability at the beginning and ending of the experiment. By statistical computation these two groups are considered similar in mental ability throughout the experiment. Due to the inability to test the groups for achievement at the beginning of the experiment, no established comparability in this area was made. By referring to Table XIII the reader will note that these two groups are comparable in achievement at the conclusion of the study. The fluctuating factor in the results of this two year experiment was the comparability of the two groups in physical fitness tests.

Having determined that a two year plan was the best to follow in this particular experiment, the execution of the plans was started in September, 1944. The first step was the administering of a battery of tests in September, 1944, which were again repeated in June, 1945, to try to determine the mental and physical progress of each group. The test for the null hypothesis (see page 38) was used on each test to establish the similarity and comparability of the groups.

## Types of Tests Used

The Otis Quick-Scoring Mental Ability Tests-Alpha A for grades 1-4, by Arthur S. Otis, were the mental ability tests used.

> "For a single grade the reliability co-efficients of the Nonverbal and Verbal Tests are .68 and .71, respectively . . . . The reliability of the total score (Nonverbal plus Verbal) is .81. These co-efficients indicate that the Nonverbal and Verbal Tests are of about equal reliability, but when combined they yield a total score that is appreciably more reliable than either one taken by itself." [1]

The I. Q. scores were determined from the combination of both the Verbal and Nonverbal tests. This particular test was suggested by Dr. Shirley Hamrin, who is in charge of the testing service at Northwestern University School of Education. This test can be given as a group test, and it can be used effectively with non-readers.

The Metropolitan Achievement Tests, Primary 1, Revised Battery, by Gertrude Hildreth,[2] were also administered. "The reliability of the total test is high, ranging from .91 for the first grade to .97 for the fifth grade." The results of these tests, however, are considered separately, since not all the children received in September were able to obtain a score on the test.

Physical Fitness Tests had not been generally used until World War II. They were then used with adolescent or adult people. No tests were available for six or seven year old youngsters. After consulting with Miss Catherine Carrick, Physical Education Supervisor for the

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1. Otis, Arthur S., Otis Quick-Scoring Mental Ability Tests Manual of Directions for Alpha Test, p. 15.

2. Buros, Oscar Krisen, The Nineteen Thirty Eight Mental Measurements Yearbook, p. 874.

Omaha Schools, and Dr. Madeline Marr, then acting as the Supervisor of the Health Service Department of the Omaha Schools, it seemed advisable to devise original tests. Suggestions of physicians consulted in regard to such tests proved too technical for a layman to utilize, since they would have required too much time and equipment to administer. In August of 1944, Mr. Karl Krantz, head of the Physical Education Department of Northwestern University, was consulted about physical fitness tests. He had done a great deal of work with such tests, and at that particular time was doing the physical fitness testing for the Navy at the Great Lakes Training Station. It was Mr. Krantz who helped work out the tests for young children which were used in this study.

In compiling the physical fitness tests the following points were considered: (1) establishment of types of physical abilities to be measured, (2) thorough examination of already available material and (3) selection of materials adequate for measuring the capacity of a young child.

The physical abilities to be measured were: heart reaction, arm and shoulder strength, abdominal strength, leg strength, combined strength, height and weight.

## The Heart Reaction Test

To test the heart reaction the child was asked to run in place for one minute. The pace set for him was at the rate of approximately two steps per second. The

heart beat rate was recorded before he started. The range for these children was between seventy and eighty. After the activity the rate would increase from about one-fourth to one-half. After stopping the activity the beat was timed to see how long it would take the heart to return to its normal rate. The stronger hearts returned to normal in a shorter time than did the weaker hearts. The number recorded on the test therefore was in seconds, and the smaller number represented the stronger hearts. "The trained man--i.e. with a heart in good condition--will therefore have a considerable range over which the output per beat can be increased with increasing inflow, without alteration of rhythm.[3] In the untrained man this margin will be smaller, so that the second mechanism of adaptation, viz. quickening of the heart beat, will be sooner brought into action to cope with the increased inflow associated with muscular exercise. Thus, one finds a considerable difference in the effect of exercise on the pulse rate in trained and untrained individuals respectively, and this is especially shown in the promptness of recovery of the pulse when the exercise comes to an end, the effects lasting much longer in the untrained."

Arm and Shoulder Tests

To test the arm and shoulder strength two tests

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3. Starling, Ernest H., Principles of Human Physiology, p. 815.

were administered. One test was for pulling weight, and the other for pushing weight. The test for pulling weight was a chinning test. Owing to the lack of proper chinning equipment, an improvised device was used. The child doing the chinning lay on his back on the floor, while the child assisting stood over him in an erect position with hands extended downward. The child on the floor took the assistant's hands and pulled his own weight up to a stick held even with the hands of the assisting child. The child assisting was required to keep his back straight. Since the performer pulled his own weight the distance of his arm length, the result was comparable to actual chinning. This test was recorded as the number of times the child was able to perform the feat without resting. The other test for determining arm and shoulder strength was the weight pushing test. The child was asked to do push-ups from the floor with a straight back. The test was recorded as the number of times he was able to do this without rest.

Abdominal Strength Test

To test the abdominal strength a line was marked around the gymnasium floor. The line was measured off in inches. The child walked on his hands in wheelbarrow fashion, with another child holding his feet. The distance a child could travel before his back sagged represented the figure used for the abdominal strength. This figure was recorded on the test in inches.

Leg Strength

To determine the leg strength the child was given a piece of chalk and asked to mark on the board as high as he could reach while standing with feet flat on the floor. He was then asked to bend his knees and jump up as high as possible and place a second mark on the board. Each child was given at least three chances and the highest mark recorded. The distance in inches between the first mark and the highest jumping mark represented the leg strength. The number was recorded on the test in inches.

Combined Strength

The test used for combined strength was one commonly used by the Navy. It consisted of a four count exercise: (1) the child starts from a standing erect position; (2) next he jumps to a squat position, with his hands on the floor between his knees; (3) he then jumps and extends his feet behind him; (4) he then jumps back to a squat position and is again ready to repeat the exercise. The test was recorded as the number of times he could complete this exercise in one minute, setting his own pace.

Height and Weight

The height and weight were recorded in inches and pounds respectively. The children removed their shoes before the measurements were taken.

All of the tests were administered to the control

group in September of 1944 and June of 1945, and to the experimental group September of 1945 and June of 1946.

## Plans for the Experimental Group

The intensified health program for the experimental group included more class time allotment for physical education, a specific nutrition program, an organized milk program, various types of cleanliness activities, physical rearrangement of the classroom, immunization, weight tabulation, dental care, and attempted completion of the physical examinations. The experiment covered a period of two years.

## Questionnaire

At the close of the second year of the study a questionnaire was sent to the parents of the children in the experimental group, to determine their opinions of the merits of the added health work. A copy of this questionnaire may be found in the appendix. The questions were directed toward the idea of improvement, and required "yes" or "no" answers. Since most parents are reluctant to admit their children have regressed in health habits, this plan was adopted to insure more reliable returns. Parents were requested not to sign questionnaires, in the hope that unbiased answers would be obtained.

The following seven questions were asked in the questionnaire:

1. Does your child eat more vegetables?

2. Does your child drink more milk?

3. Is he more willing to go to bed without a great deal of protest?

4. Has your child asked to visit the dentist?

5. Is he more interested in keeping well and strong?

6. Have you noticed an improvement in your child's habits of cleanliness?

7. Has there been any improvement in your child's disposition?

Each question was followed by a "yes" and "no" answer to be checked. The questionnaires were distributed to the pupils to deliver to their parents, and a complete return was received.

# CHAPTER IV

## AN UNEXPECTED OUTCOME DUE TO THE EXTENDED SCHOOL CARE PROGRAM

### An Explanation of the Program

During the first year of the experiment with the control group, the government was using South Lincoln School as a center for an extended school care program. This program was initiated by the federal government as an emergency war measure to relieve the labor shortage by permitting mothers to have their children cared for while they were working. The mother paid for half of the child's care, while the government paid for the other half. In this program children could be brought to school as early as 6:30 in the morning, and were permitted to remain until 6:30 in the evening. Seven children from the control room attended the extended school. These children received a hot lunch at noon that was under the supervision of Dr. Madeline Marr. This meal usually consisted of meat, potatoes, one or two more vegetables, bread, butter, milk, and usually some kind of fruit for desert. The food was well prepared and very tasty. The children were given all they wanted to eat. Eating in the company of other children, their appetites grew unbelievably. Visitors were astonished to note the quantity of food the children consumed. After school they were served a lunch of milk or fruit

juice, with crackers or bread and butter. During the supervised play period after school they had the advantage of playing with all age youngsters, and were able to develop their physical skills at their own speed. One little boy at six years of age was giving the eleven and twelve year old children stiff competition shooting baskets. Since six different instructors worked with them at various times, these childred had the advantage of being introduced to varied interests and of associating with many personalities. Supervised activities offered constant opportunities for active use of their bodies.

Testing Results

After administering and scoring the September and June tests to the control group, differences that seemed unusual began to appear upon comparison of the two tests. The arithmetic mean of the mental ability test in September was 100, but in June it was 104.8. This change in an individual score would not have been at all significant, but as a mean for the group it seemed like an unusual difference. Individual test scores were then examined to determine where the changes had occured. It was noted that the common element among the children who were showing unusual gains was attendance of the extended school program. All of the test results were then retabulated, separating test scores of the extended school children from the others. In the new series, the

arithmetic means, standard deviations, comparison of arithmetic means, and comparison of variance of the two groups for September 1944 and June 1945 were established. The two following tables illustrate the test scores for these computations. Table I indicates the test scores for the control group for September 1944, and Table II indicates the test scores for the same group for June 1945, with scores of extended school care group designated by asterisk. Since the use of small samples is a relatively new process in research work, justification seems to be in order. E. F. Lindquist[1] in his new book, Statistical Analysis in Educational Research defends the use of small samples in the following manner:

> "In the past, the attitude seems to have been that we seldom have to use small samples in educational research--that most of our samples consist of large numbers of pupils and observations. It is perhaps partly for this reason that we have so seriously neglected many of the important contributions that have recently been made to statistical theory. This attitude, however, is based on a misconception of the nature of our samples . . . . Most of our samples--regardless of the number of pupils or observations involved--are "small" samples, and the techniques that we have generally employed in the past are definitely inappropriate and have often been very seriously misleading."

All of the formulas used for group comparisons were designed to be used in small samples. Interpretations of group comparison results are translated from tables

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1. Lindquist, E. F., Statistical Analysis in Educational Research, p. 20-21.

TABLE I

TEST SCORES OF SEPTEMBER 1944
FOR CONTROL GROUP

| Students | Mntl. Abil. | Heart React. | Arm Pull | Arm Push | Abdom. Strgth | Leg Strgth | Comb. Strgth | Height | Weight |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 114 | 40 | 2 | 2 | 731 | 4.5 | 20 | 47. | 50. |
| 2 | 87 | 40 | 8 | 6 | 936 | 9.75 | 18 | 46.5 | 45. |
| 3 | 101 | 50 | 13 | 24 | 917 | 8.75 | 28 | 48. | 59.5 |
| 4 | 92 | 50 | 6 | 1 | 477 | 3.5 | 26 | 48. | 50. |
| 5 | 109 | 45 | 10 | 5 | 216 | 7.5 | 20 | 44. | 45. |
| 6 | 103 | 45 | 7 | 13 | 854 | 7. | 31 | 48. | 56.5 |
| 7 | 106 | 40 | 9 | 1 | 360 | 6.5 | 20 | 48.5 | 53. |
| 8 | 100 | 50 | 7 | 2 | 300 | 6.75 | 28 | 45.5 | 45.5 |
| 9 | 100 | 40 | 10 | 13 | 954 | 6.5 | 21 | 45.5 | 48.5 |
| 10 | 93 | 45 | 8 | 1 | 216 | 7. | 26 | 48. | 53. |
| 11 | 107 | 45 | 8 | 5 | 720 | 5.5 | 24 | 43.5 | 42. |
| 12 | 95 | 45 | 10 | 4 | 1606 | 5.5 | 16 | 46. | 43. |
| 13 | 90 | 50 | 10 | 3 | 648 | 5.5 | 24 | 46. | 47. |
| 14 | 105 | 45 | 13 | 6 | 504 | 6. | 22 | 48.5 | 53. |
| 15 | 118 | 40 | 11 | 1 | 1580 | 6.5 | 27 | 45. | 41. |
| 16 | 89 | 45 | 13 | 12 | 601 | 7.5 | 25 | 48. | 55. |
| 17 | 87 | 50 | 12 | 8 | 936 | 4.25 | 14 | 45. | 46. |
| 18 | 97 | 55 | 5 | 1 | 355 | 7. | 25 | 44.5 | 42. |
| 19 | 98 | 65 | 11 | 12 | 2232 | 9. | 32 | 47. | 51. |
| 20 | 116 | 50 | 10 | 6 | 1056 | 5.75 | 23 | 48. | 50. |
| 21 | 82 | 50 | 16 | 12 | 1584 | 6. | 21 | 46. | 46. |
| 22 | 90 | 40 | 7 | 6 | 342 | 7.5 | 25 | 48.5 | 48.5 |
| 23* | 113 | 50 | 8 | 2 | 596 | 5.75 | 25 | 47.5 | 47. |
| 24* | 90 | 50 | 4 | 1 | 864 | 6.25 | 23 | 52. | 66.5 |
| 25* | 95 | 45 | 12 | 20 | 1080 | 7. | 31 | 45. | 47.5 |
| 26* | 113 | 50 | 6 | 8 | 504 | 5. | 23 | 51. | 61.5 |
| 27* | 120 | 60 | 11 | 10 | 616 | 7.5 | 26 | 47. | 51. |
| 28* | 98 | 70 | 3 | 1 | 1080 | 5.5 | 25 | 47. | 45. |
| 29* | 92 | 50 | 4 | 1 | 606 | 8.5 | 24 | 47.5 | 51. |

*Children attending extended school care.

TABLE II

TEST SCORES OF JUNE 1945
FOR CONTROL GROUP

| Students | Mntl. Abil. | Heart React. | Arm Pull | Arm Push | Abdom. Strgth | Leg Strgth. | Comb. Strgth | Height | Weight |
|---|---|---|---|---|---|---|---|---|---|
| 1. | 107 | 35 | 12 | 23 | 792 | 6.5 | 26 | 48. | 54. |
| 2. | 92 | 35 | 11 | 30 | 648 | 8.25 | 25 | 48. | 48. |
| 3. | 115 | 40 | 17 | 32 | 1258 | 9. | 30 | 48. | 62. |
| 4. | 109 | 40 | 11 | 7 | 576 | 6.25 | 24 | 49. | 53. |
| 5. | 108 | 30 | 19 | 26 | 314 | 7.5 | 29 | 45. | 50. |
| 6. | 115 | 40 | 7 | 11 | 658 | 7.5 | 28 | 49.5 | 63.5 |
| 7. | 115 | 50 | 12 | 32 | 936 | 9.75 | 23 | 49.5 | 59. |
| 8. | 99 | 35 | 9 | 8 | 1296 | 9. | 28 | 46.5 | 48. |
| 9. | 95 | 30 | 16 | 17 | 1584 | 7. | 22 | 45.5 | 50. |
| 10. | 82 | 45 | 9 | 7 | 504 | 7.25 | 26 | 50. | 57. |
| 11. | 107 | 35 | 20 | 34 | 1224 | 8. | 31 | 44.5 | 45.5 |
| 12. | 86 | 30 | 11 | 13 | 1584 | 6. | 23 | 46.5 | 47. |
| 13. | 104 | 35 | 15 | 34 | 1584 | 6. | 28 | 46.75 | 50.5 |
| 14. | 106 | 45 | 14 | 16 | 1872 | 6. | 33 | 49.5 | 57. |
| 15. | 124 | 30 | 14 | 9 | 2664 | 7.5 | 30 | 47.5 | 48. |
| 16. | 81 | 35 | 18 | 50 | 1584 | 8. | 28 | 49. | 60. |
| 17. | 105 | 35 | 18 | 30 | 1584 | 4.25 | 28 | 46. | 51. |
| 18. | 96 | 45 | 9 | 11 | 288 | 8.125 | 29 | 45.5 | 46. |
| 19. | 98 | 50 | 21 | 24 | 1584 | 9.25 | 33 | 47. | 58. |
| 20. | 117 | 45 | 20 | 27 | 1024 | 8.25 | 28 | 48.5 | 51. |
| 21. | 80 | 40 | 22 | 33 | 1584 | 8. | 27 | 47.5 | 50.5 |
| 22. | 98 | 40 | 7 | 12 | 360 | 7.75 | 26 | 49. | 51. |
| 23.* | 115 | 45 | 21 | 10 | 708 | 9.5 | 27 | 48.5 | 50. |
| 24.* | 95 | 40 | 16 | 22 | 576 | 8.75 | 26 | 52. | 73. |
| 25.* | 120 | 30 | 16 | 20 | 1152 | 10.25 | 33 | 45.5 | 51. |
| 26.* | 125 | 45 | 15 | 20 | 504 | 10. | 26 | 52. | 68. |
| 27.* | 130 | 50 | 22 | 100 | 1728 | 13.75 | 33 | 48. | 54. |
| 28.* | 115 | 35 | 12 | 14 | 1224 | 8. | 25 | 47.5 | 48. |
| 29.* | 100 | 35 | 12 | 20 | 658 | 8.5 | 29 | 48. | 56.5 |

*Children attending extended school care.

based upon degrees of freedom. "The number of degrees of freedom in a table of frequencies is the number of those frequencies to which we may assign arbitrary values and still satisfy the external requirements imposed on the table."[2]

The arithmetic mean was found for each group of tests to determine the middle measure of each group. "The arithmetic mean is the best known and most widely used measure of central tendency."[3] The formula for finding the arithmetic mean that was used for these tests was $g \pm \frac{(x-g)}{n}$, where g is the guessed mean, (x-g) is the number of deviations away from the guessed mean, and n is the number of cases in the array. The standard deviation is an average of variation from the arithmetic mean of the distribution. The formula used for this calculation was $\sqrt{\frac{S(x-g)2 - \frac{S(x-g)2}{n}}{n-1}}$, where $S(x-g)^2$ represents the deviations from the guessed mean squared, $\left[S(x-g)\right]^2$ the squares of the deviations from the guessed mean, n the number of cases in the array, and n-1 the degrees of freedom--one degree of freedom being lost from the

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2. Lindquist, E. F., Statistical Analysis in Educational Research, p. 33.

3. Greene, Harry A., Gerberich, Raymond J., and Jorgensen, Albert N., Measurement and Evaluation in the Elementary School, p. 503.

calculation of the mean. An example for the use of these formulas may be found in Statistical Methods by George W. Snedecor.[4]

In comparing the means of two groups little can be gained by merely noting the differences between the two means. The factors that enter into the difference are the number of cases in the array, and the range and placement in the distribution. (See page 39) To have a more stable method of comparison than mere judgment, statisticians have devised formulas that bring two groups together for comparison. The letter that designates this comparison of means will be indicated in this study by "t".

To bring these groups together into one figure for comparison, the formula devised by George W. Snedecor for the comparison of means in unequal sized groups was applied. The formula used was a test for null-hypothesis. This implies that the groups are similar, if then the result is large enough to become significant, and not due to random sampling between means, the difference is probably a real difference and not a random difference. Snedecor's formula for this mean comparison is $t = \bar{x}\sqrt{\frac{n_1 n_2 (n_1+n_2-2}{(n_1+n_2)S_x^2}}$, where "t" is the number of standard deviations the result falls away from the mean, $\bar{x}$ is the

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4. Snedecor, George W., Statistical Methods, 1946, p. 90.

5. Snedecor, George W., Statistical Methods, 1946, p. 82.

difference between the two means, $n_1$ is the number of cases in the first array, $n_2$ is the number of cases in the second array, -2 is the number of degrees of freedom that have already been lost by previous calculations, and $Sx^2$ is the pooled sum of squares around the means of both distributions. The formula must be interpreted from a table worked out upon the number of times the result found appears in the population. Since there were twenty-nine cases in all, and there were two degrees of freedom lost, the portion of the "t" table that deals with twenty-seven degrees of freedom is here inserted.

TABLE III

VALUES OF "t"

| *% | 0.5 | 0.4 | 0.3 | 0.2 | 0.1 | 0.05 | 0.02 | 0.01 |
|---|---|---|---|---|---|---|---|---|
| *t | .684 | .855 | 1.057 | 1.314 | 1.703 | 2.052 | 2.473 | 2.771 |

* Supplemented for clarity to reader.

This table is taken from one used by Snedecor[6] in his latest book on Statistical Methods.

Studying this table from left to right it will be noted that the "t" scores at the left are smaller and therefore there are more chances of these scores being

6. Snedecor, George W., Statistical Methods, 1946, p. 65.

found in a population if the groups are similar. As the reader proceeds toward the right, significant differences may appear. The column that is considered as the dividing one for significant differences is the .05 column. This means that this result would appear only five times out of one hundred if these groups were similar. This percentage is so low that a group is considered to have significant differences if it reaches this .05 column. Samples of these computations may be found in the appendix.

Table IV is a condensed picture of the comparison of the means of the children with relation to their participation in the extended school. The groups are compared before attending the extended school and after one year's attendance. Every column in this table headed "before" represents the September 1944 scores, preceding attendance at the extended school program. The columns headed "after" represent the June 1945 scores, after the children had attended extended school care for one school year. The figures in the "t" column must be interpreted from Table III. It may be noted in this table that scores of 2.052 or greater are significant.

In September these two groups were comparable in all tests except the heart reaction test, and the children attending the extended school program had the disadvantage in this particular test. Significant differences were found in three tests at the end of the year: mental ability, heart reaction, and leg strength. The scores of children attending extended school care program displayed

TABLE IV

COMPARISON OF MEANS
BETWEEN CHILDREN ATTENDING AND NOT ATTENDING
EXTENDED SCHOOL CARE

| Test | Children | Arithmetic Mean $\bar{x}$ | | Comparison of Means (t) | | Group Difference * | |
|---|---|---|---|---|---|---|---|
| | | Before | After | Before | After | Before | After |
| Mental Ability | Attending | 103. | 114.29 | .84 | 2.23 | 0 | + |
| | Not Attending | 99.05 | 101.77 | | | | - |
| Heart Reaction | Attending | 53.57 | 40. | 2.3 | .52 | - | 0 |
| | Not Attending | 46.59 | 38.4 | | | + | |
| Arm Pull | Attending | 6.86 | 16.29 | 1.75 | 1.08 | 0 | 0 |
| | Not Attending | 9.36 | 14.18 | | | | |
| Arm Push | Attending | 6.14 | 29.43 | .15 | .88 | 0 | 0 |
| | Not Attending | 6.55 | 22.09 | | | | |
| Abdominal Strength | Attending | 763.72 | 935.71 | .28 | .87 | 0 | 0 |
| | Not Attending | 823.86 | 1159.18 | | | | |
| Leg Strength | Attending | 6.5 | 9.82 | .05 | 3.68 | 0 | + |
| | Not Attending | 6.53 | 7.52 | | | | - |
| Combined Strength | Attending | 25.29 | 28.43 | 1.01 | .67 | 0 | 0 |
| | Not Attending | 23.45 | 27.5 | | | | |
| Height | Attending | 48.14 | 48.86 | 1.94 | 1.64 | 0 | 0 |
| | Not Attending | 46.59 | 47.56 | | | | |
| Weight | Attending | 52.79 | 57.21 | 1.56 | 1.48 | 0 | 0 |
| | Not Attending | 48.68 | 52.73 | | | | |

* 0 = No significant difference
\+ = Significant gain in mean difference
\- = Significant loss in mean difference
2.052 up = Point of significant difference

significant improvement in all three of these tests. The mental ability and leg strength test scores changed from comparable groups to improved scores on the part of the children of the extended school program. In the heart reaction test, the extended school children raised from an inferior group to an even group. The mental ability test probably changed because of improved diets and social environment. The heart test improvement probably resulted from an improved physical state. The leg test probably was due to the increased use of their legs from the many running games in which they had participated. Gains in means can be noted in other tests, but the differences were not great enough to register significantly with such small samples.

Although the results of these tests seem at first to be unusual, since mental ability has been considered in the past as a relatively stable measure in a child, there have been many experiments that disprove this. The following statement in defense of these findings is here presented:

> "Studies made by the University of Iowa Child Welfare Research Station pointed to the possibility of definitely raising the intelligence quotient of a child by improving the cultural and economic conditions of his environment. More than twenty IQ points may be gained or lost respectively, through changes to improved or less wholesome surroundings..... Social implications of such findings point significantly to our obligation to create for the young child the finest of physical and cultural atmospheres."7

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7. Leonard, Edith M., Miles, Lillian E., and Van Der Kar, Catherine S., The Child at Home and School, p. 115

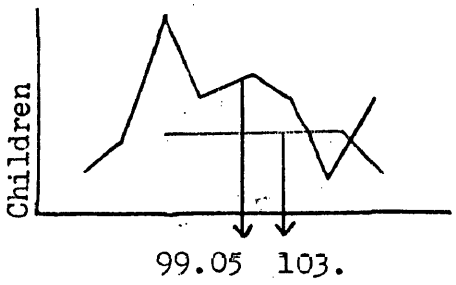
The following figures are presented to give a graphic representation of the mean differences of the groups on the various tests. Both the September scores and the June scores are pictured to show the differences. The means of the groups are dropped from the curves to show the mean differences. Significant differences are pictured in red, while insignificant differences appear in green. The pink line represents the extended school children, and the blue line represents the children not attending extended school care. Figure 1 represents the September group mean differences, while Figure 2 represents the June group mean differences.

To compare the means of two groups does not in itself give a complete picture of the situation. Outstanding progress by a few individuals rather than the group as a whole might be the determining factor in the mean change of the group. In cases where there are significant mean changes in groups this item of variance then must also be taken into consideration to complete the picture of the changes in the group. The variance of the group is the squared standard deviation of the group. It would be fallacious to compare the variance of two groups merely by observation, so, as was the case in the comparison of means, the two figures are brought together in a single number which will be labeled "F".

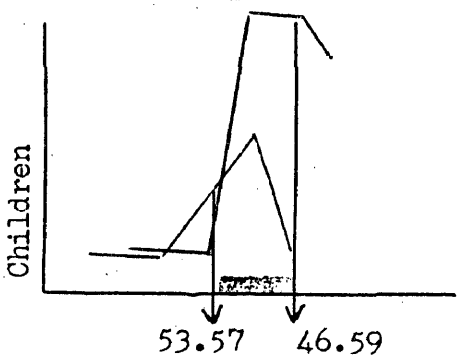
To test the variance between the two groups the formula $F = \frac{s^2x}{s^2y}$ was used, where "F" is the ratio of two estimates of variance. The larger variance $s^2x$

Figure 1.
September Mean Differences
In Regard to Extended School Care
——— Children Attending
——— Children Not Attending
Insignificant Mean Difference
Significant Mean Difference
↓ Group Mean

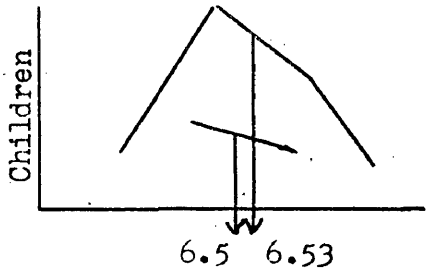
MENTAL ABILITY



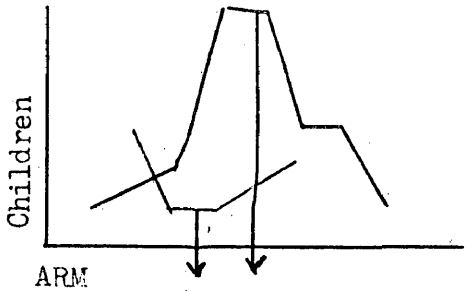

HEART REACTION



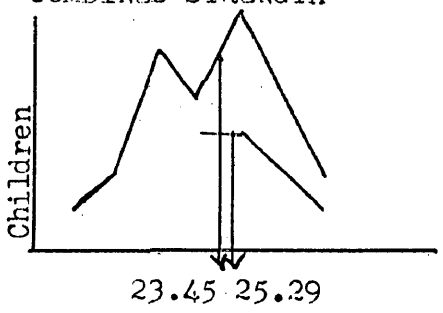

LEG STRENGTH



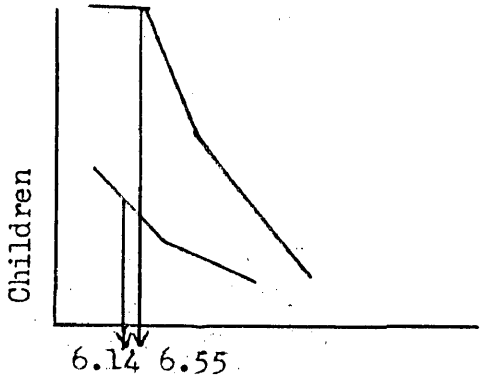

ARM PULL



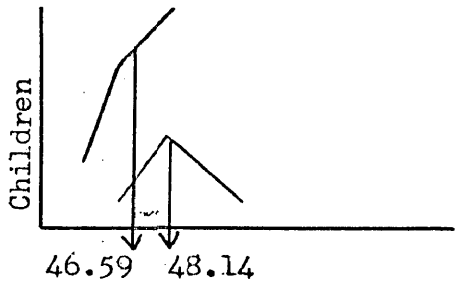

COMBINED STRENGTH



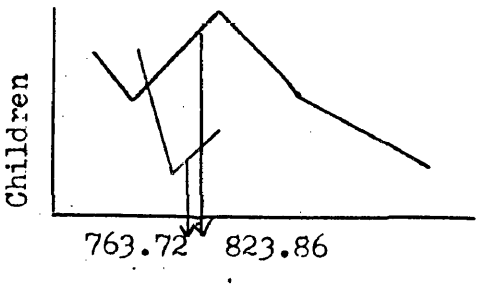

ARM PUSH



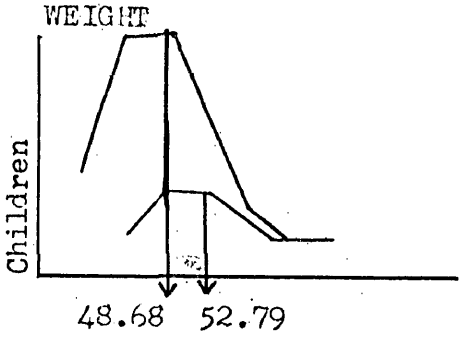

HEIGHT




ABDOMINAL STRENGTH




WEIGHT



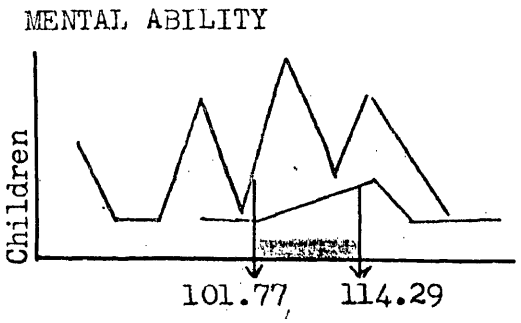
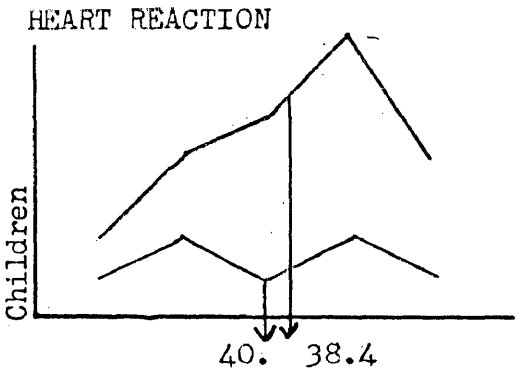
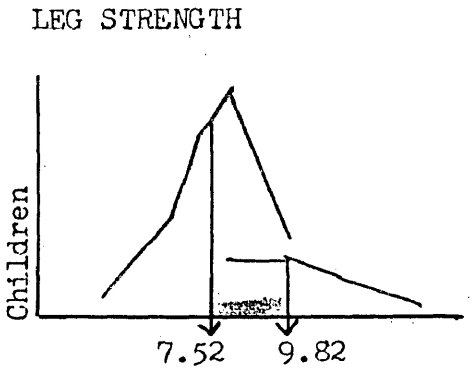
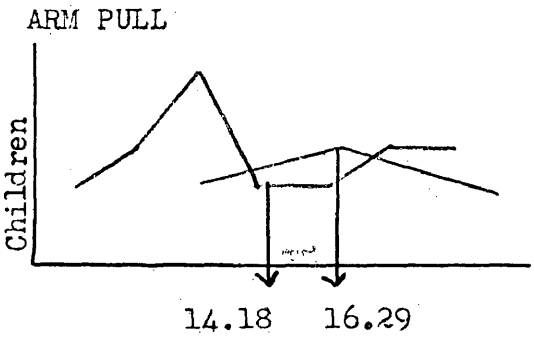
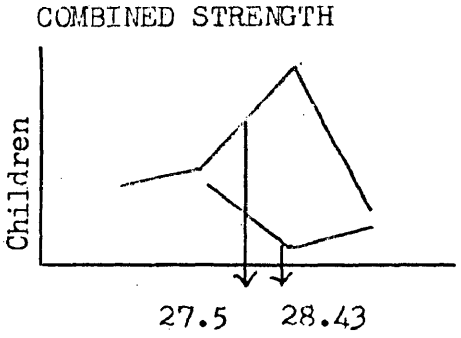


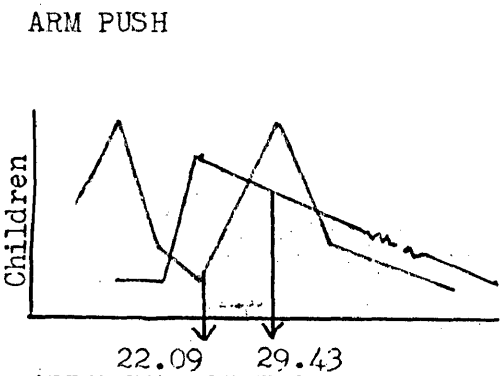

Figure 2.
June Mean Differences
In Regard to Extended School Care
——— Children Attending
——— Children Not Attending
Insignificant Mean Difference
Significant Mean Difference
↓ Group Mean

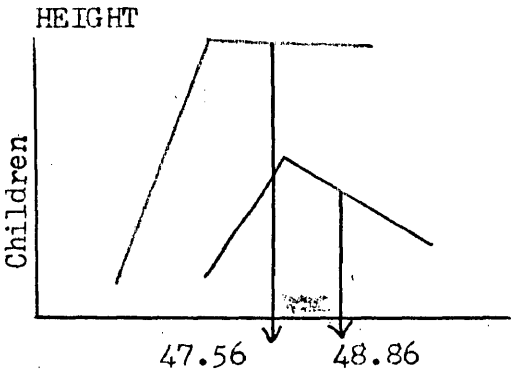


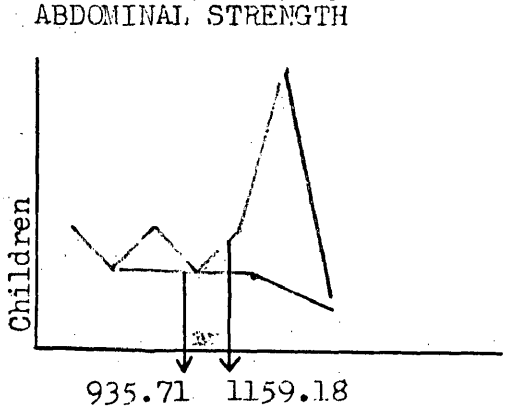



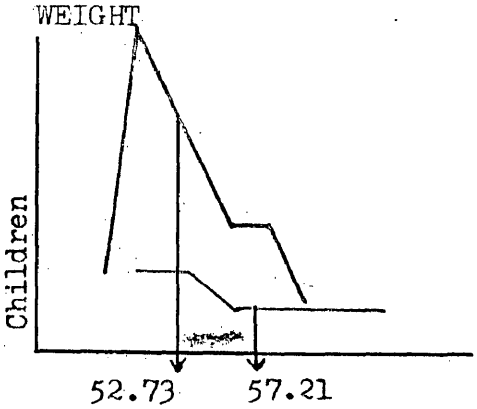



is always placed in the numberator of the ratio, while the smaller variance $s^2_y$ is always placed in the denominator. An explanation of this formula may be found in the tenth chapter of Statistical Methods by George W. Snedecor. The ratio then calculated must be interpolated from an "F" table. Two points on the "F" table used by Snedecor are here inserted.

TABLE V

Values of "F"

| | | | |
|---|---|---|---|
| 6 Degrees of Freedom | | | |
| 21 Degrees of Freedom | .1 | 2.57 | |
| | .02 | 3.81 | Point of Significant Difference |
| 21 Degrees of Freedom | | | |
| 6 Degrees of Freedom | .1 | 3.87 | |
| | .02 | 7.39 | Point of Significant Difference |

This table is taken from one used by Snedecor[8] in his latest book on Statistical Methods.

Table VI compares the variance of the two groups. The "F" scores from Table VI must be interpreted from Table V in the following manner. The tests interpolated from the top part of the table are: Mental Ability, both

8. Snedecor, George W., Statistical Methods, p. 65.

TABLE VI

COMPARISON OF VARIANCE BETWEEN CHILDREN ATTENDING AND NOT ATTENDING EXTENDED SCHOOL CARE

| Test | Children | Standard Deviation s | | Comparison of Variance F | | Group Differences * | |
|---|---|---|---|---|---|---|---|
| | | Before | After | Before | After | Before | After |
| Mental Ability | Attending | 12.03 | 12.72 | 1.45 | 1.07 | 0 | 0 |
| | Not Attending | 9.97 | 12.31 | | | | |
| Heart Reaction | Attending | 8.52 | 7.07 | 1.98 | 1.28 | 0 | 0 |
| | Not Attending | 6.05 | 6.25 | | | | |
| Arm Pull | Attending | 3.58 | 3.95 | 1.31 | 1.41 | 0 | 0 |
| | Not Attending | 3.13 | 4.7 | | | | |
| Arm Push | Attending | 7.15 | 31.41 | 1.53 | 7.23 | 0 | + |
| | Not Attending | 5.77 | 11.68 | | | | - |
| Abdominal Strength | Attending | 242.35 | 447.65 | 4.74 | 1.82 | - | 0 |
| | Not Attending | 527.93 | 604.16 | | | + | |
| Leg Strength | Attending | 1.23 | 1.91 | 1.5 | 2.29 | 0 | 0 |
| | Not Attending | 1.51 | 1.26 | | | | |
| Combined Strength | Attending | 2.75 | 3.36 | 2.7 | 1.26 | 0 | 0 |
| | Not Attending | 4.52 | 2.99 | | | | |
| Height | Attending | 2.46 | 2.38 | 2.43 | 2.16 | 0 | 0 |
| | Not Attending | 1.58 | 1.62 | | | | |
| Weight | Attending | 8.09 | 9.59 | 2.65 | 3.26 | 0 | 0 |
| | Not Attending | 4.96 | 5.31 | | | | |

0 = No significant difference
+ = Significant increase in variance
- = Significant decrease in variance

before and after; Arm Pull, before; Arm Push, both before and after; Leg Strength, after; Combined strength, after; Height, both before and after; and Weight, both before and after. The remainder of the tests must be interpreted from the lower part of the table. The words "before" and "after" signify comparisons before the group attended the extended school program in September, and after attending for a school year. The two tests that registered significant differences in variance between the two groups were the Arm Push Test and the Abdominal Strength Test. There was no significant difference in variance in Arm Push between the two groups in September. However, one boy in the extended school care group developed so much that he doubled the closest score of either group. His June score for this test was one hundred, while the closest score was fifty. There was a significant difference in variance in abdominal strength at the beginning of the year. The highest score in the group not attending extended school care was 1408.14 above the mean, while in the group attending extended school care the highest score was only 316.29 above the mean. There was, however, no significant difference between these groups for this test in June 1945. The unusually high scores of the group not attending extended school were closer to the mean.

Since the tests that displayed a significant increase in group means had no significant difference in variance,

the conclusion can be drawn that the gains were made by the group as a whole rather than by certain outstanding individuals.

# CHAPTER V

## THE INTENSIFIED HEALTH PROGRAM

During the second year of the experiment an intensified health program was carried on in the experimental room to determine whether the results would justify the time spent. Much reading was done to determine the requirements of such a program. Special emphases were given to: (1) additional physical education classes, (2) a nutrition project, (3) an increased milk program, (4) cleanliness activities combined with a daily inspection period, (5) physical rearrangement of the classroom to meet the health needs of the group, (6) vaccination and immunization, (7) weight tabulation, (8) dental care and, (9) a more complete physical examination record of the children. This program was started in September of 1945 and continued through May of 1946.

### Physical Education

> "Childhood is essentially the motor period of life, and every idea tends to immediate expression in some form of activity. It is only through a child's play that he may respond to the inner urge of his own being; hence it is only through play that he is a free agent. Play is the child's growth; it is his life itself and his means of interpreting phases of his environment, people, things, and ideas as he sees and understands them. Many complexes, maladjustments, behavior difficulties, and other problems are checked by provision of adequate play expression in childhood, especially when this includes

social living with other children of the same age."[1]

At the suggestion of Miss Catherine Carrick, Supervisor of Physical Education for the Omaha Elementary Schools, the daily physical education requirement of thirty minutes for the room was established. If the weather permitted, this daily requirement was met by regular recess periods. However, games were taught and organized previous to this period, to assure more complete participation. Since South Lincoln School did not have a full-time physical education teacher, the primary rooms were not included in the regularly scheduled physical education program. Therefore, any physical education program for primary children must necessarily be taught by the classroom teacher. The activities stressed for this particular room were: folk dancing, rhythm work, singing games, simplified exercises, tumbling, tag games, relays, circle games, chasing games, jumping rope, and games using a large ball. In organizing this program the following ideas were kept in mind: These children particularly enjoyed games requiring imitation. Boys and girls played together uninhibitedly. Participation in folk dancing and singing games was very spontaneous. Their hands and arms were not yet ready for skills with balls as small as baseballs, therefore a ball as large

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1. Leonard, Edith M., Miles, Lillian E., and Van Der Kar, Catherine S., The Child at Home and School, p. 240.

as a soccer ball was used. Exercises were presented without routine, in a dramatic, story-play manner.

In defense of thirty minutes daily allotment to physical education the following observations were made: (1) the children were much more receptive after a period of activity; and (2) practical application for number work in "counting off" and keeping score, in measurement of distances and in learning left from right, eliminated the necessity of teaching such concepts in the room.

Nutrition Program

A nutrition program was started early in the fall, and carried out throughout the entire year. One excellent help in teaching such a unit was the material that could be procured from different agencies. The Omaha Dairy Council offered a wealth of valuable material particularly helpful for this age level, such as: food models, with accompanying word cards and chart rack, a basic seven food chart, educational films, posters, and a series of beautifully illustrated booklets. The State Board of Health furnished a great deal of free nutritional material. Their basic seven food chart seemed a little easier for young children to understand. The Omaha Dairy Council provided a pair of white rats for this nutritional experiment. The rat feeding experiment is usually carried on with older children, but in this case the Dairy Council permitted the experiment to be carried out with

younger children. The interest of the children was unusual. They always remembered the food for the rats, and enjoyed caring for them. The parents became interested, sending notes of inquiry, and coming to school regularly to observe the children's interest in the experiment. The children kept a daily diary of the care and progress of the rats; a daily record of their food; and they also composed charts, stories, and poems about the rats. A few of the poems are here inserted to demonstrate the achievement that can be made by children who are experiencing the work they are actually using.

1 - "Pinkey's hair is soft,
Winkey's hair is rough,
Pinkey eats a lot,
Winkey doesn't eat enough."

2 - "Pinkey is fat,
Winkey is thin,
If they had a race
Who would win?"

3 - "We will miss Pinkey and
Winkey when they go away,
It has been fun watching them
every day."

"It is not easy to tell, in a given case of physical retardation, what all the factors in the situation may be, since poor heredity, physical defects, bad hygiene, and latent disease must all be reckoned with. But because these other handicaps exist it must not be assumed that diet does not immediately cause a child to gain, that food has little to do with physical condition. Whatever other measures may be instituted for the betterment of child health, it is of fundamental importance that there be the best diet we know how to provide, first for the mother, that she may be able to carry her child most successfully through the periods of prenatal life and of lactation; later for the child directly, through his growing years. Along with his care must go education, so that when the child comes to choose his

> own food, he will be guided not only by past habits and resultant tastes, but by sound knowledge of what wisely selected food is able to do for him in maintaining vigor, preventing disease, and promoting efficiency. It is both the privilege and the responsibility of the school to teach the rules of good nutrition and so set the stage that children acquire the habit of observing these rules, and eventually come to understand their significance."[2]

Milk Program

The children of Omaha have had the opportunity in recent years of buying milk through the schools at a substantial reduction. The cost of their milk amounts to just a fraction of a cent over a penny per half pint bottle. The rest of the expense of this milk is defrayed by various organizations. Although the cost is so very small, not all of the children take advantage of this offer. The teacher has the privilege also of ordering free milk for the children who are unable to buy it. There seems to be a general agreement among nutritional experts that a growing child needs a quart of milk daily. The children at South Lincoln School were not beginning to meet this quota. When first questioned about the amount of milk they were drinking, each child felt satisfied that he was drinking a quart daily. Each was asked to bring to school the glass from which he had been drinking milk. These glasses were measured for liquid content,

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2. National Education Association, American Medical Association, Health Education, National Education Association of U. S., p. 54-55.

and the general findings of the group were that most children drank about a half quart daily. The children then decided they would, as a group, participate one hundred percent in the school milk program. The children were weighed each month, and each child who had not shown a reasonable weight gain had a second bottle ordered for supplementary afternoon milk. The parents of all such children were contacted either by telephone or home visitation. The low cost of the milk, and the extra need of their children were arguments that brought splendid response from all the parents so contacted. Any parent who wished to order a second bottle of milk daily for his child had that privilege, and many took advantage of the second bottle. Since all children were drinking milk at the same time, it seemed to be the established thing to do, and there were no complaints all year about the "milk not tasting just right", or any child being "too full to drink his milk". The milk program for the rest of the building was discontinued after spring vacation because the weather began to grow warmer, and there was no provision for refrigeration in the building. The parents of the experimental room were contacted, and without exception they requested that the milk program be continued until the close of school. The great change in the attitude of the parents was worth all of the extra effort that went into the one hundred percent milk program.

Cleanliness Activities

A full-length mirror was hung on the back door. As the children entered the room they passed the mirror. The caption at the top of the mirror read, "Mirror, mirror on the wall, am I clean, and straight, and tall?" Any child passing the mirror, who was not satisfied with his own reflection, had the opportunity of going to the washroom to improve his appearance before entering the room. There was a noticeable effect within a week after placing the mirror on the door. Combs began to appear in little boys' pockets. Toothpicks were provided for children who wished to clean their fingernails. Some of the homes in the neighborhood lacked even the bare essentials that went into sanitation. These children had to depend upon the school for the facilities to keep themselves clean. As the children began to take more pride in their personal cleanliness, a new device was used that proved very popular. Outlines of the hands of six different children were drawn upon cardboard. One side was colored black, while the other remained white. There was one hand posted on the bulletin board for each row represented in the room. When a whole row had been checked clean by the acting president of the room, the white side was displayed; otherwise the black appeared. Care was constantly taken to praise the children who were showing improvement under adverse home conditions. While personal cleanliness in itself is not directly a contributing factor to good

health, it helps to establish patterns acceptable to society. While the children were inspecting themselves in the mirror, the opportunity for a daily health inspection by the teacher was utilized. At such a time, without apparent scrutiny on the part of the teacher, facts about the child could be noted. The following things were observed: the child's color, any signs of cold, skin eruptions, and signs of pediculae. This initial check at the beginning of the day served to help keep the teacher aware of the physical condition of her children throughout the day. The fact that annoying behavior often signifies an ill child rather than a naughty child was not ignored.

Physical Set-Up of the Room

> "While orderly and pleasant living conditions in the classroom may have little direct bearing upon the health of the child, they may indirectly contribute to his physical and mental well-being. Children are sensitive to surroundings that are attractive and comfortable and should enjoy living in the classroom."[3]

At the early part of the year the children held a group discussion about the importance of their eyes and ears. Ways of conserving these faculties were discussed. Proper seating and lighting arrangements were considered. Since the room had an eastern exposure, the amount of lighting varied greatly with the time of day, and also

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3. National Education Association, American Medical Association, Health Education, p. 100.

with the location in the room. An attempt was made to train the children to adjust the window shades to meet their own needs, and to move their seats into the best positions for good lighting. They learned to regulate the ventilation of the room upon their own initiative. Children were often encouraged to arrange their own chairs in the front of the room for their reading groups. Invariably their chairs were placed much closer to the board than would have been judged necessary by an adult. Eye and ear difficulties were checked early in the year, according to the report listed on the health cards, and such cases were seated in advantageous positions. Left-handed children were given movable chairs, and were instructed to adjust their chairs to favorable lighting conditions. Classroom housekeeping jobs such as: the dusting of the room, caring for all plants and pets, straightening of their library and equipment cupboards, and caring for the erasers and blackboards were assumed by the children. These little tasks helped them take a pride in their room.

Vaccination and Immunization

A goal was set at the first of the year for 100% vaccination and immunization program. This was a much more difficult task than the 100% milk program, because any parent who postpones the vaccination and immunization of his child until he reaches the second grade is either ignorant of the danger, or indifferent to his responsibility in the welfare of the community. While there were

no State or City statutes forcing vaccination or immunization, free immunization and vaccination offered by the City was a helpful factor in working toward this goal. It was soon apparent that many of the parents had misconceptions of vaccination and immunization. A very interesting study has been made by Elmo Roper entitled A Study of the Public's Knowledge and Attitude Regarding Certain Infectious Diseases and Immunization Against Them.

> "Immunization against smallpox and diptheria has been available for many years. Yet 24% of the people don't believe that vaccination can prevent smallpox; 28% of the people don't know or don't believe diphtheria can be prevented by inoculation. Six out of every 10 people said inoculation or vaccination did not prevent a person from getting diphtheria or smallpox but thought immunization would lessen the disease; another 2 out of 10 said immunization might be effective in some cases; another 1 out of every 10 remarked, "If you're going to get it, you're going to get it". When all mothers who said a person could be prevented from getting diphtheria were asked "if inoculation were necessary more than once", 58% didn't know or said once was enough."[4]

There is a common tendency among school people to feel that a high percentage of once immunized children of a given area will prevent an epidemic, yet Dr. G. E. Robertson, in a lecture before teachers, stated that immunization should be repeated every six years. He presented a slide that displayed a smallpox pustule beside a smallpox vaccination scar to disprove the theory that a vaccination scar represents immunity. The procedure

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4. Roper, Elmo, A Study of the Public's Knowledge and Attitude Regarding Certain Infectious Diseases and Immunization Against Them, p. 5-6.

that was used to raise the percentage of immunity in the experimental room was as follows: First, the children discussed vaccination and immunization; second, the nurse came into the room and read the names of the children who were "safe"; third, a chart was made with the children's names placed in the green safety circles; fourth, a note was sent home to the parents reminding them that their children were not vaccinated or immunized; fifth, home visits were made by the nurse; sixth, if all this failed a second visit was made by the nurse and the teacher, in order to enlist the interest of the parents. The teacher carried on alone from here, making regular checks with the family. At an assembly for parents, secong vaccinations were stressed. To prove the need of second vaccinations it is interesting to note that a secong vaccination given to a child in this group had a more severe reaction than any of the first vaccinations.

Weight Tabulation

There is a height and weight record made by the school nurse for each child in the public schools once each semester. To supplement these semester weighings, the children made weight cards for themselves, and were weighed monthly. This is a very simple task for a teacher, and if used correctly gives her an indication of the general growth of each child. Too often in the past, weight has been compared with arbitrary standards set up by group weights and standards. This old idea of weight

standards has generally been discarded, but it is still a very significant factor if each child's weight is considered in line with his own development.

> "In view of the variability of growth, it is obvious that to compare a child with a standard derived from measuring large groups of children and computing an average or mean is fallacious. As an index of health the most significant comparison is of a child with himself, his status of today with his status in the past."5

It was found in this study that the knowledge gained from a monthly weight record was a valuable asset in talking to parents. Weight is one index of a child that holds both interest and understanding for the parent. It became evident as the experiment progressed that parents more readily agreed to an examination by a physician when presented with the monthly weight loss or lack of normal gain in their child.

Dental Care

Regular dental care was quite a serious problem in this community, where a trip to the dentist made a sizeable dent in the family purse. Parents were prone to feel that temporary teeth were not important, and did not need the care given to permanent teeth. Many of these same parents did not recognize the six year molar when it appeared, and mistook it for another temporary tooth, losing sight of the fact that if it were to be lost during

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5. National Education Association, American Medical Association, Health Education, p. 41.

youth, the rest of the teeth might be thrown out of alignment. Parents were interviewed with the idea in mind that temporary teeth should be preserved as long as possible, so they might act as guides for the permanent teeth. The school nurse conducted a building-wide campaign to try to get children to their dentists for a regular check-up. As a follow-up measure, in the room, a chart was made with stairs leading to an imaginary dentist's office. Silhouettes of the children who visited their dentists were placed on the chart. Requests were sent home on the report cards asking parents to take the children to the dentist for examination. Added emphasis was also introduced in the form of dental films, and a puppet show "Jack Friar" presented by the Omaha Dental Auxillary. The Dairy Council presented a film to the children and parents entitled A Tooth Talks as a part of an assembly program presented on nutrition. Home visitations were made by both the nurse and teacher in cases of severe neglect.

> "Few people escape the ravages of dental disease, because dental disease may be the result of other bodily ills or may itself produce other physical irregularities, and because dental caries is largely a disease of childhood. It is highly desirable, therefore, that those things be taught which will arouse in the individual the desire to eliminate already existing trouble and develop a resistance to any future evidence of dental pathology."6

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6. National Education Association, American Medical Association, Health Education, p. 84.

Physical Examinations

When children enter kindergarten in the Omaha schools they are invited with their parents to a Pre-school Health Round-up. Here the mothers are requested to have a medical record filled out by the family physician, and returned to school with the child. This record is then transferred to his school health record. If this is not done, the only record the school has is an examination made by the school nurse. Only twenty-two out of forty of the children in the experimental room had medical examinations. The remaining parents were contacted in March of 1946 and asked to secure medical records for their children. Since the expense involved in a medical examination was no small item, it was considered wiser to wait until later in the year when friendly relations had been established between the parents and the teacher, before presenting this phase of the experiment. The results of the response were very gratifying. Although the percentage of increase was not as high as on the vaccination, milk, or dental programs, it was an almost unheard of thing in this community for parents who had not complied with the request for medical examination of the child before kindergarten entry, to meet this obligation later in his primary school career.

Parent Cooperation

To promote the success of a health unit, the cooperation of the parents was of vital importance. This was a major objective during the course of the experiment. Two

assembly programs were held during the year for the parents. The attendance at both functions was very reassuring. In many cases both of the parents attended. The assembly in the fall was held at the conclusion of a unit about the development of good health habits. After the assembly, a tea for the parents was held in the auditorium. Mr. Don Warner, Director of Specialized Services for the Omaha Schools, gave a talk to the parents. A display table was arranged with material gathered from various local, state, and national agencies. This material was either given to the parents upon request, or loaned to them when not available in large quantities. The school nurse was present, and had with her the school medical record of each child. Each parent was encouraged to have a conference with the nurse about his own child's health record.

The spring assembly was held at the conclusion of the nutritional white rat experiment. This program was concluded with a dental film. At the conclusion of the essembly, a discussion was held with the parents to encourage second vaccinations. This discussion was timely, due to the national epidemic of smallpox that had started on the west coast and was spreading throughout the nation. As a whole, the cooperation received from the parents was very gratifying. The telephone calls and home visitations seemed to bring the best results. The parents of all children who needed tonsil operations were contacted in the spring. If the child was in good health, an

operation was urged at this time, rather than a delay until summer vacation. Although extra effort was involved in securing cooperation from parents who would not normally pay too much attention to the health needs of their children, the effort was well worthwhile, even taking into account the failures that were encountered.

To test the results of added physical education periods, a nutrition program, a 100% milk program, cleanliness activities, physical rearrangement of the classroom, vaccination and immunization, weight tabulation, dental care, and increased urgency for medical records as discussed in this chapter, physical fitness tests were administered along with mental ability and achievement tests at the beginning and ending of the year. Realizing that many of the things stressed in this program were not measurable by these tests, questionnaires were also sent to the parents to find their reactions to changes in the children's health habits and attitudes. A summary of these findings will be discussed in the following chapter.

# CHAPTER VI

## THE RESULTS OF THE STUDY

The results of this study are considered from three aspects: the gains of the children as measured by their physical fitness tests, mental ability tests, and achievement tests; the improvement of specific group standards of health as measured by the yearly records of the school nurse; and the opinion of each parent as to the merit of this health program in relation to his child, as based upon information gathered from questionnaires.

### Gains of the Children

To determine the group progress in physical fitness and mental growth the results of the battery of tests given to the control and experimental groups were compared as to group means, standard deviation, difference in means, and difference in variance. The same formulas that were formerly explained in Chapter IV were again used for the control and experimental groups. A sample of these computations may be found in the appendix. The groups were found to be comparable in mental ability and in all of their physical fitness tests at the beginning of the experiment. Figure 3 illustrates this comparability by picturing the group means and the insignificant differences between them. The data for the scores of the experimental group from which these graphs were drawn is

TABLE VII

TEST SCORES OF SEPTEMBER 1945
FOR EXPERIMENTAL GROUP

| Students | Mntl. Abil. | Heart React. | Arm Pull | Arm Push | Abdom. Strgth | Leg Strgth | Comb. Strgth | Height | Weight |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 97 | 25 | 14 | 15 | 640 | 5. | 24 | 43.5 | 39. |
| 2 | 82 | 45 | 10 | 22 | 936 | 7. | 24 | 45.5 | 45. |
| 3 | 113 | 40 | 12 | 10 | 1152 | 6.5 | 24 | 48.5 | 46. |
| 4 | 113 | 40 | 11 | 6 | 1235 | 9. | 23 | 51. | 59. |
| 5 | 94 | 100 | 9 | 2 | 432 | 6. | 23 | 52.5 | 56. |
| 6 | 125 | 45 | 8 | 5 | 648 | 7.5 | 33 | 50. | 55.5 |
| 7 | 99 | 40 | 9 | 13 | 1584 | 10.5 | 22 | 43. | 43. |
| 8 | 114 | 30 | 1 | 3 | 325 | 5.25 | 21 | 44.5 | 52.5 |
| 9 | 114 | 35 | 5 | 17 | 360 | 7.5 | 21 | 47. | 53. |
| 10 | 104 | 40 | 11 | 7 | 504 | 7.25 | 28 | 49.5 | 57. |
| 11 | 126 | 70 | 6 | 7 | 610 | 4.5 | 20 | 46. | 46. |
| 12 | 83 | 60 | 4 | 3 | 510 | 6. | 30 | 49.5 | 56.5 |
| 13 | 83 | 40 | 12 | 6 | 800 | 7.5 | 22 | 48.5 | 51. |
| 14 | 115 | 35 | 6 | 7 | 700 | 6.5 | 33 | 46.5 | 46. |
| 15 | 99 | 40 | 8 | 15 | 1450 | 5.5 | 25 | 48. | 50. |
| 16 | 100 | 35 | 5 | 14 | 875 | 6. | 24 | 48. | 52.5 |
| 17 | 108 | 55 | 1 | 10 | 510 | 7. | 24 | 47. | 50. |
| 18 | 96 | 25 | 12 | 11 | 1590 | 7.5 | 26 | 48. | 54. |
| 19 | 110 | 55 | 3 | 6 | 1080 | 6. | 24 | 50.5 | 61.5 |
| 20 | 103 | 45 | 7 | 1 | 288 | 5.5 | 21 | 43.5 | 39. |
| 21 | 92 | 50 | 12 | 25 | 792 | 10.75 | 29 | 50. | 62. |
| 22 | 88 | 40 | 10 | 23 | 2296 | 6. | 29 | 46. | 49.5 |
| 23 | 97 | 35 | 5 | 5 | 870 | 6. | 22 | 47.5 | 52. |
| 24 | 111 | 40 | 9 | 11 | 720 | 8.25 | 25 | 47.5 | 54. |
| 25 | 80 | 40 | 2 | 7 | 400 | 7. | 17 | 46. | 53. |
| 26 | 99 | 45 | 8 | 9 | 380 | 8.25 | 15 | 50.5 | 72. |
| 27 | 115 | 50 | 10 | 12 | 504 | 7.25 | 25 | 49.5 | 50. |
| 28 | 104 | 65 | 1 | 1 | 145 | 5.5 | 23 | 47. | 50. |
| 29 | 108 | 45 | 6 | 6 | 1008 | 8.25 | 25 | 52. | 67. |
| 30 | 85 | 35 | 11 | 6 | 360 | 7.25 | 19 | 49. | 53.5 |
| 31 | 99 | 40 | 7 | 4 | 432 | 6. | 29 | 49. | 57.5 |
| 32 | 104 | 40 | 7 | 6 | 216 | 10. | 27 | 46. | 47.5 |
| 33 | 119 | 35 | 10 | 14 | 1152 | 9. | 26 | 50. | 53.5 |
| 34 | 100 | 50 | 17 | 2 | 300 | 8. | 27 | 49. | 55. |

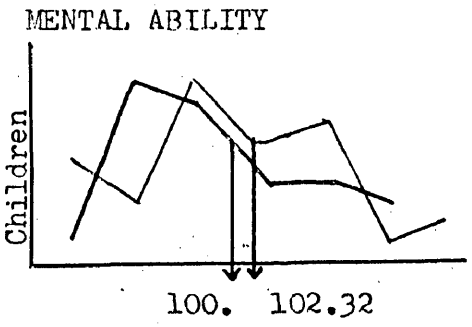
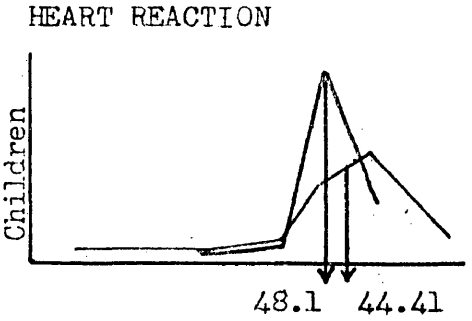
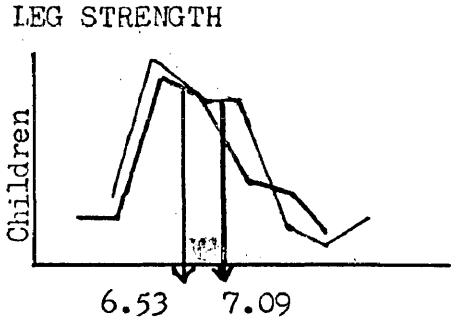
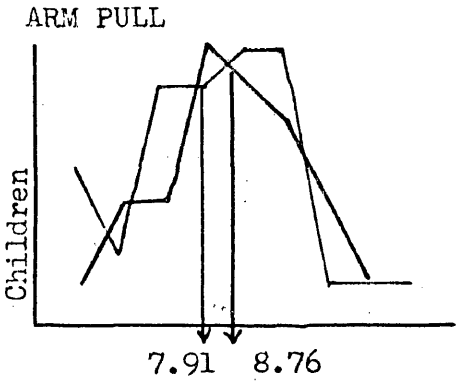
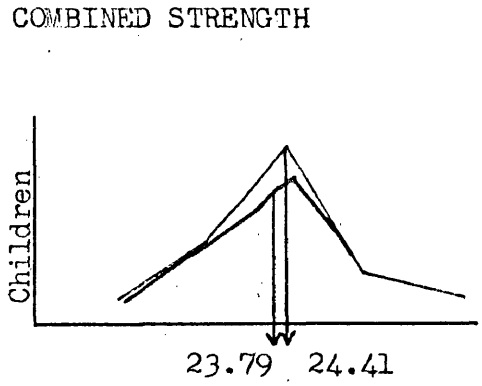


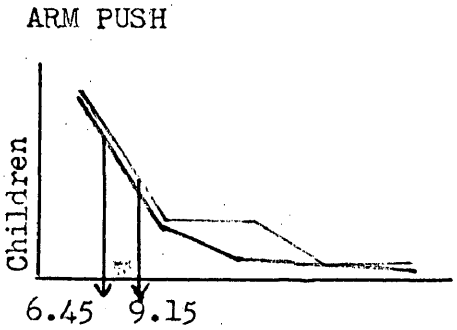

Figure 3.
September Mean Differences of Experimental and Control Group
——— Control Group
——— Experimental Group
Insignificant Mean Difference
Group Mean

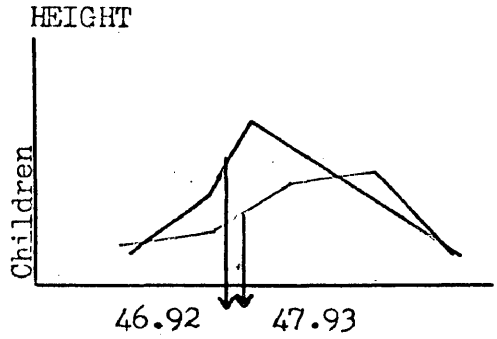


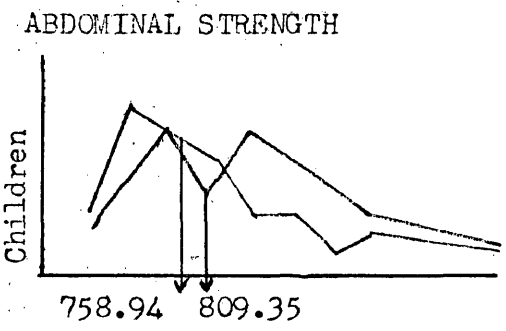



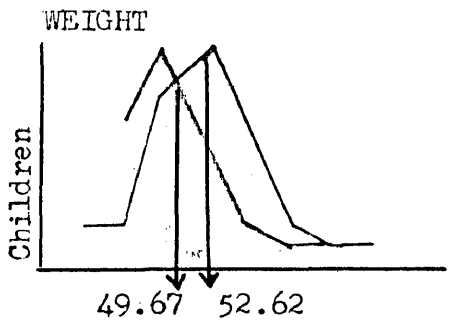



shown in Table VII. The scores for the control group were drawn from Table I. The pink line in Figure 3 represents the experimental group, the blue line the control group, and the green section represents the insignificant group mean differences. It may be noted that the two groups were comparable at the beginning of the experiment in all of their physical fitness tests, and also in their mental ability.

At the conclusion of the experiment significant gains had appeared in: (1) heart reaction, (2), arm pull, (3) arm push, (4) abdominal strength, (5) leg strength, (6) combined strength, and (7) height. Table VIII presents the scores of the experimental group for June. All calculations were computed from this table. The graphs in Figure 4 were also built from these scores and the scores on Table II. This graph pictures the changes in the group means of the various tests by the end of the experiment.

The two tests that displayed no changes were mental ability and weight. Since mental ability is considered a relatively stable measure, and since there had been no noticeable environmental change with the experimental group, as had been the case with the extended school care pupils, this constancy in mental ability was to be expected. The fact that the height changed significantly without affecting the weight may be accounted for by the facts that a child of this age has a high standard metabolism rate, and that height and weight changes are seasonal and

TABLE VIII

TEST SCORES OF JUNE 1946
FOR EXPERIMENTAL GROUP

| Students | Mntl. Abil. | Heart React. | Arm Pull | Arm Push | Abdom Strgth | Leg Strgth | Comb. Strgth | Height | Weight |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 98 | 20 | 49 | 109 | 1610 | 7. | 30 | 46. | 41.5 |
| 2 | 88 | 30 | 25 | 44 | 2308 | 9. | 32 | 48. | 47.5 |
| 3 | 140 | 30 | 19 | 47 | 2194 | 9. | 34 | 49.5 | 51. |
| 4 | 125 | 30 | 21 | 13 | 1360 | 11.5 | 27 | 54.5 | 67. |
| 5 | 98 | 30 | 15 | 21 | 1072 | 9. | 30 | 54. | 62. |
| 6 | 132 | 35 | 16 | 14 | 1288 | 11. | 33 | 53. | 61.5 |
| 7 | 111 | 35 | 21 | 50 | 1890 | 13.5 | 31 | 46. | 47. |
| 8 | 131 | 15 | 5 | 22 | 554 | 7.5 | 31 | 47. | 56.5 |
| 9 | 109 | 20 | 20 | 30 | 1830 | 11. | 29 | 50. | 56. |
| 10 | 105 | 20 | 23 | 31 | 350 | 11.5 | 33 | 52. | 63. |
| 11 | 139 | 45 | 12 | 26 | 856 | 6.5 | 26 | 49. | 53. |
| 12 | 86 | 30 | 8 | 13 | 554 | 8. | 33 | 52.5 | 62. |
| 13 | 79 | 25 | 28 | 11 | 1290 | 10. | 25 | 51.5 | 55. |
| 14 | 126 | 30 | 21 | 20 | 1826 | 10. | 36 | 48. | 53. |
| 15 | 109 | 30 | 25 | 33 | 1826 | 7.5 | 31 | 51. | 53. |
| 16 | 103 | 35 | 15 | 22 | 1000 | 8. | 28 | 51. | 57. |
| 17 | 110 | 25 | 16 | 23 | 940 | 9.5 | 35 | 49.5 | 55.5 |
| 18 | 104 | 20 | 16 | 30 | 2466 | 9.5 | 30 | 51. | 57.5 |
| 19 | 129 | 40 | 11 | 24 | 1025 | 8. | 28 | 53. | 68. |
| 20 | 108 | 40 | 12 | 20 | 1432 | 7.5 | 27 | 46.5 | 43. |
| 21 | 106 | 35 | 43 | 53 | 1610 | 13.5 | 32 | 52.5 | 67.5 |
| 22 | 110 | 35 | 14 | 60 | 3220 | 8. | 30 | 49. | 51. |
| 23 | 97 | 15 | 20 | 35 | 1610 | 8. | 29 | 50. | 58. |
| 24 | 109 | 35 | 20 | 31 | 1682 | 10.5 | 30 | 50. | 57. |
| 25 | 82 | 25 | 12 | 17 | 750 | 10.5 | 35 | 49. | 57.5 |
| 26 | 101 | 30 | 14 | 49 | 1432 | 11. | 28 | 53. | 79. |
| 27 | 136 | 30 | 12 | 62 | 1504 | 10. | 28 | 52. | 52. |
| 28 | 122 | 40 | 15 | 47 | 400 | 8. | 31. | 49.5 | 55.5 |
| 29 | 119 | 30 | 24 | 112 | 1610 | 10. | 26 | 54.5 | 72. |
| 30 | 89 | 20 | 23 | 24 | 482 | 9.5 | 26 | 52. | 57. |
| 31 | 101 | 30 | 20 | 40 | 780 | 8. | 31 | 52. | 63. |
| 32 | 118 | 25 | 24 | 22 | 1750 | 12.5 | 40 | 49. | 52.5 |
| 33 | 133 | 20 | 13 | 40 | 1710 | 11. | 29 | 53. | 61. |
| 34 | 113 | 35 | 25 | 33 | 1290 | 10. | 32 | 51.5 | 59. |

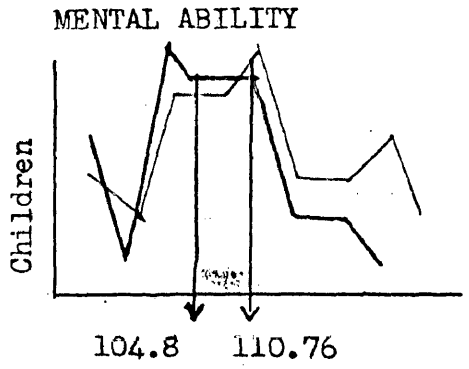
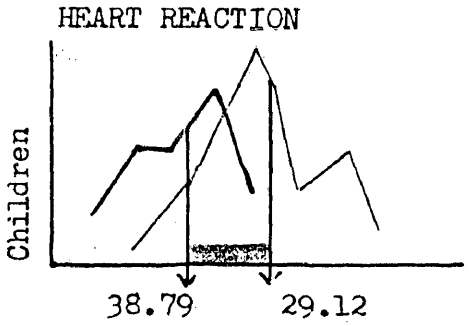
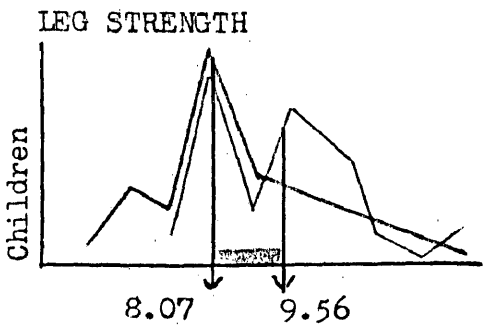
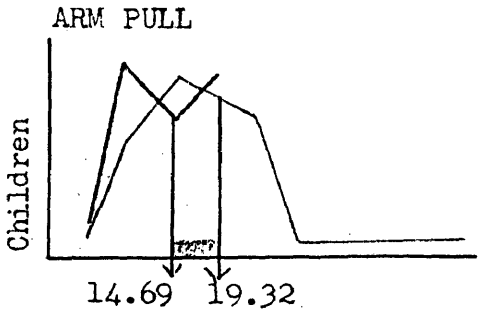
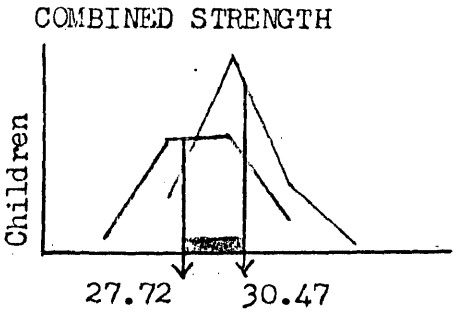


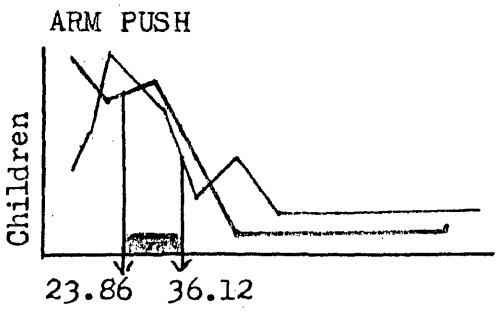

Figure 4.
June Mean Differences of
Experimental and Control Groups
——— Control Group
——— Experimental Group
Insignificant Mean Difference
Significant Mean Difference
↓ Group Mean

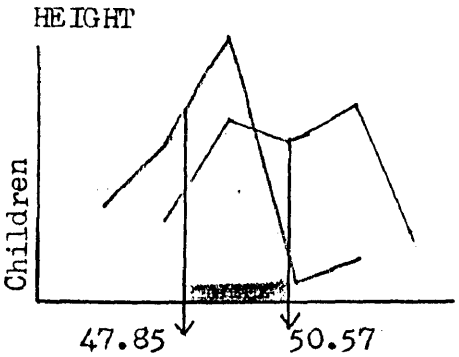


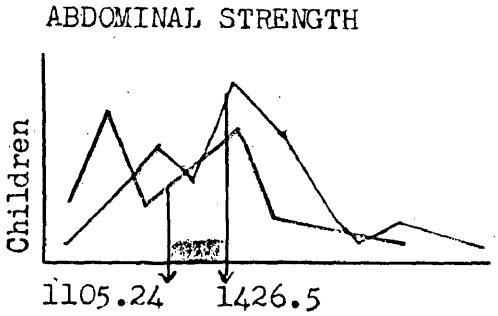



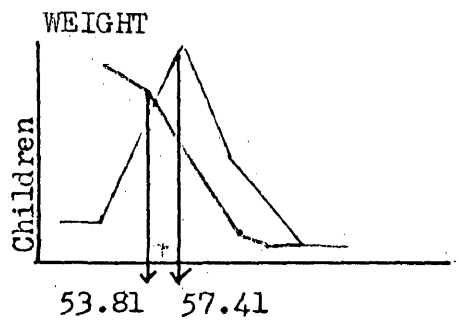



TABLE IX

COMPARISON OF MEANS
OF
CONTROL AND EXPERIMENTAL GROUPS

| Test | Children | Arithmetic Mean $\bar{x}$ | | Comparison of Means (t) | | Group Differences * | |
|---|---|---|---|---|---|---|---|
| | | Before | After | Before | After | Before | After |
| Mental Ability | Experimental | 102.32 | 110.76 | .79 | 1.55 | 0 | 0 |
| | Control | 100. | 104.8 | | | | |
| Heart Reaction | Experimental | 44.41 | 29.12 | 1.26 | 5.42 | 0 | + |
| | Control | 48.1 | 38.79 | | | | - |
| Arm Pull | Experimental | 7.91 | 19.32 | .85 | 2.59 | 0 | + |
| | Control | 8.76 | 14.69 | | | | - |
| Arm Push | Experimental | 9.15 | 36.12 | 1.73 | 2.33 | 0 | + |
| | Control | 6.45 | 23.86 | | | | - |
| Abdominal Strength | Experimental | 758.94 | 1426.5 | .4 | 2.09 | 0 | + |
| | Control | 809.35 | 1105.24 | | | | - |
| Leg Strength | Experimental | 7.09 | 9.56 | 1.29 | 3.29 | 0 | + |
| | Control | 6.53 | 8.07 | | | | - |
| Combined Strength | Experimental | 24.41 | 30.47 | .6 | 3.38 | 0 | + |
| | Control | 23.79 | 27.72 | | | | - |
| Height | Experimental | 47.93 | 50.59 | 1.64 | 4.96 | 0 | + |
| | Control | 46.97 | 47.85 | | | | - |
| Weight | Experimental | 52.62 | 57.41 | 1.77 | 1.87 | 0 | 0 |
| | Control | 49.67 | 53.81 | | | | |

* 0 = No significant difference
\+ = Significant gain in mean difference
\- = Significant loss in mean difference
2.00 and up = point of significant difference

inversely related to one another. These two observations were made by a Swedish physician, Gustav Nylin.[1]

> "The investigations carried out on both pre-school children and school children have shown that there is a periodicity in growth during the year, the height-increase exhibits two maxima--a marked maxima during March-May, and a smaller, but distinct maxima during November-January--and two minima, one during September-November and one during January-March. On the whole, weight-increase varies inversely to height increase, a maximum in height-increase presenting itself simultaneously with a minimum in weight-increase and vise versa... Standard metabolism for children round about the age of six years exhibits a periodicity closely connected with the periodicity in height-increase, in that during periods of great height-increase the standard metabolism rises."

Table IX was designed to present the means, comparison of means, and interpretation of the comparison "t" scores of the control and experimental groups at the beginning and end of the experiment. The same formulas were used as had been previously used for Table IV. To interpret the scores for the comparison of means a portion of the "t" score table taken from Statistical Methods by George W. Snedecor[2] is here inserted.

TABLE X

Values of "t"

| | Probability of a Larger Value of "t" | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *% | 0.5 | 0.4 | 0.3 | 0.2 | 0.1 | 0.05 | 0.02 | 0.01 | D.F |
| *t | .683 | .854 | 1.055 | 1.310 | 1.697 | 2.00 | 2.457 | 2.660 | 60 |

*Supplemented for Clarity to Reader

1. Periodical Variations in Growth, Standard Metabolism and Oxygen Capacity of the Blood in Children, p. 192.

2. Snedecor, George W., Statistical Methods, p. 65.

TABLE XI

COMPARISON OF VARIANCE
OF
CONTROL AND EXPERIMENTAL GROUPS

| Test | Children | Standard Deviation s | | Comparison of Variance F | | Group Differences | |
|---|---|---|---|---|---|---|---|
| | | Before | After | Before | After | Before | After |
| Mental Ability | Experimental | 12.15 | 16.51 | 1.36 | 1.53 | 0 | 0 |
| | Control | | | | | | |
| Heart Reaction | Experimental | 13.96 | 7.43 | 3.71 | 1.37 | + | 0 |
| | Control | 7.25 | 6.36 | | | - | |
| Arm Pull | Experimental | 3.86 | 8.7 | 1.33 | 3.65 | 0 | + |
| | Control | 3.36 | 4.55 | | | | - |
| Arm Push | Experimental | 6.19 | 23.29 | 1.07 | 1.67 | 0 | 0 |
| | Control | 6. | 18. | | | | |
| Abdominal Strength | Experimental | 472.8 | 607.85 | 1.01 | 1.13 | 0 | 0 |
| | Control | 471.49 | 571.12 | | | | |
| Leg Strength | Experimental | 1.53 | 1.78 | 1.17 | 1.06 | 0 | 0 |
| | Control | 1.43 | 1.73 | | | | |
| Combined Strength | Experimental | 3.99 | 3.25 | 1.11 | 1.14 | 0 | 0 |
| | Control | 4.2 | 3.05 | | | | |
| Height | Experimental | 2.37 | 2.35 | 1.55 | 1.59 | 0 | 0 |
| | Control | 1.9 | 1.87 | | | | |
| Weight | Experimental | 6.96 | 7.78 | 1.36 | 1.36 | 0 | 0 |
| | Control | 5.97 | 6.68 | | | | |

By interpreting from this table it will be noted that any "t" score of 2.000 or larger will be considered significant, since the .05 column is considered the point where significant differences become apparent.

While these significant gains were made in group means the variance was relatively stable only deviating significantly in two cases, namely, the September heart reaction comparison for the control and experimental groups, and the June arm pull for these same groups. Both of these tests had a very wide range. The "F" ratio formula of Fisher explained previously, was again used to determine the group comparisons of variability. This general stability of variance makes the significance of the group gains in the comparison of means even more significant. This stability in variance implies general group gains rather than a few unusual gains. These comparisons of variance along with the standard deviations are presented in Table XI.

In order to be able to interpret the "F" scores for comparison, it is necessary to enclose a portion of the "F" table taken from Statistical Methods by George W. Snedecor.[3] Two sections of the "F" table are inserted. All of the tests except one are interpreted from the top section of the table. The one interpreted from the bottom section is the September combined strength test.

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3. Snedecor, George W., Statistical Methods, The Collegiate Press, Inc., P. 224.

TABLE XII

Values of "F"

| | | | |
|---|---|---|---|
| 30 Degrees of Freedom | | | |
| 28 Degrees of Freedom | .1 | 1.87 | |
| | .02 | 2.44 | ..Point of Significant Difference |
| 30 Degrees of Freedom | | | |
| 32 Degrees of Freedom | .1 | 1.82 | |
| | .02 | 2.34 | ..Point of Significant Difference |

Special consideration is necessary for the achievement test results, since the groups were not comparable at the beginning of the experiment. The inability on the part of many of the pupils to read at the beginning of the year made a group achievement test impossible. The groups were comparable both in means and variance at the end of the experiment. The only bases for judging their comparability at the first of the year would be two items: first, the two groups had comparable mental ability, and second, both groups had the same kindergarten and first grade teachers. The following table of achievement illustrates the mean comparison and comparison of variance of the control and experimental groups in June of 1945 and 1946. To obtain the scores used for these calculations the difference between the child's achievement age and chronological age in months was used. This procedure was followed because the age

TABLE XIII

COMPARISON OF ACHIEVEMENT OF
CONTROL & EXPERIMENTAL GROUPS
AT CONCLUSION OF THE EXPERIMENT

| | Control | Experimental | Comparisons Between Control and Experimental Groups |
|---|---|---|---|
| Arithmetic Mean $\bar{x}$ | - .17 months | - 2.15 months | |
| Comparison of Means t | | | .93 |
| Group Differences in Comparison of Means | | | 0 |
| * Standard Deviation s | 7.77 | 7.98 | |
| Comparison of Variance F | | | 1.06 |
| Group Differences in Comparison of Variance | | | 0 |

* Scores = Chronological Age - Achievement Age

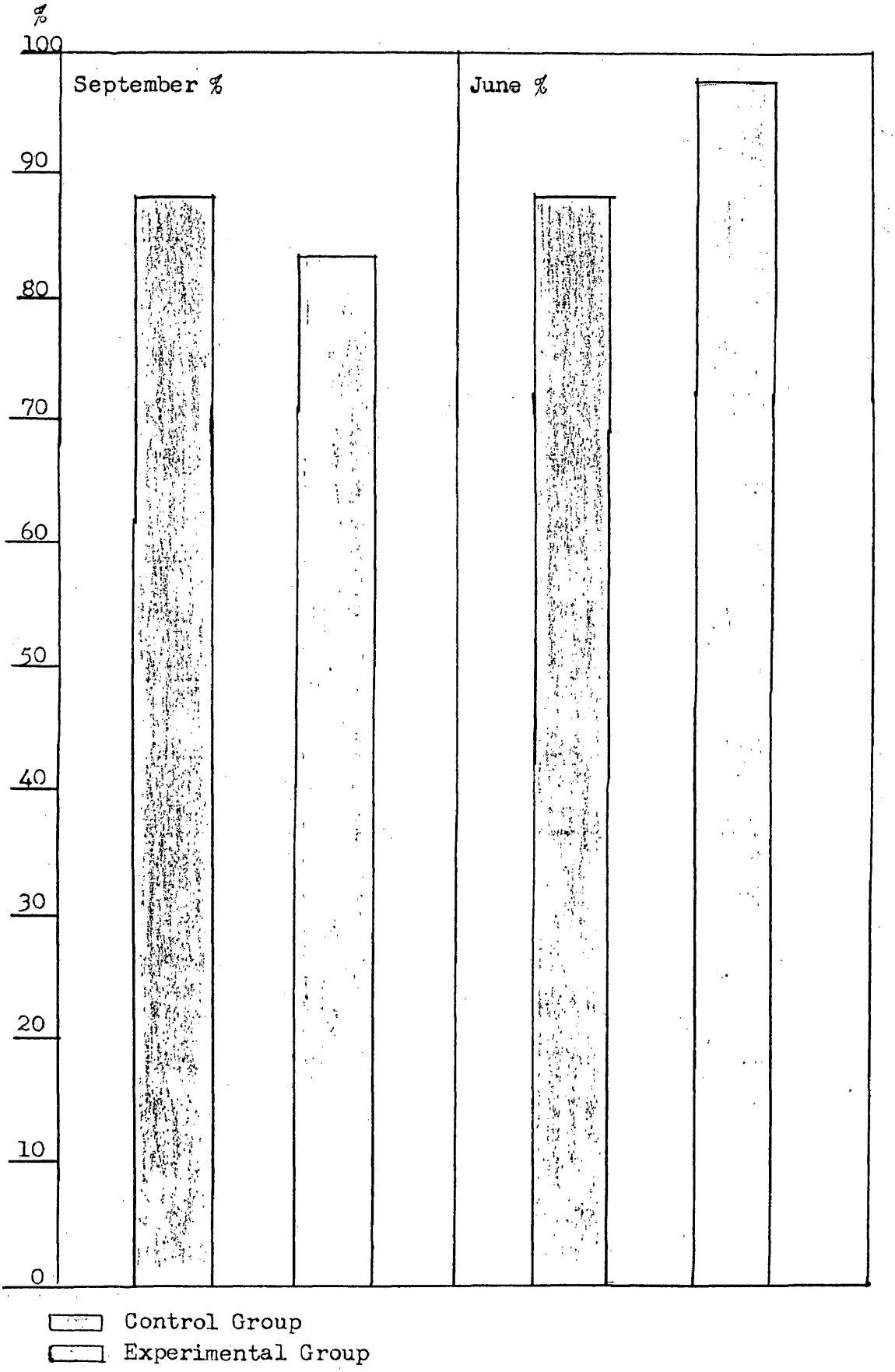
range seemed so great for both groups. To illustrate: A child of eight years scoring an eight year and five months achievement age would earn a score of five months (See Table XIII). There is no objective proof that the groups were comparable in achievement at the beginning of the year. There is, however, proof that they were comparable at the end of the year. If the reader wishes to assume that the groups were comparable in achievement at the first of the year, then he may also assume that the extra work devoted to health did not affect the academic work.

Gains in Group Health Standards

To determine the improvement of specific group standards from the nurse's records the following things were considered: the percentage of vaccination, the number of dental cards turned in to the nurse, the number of medical examinations completed, and specific physical disabilities. The percentage of vaccination for the control group in September was 88.24. This score was unchanged in June, with no new children being vaccinated throughout the year. The experimental group had an 83.78% immunization record in September, but by June this score had been raised to 97.3%. This left only one child in the experimental group without vaccination or immunization. The child in question had been suffering from chronic throat trouble. Her tonsils had been removed the year before, but she was still not well

Figure 5

Vaccination and Immunization
of Control and Experimental Groups

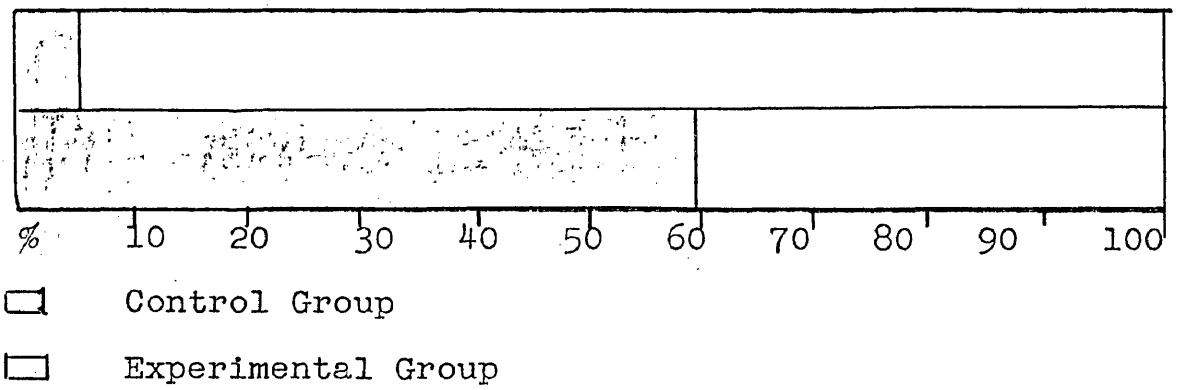


enough for her family physician to recommond vaccination and immunization. Being under the regular care of a physician, this matter will be remedied as soon as it seems advisable. Figure 5 presents a graphic representation of the immunization and vaccination percentages both before and at the conclusion of the experiment.

Only 5.89% of the control group visited a dentist during the course of the school year, while 59.46% of the experimental group brought evidence of dental care as recorded on cards returned to the school nurse. The following figure pictures this increase in dental care.

FIGURE 6

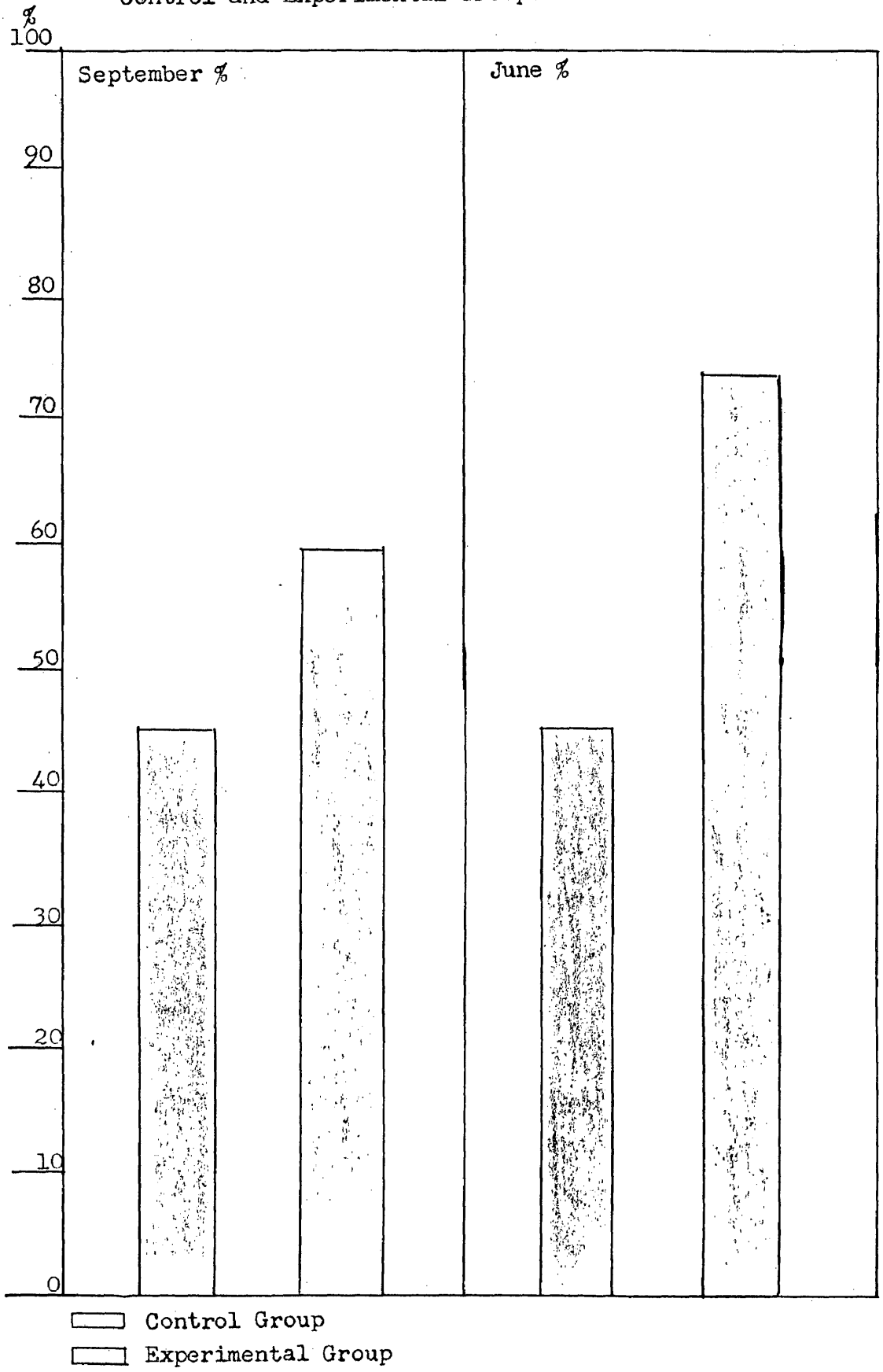
Dental Care of Control and Experimental Groups




Records of medical examinations were on file for 44.12% of the children when they entered the control room in September of 1944, and the figure remained the same in June of 1945. The experimental group had a 59.46% record of medical examinations at the beginning of the year in September of 1945. This record was raised to 72.97% by

Figure 7

Medical Examinations
of
Control and Experimental Groups

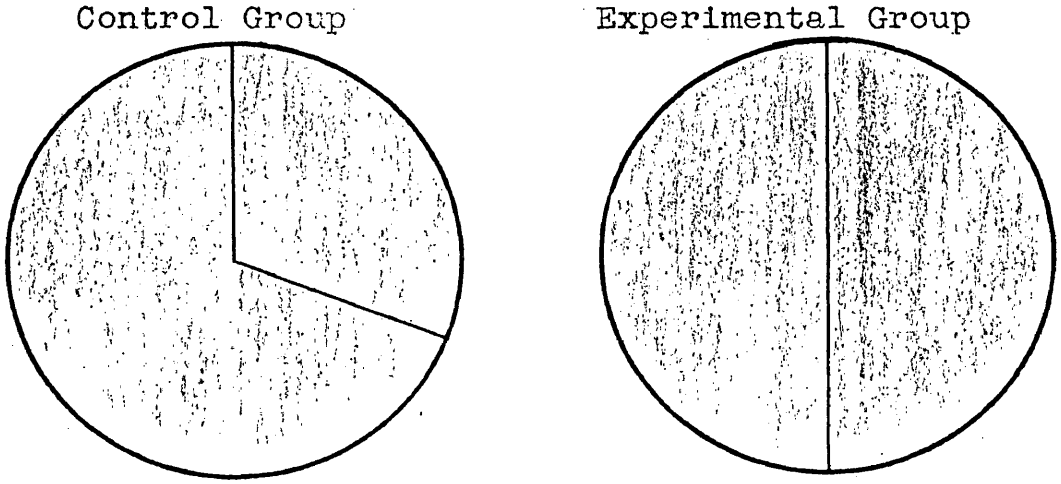


the end of the experiment in June of 1946. The school nurse was very pleased with this increase. Several of the children were not able to get appointments with their physicians until after school had dismissed for summer vacation. Some of the medical records should be ready to be recorded by the opening of school in September of 1946. Figure 7 presents the standing of the two groups in regard to medical examinations.

The control group had eleven children with defective tonsils, and one with correction. The experimental group had eleven with enlarged tonsils, and five with corrections. The control group had four corrected visional defects, and one uncorrected ear defect. The experimental group had only one visional defect, and it was corrected. There were no hearing defects in the experimental group. The following figure represents these specific physical disabilities with the corrections:

FIGURE 8

Physical Disabilities and Corrections of Control and Experimental Groups



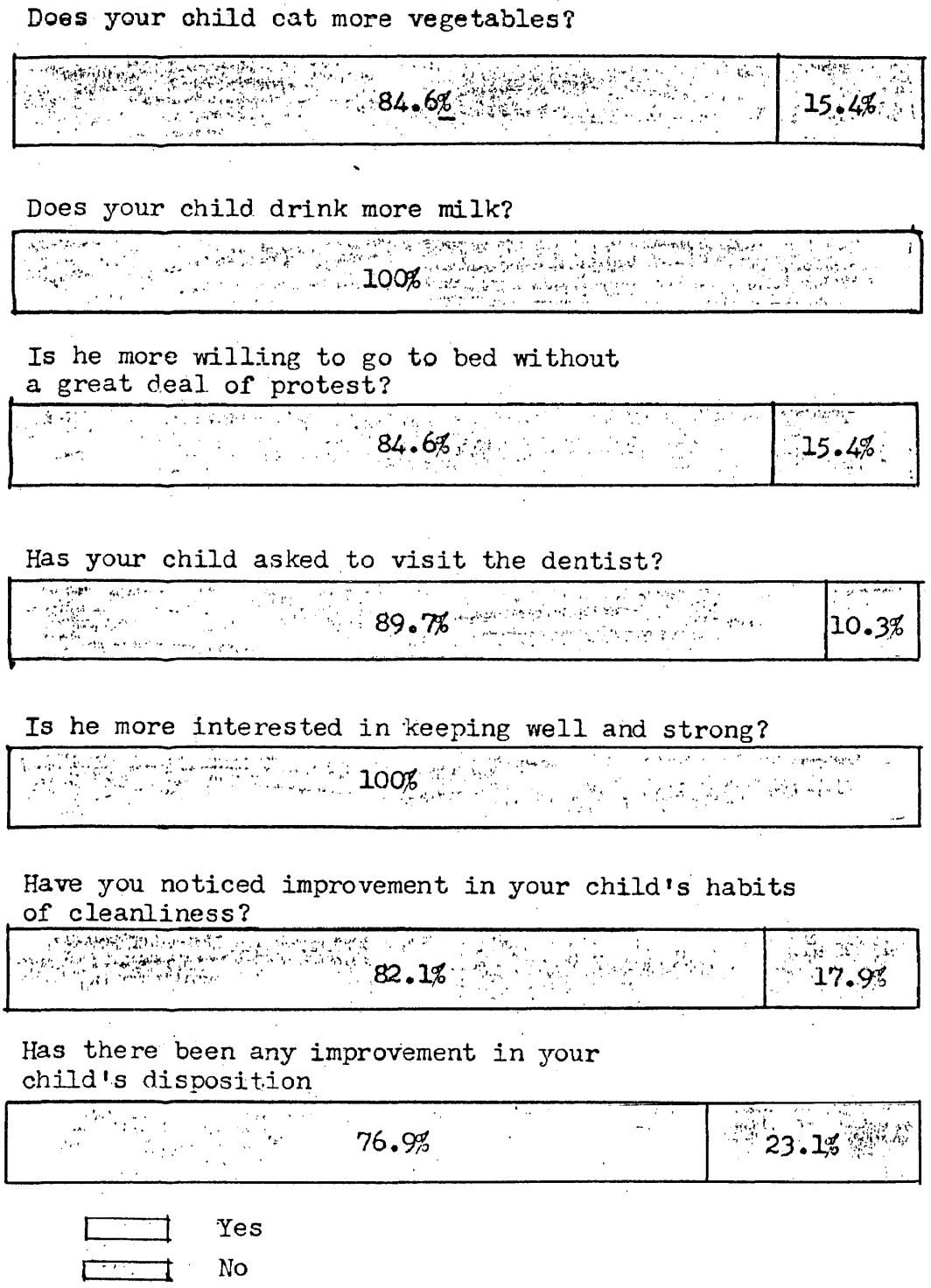
Opinion of Parents

The results of the questionnaires were considered in determining the parent's reaction toward this health program. The general trend of the answers was definitely in the affirmative. The positive answers ranged from 76.9% to 100%. The two questions that had the 100% "yes" answers were: (1) "Does your child drink more milk?", and (2) "Is he more interested in keeping well and strong?". The question that received the lowest percentage of affirmative answers was, "Has there been any improvement in your child's disposition?" Many of the parents commented favorably in attached notes; although they were specifically requested not to sign the questionnaires. The mean of the percentage scores in the affirmative was 88.27. Figure 9 demonstrates the results of the questionnaire. All figures used in Figure 9 are percentage figures.

The results of all these various measures show an improved condition in the well being of the individual child, his compliance with group standards, and his practical application of health instruction as noticed by his parents in his daily living.

Figure 9

Results of Questionnaires Received from Parents of the Experimental Group



# CHAPTER VII

## CONCLUSIONS AND RECOMMENDATIONS

### Conclusions

From the results of the investigations in this study the following conclusions seem to be true:

1. The physical fitness of a primary child may be significantly improved by an intensive health program.

2. Active interest in the problem of their own health needs can be stimulated in children of this age.

3. The school nurse alone cannot produce the results made possible by teacher cooperation in the raising of community health standards.

4. The interest of parents can be aroused in the problem of the health needs of their primary children to the point where they will cooperate to a great extent with an interested teacher.

### Recommendations

On the basis of the foregoing conclusions, the following recommendations seem to be in order:

1. Physical education should be reinstated in the curriculum of the primary grades. (Speaking of the necessity of an active childhood, S. L. Pressey[1] says, "Large-muscle activity is the natural and healthy thing for children; the fine coordinations of small muscle groups.....are very difficult".)

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1. Pressey, S. L., Psychology and the New Education, Harper & Brothers, p. 470.

2. Provision should be made for a school milk program that would include all of the children, with supplementary milk for special cases.

3. The school lunch program could be profitably extended into the elementary schools. (Floyd W. Reeves[2] states the following concerning the school lunch program: "Its effects in lifting the level of child health and of pupil efficiency have astonished even its advocates. But that program reaches only a small fraction of the pupils in our schools. If it were widely, or if possible universally, extended throughout our schools, the effects would be commensurate. 'We are wasting money', Surgeon General Parran puts it, 'trying to educate children with half-starved bodies. They cannot absorb teaching. They hold back classes, require extra time of teachers, and repeat grades. This is expensive stupidity....'".)

4. Records of a child's growth hold personal interest for him. A simplified monthly record, easily accessible to the child, is a motivating factor in his own interest toward his physical well-being.

5. A primary teacher can do much to promote regular dental care, immunization and vaccination, and medical examinations through her contacts with the child and his parents.

6. The protective attitude of parents in regard to the physical well-being of their children should be used by the primary teachers as a lever in raising the health standards of children in her charge.

7. The personal and professional prestige of each Omaha teacher should be used in backing the movement for a child guidance clinic to which she could look for help in solving some of her problems of maladjustments.

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2. Reeves, Floyd W., The Inglis Lecture, 1942 Education for Today and Tomorrow, Harvard University Press, p. 20.

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World Herald, October 10, 1945, p. 1

# APPENDIX

## ILLUSTRATIVE MATERIALS

SOUTH LINCOLN SCHOOL

April 25, 1946

Dear Parents:

As you are well aware, I have been attempting this year to teach the meaning of health in a practical way to your child. I could not have succeeded in this venture without your fine cooperation as parents.

In conclusion to this effort I am asking one more favor of you. Would you be so kind as to take time to check the following questions? It will help me to gain accurate information as to the success of my teaching.

You need not sign your name unless you care to do so.

Thanking you again, I remain

Your friend,

Evelyn Hotz

| | | | |
|---|---|---|---|
| 1. | Does your child eat more vegetables? | Yes | No |
| 2. | Does your child drink more milk? | Yes | No |
| 3. | Is he more willing to go to bed without a great deal of protest? | Yes | No |
| 4. | Has your child asked to visit the dentist? | Yes | No |
| 5. | Is he more interested in keeping well and strong? | Yes | No |
| 6. | Have you noticed improvement in your child's habits of cleanliness? | Yes | No |
| 7. | Has there been any improvement in your child's disposition? | Yes | No |

# PHYSICAL FITNESS TEST

Name_____

Date_____

---

Test 1

Heart Action - Two steps per second for one minute. Test time required for heart to return to normal rate.

---

Test 2

Arm and Shoulder Strength - (a) Chinning, pulling up weight from a lying position. (b) Push-ups.

(a)_____

(b)_____

---

Test 3

Abdominal Strength - Measure in wheelbarrow position the distance traveled before the back sags.

---

Test 4

Leg Strength - Distance between standing and jumping position measured on a wall.

---

Test 5

Combination of Strengths - Test number of times per minute subject able to stand, squat, jump with feet backward, and to squat position.

---

Test 6

Height

---

Test 7

Weight

---

SAMPLE SECTION

Similar Calculations Computed for
All Physical Fitness Tests, Weight, Mental
Ability and Achievement

HEIGHT FOR CHILDREN
NOT ATTENDING EXTENDED SCHOOL CARE
September 1944

| (n) | (x-g) | $(x-g)^2$ |
|---|---|---|
| 48.5 | 2. | 4. |
| 48.5 | 2. | 4. |
| 48.5 | 2. | 4. |
| 48. | 1.5 | 2.25 |
| 48. | 1.5 | 2.25 |
| 48. | 1.5 | 2.25 |
| 48. | 1.5 | 2.25 |
| 48. | 1.5 | 2.25 |
| 48. | 1.5 | 2.25 |
| 47. | .5 | .25 |
| 47. | ..5 | .25 |
| 46.5 | 0 | |
| 46. | - .5 | .25 |
| 46. | - .5 | .25 |
| 46. | - .5 | .25 |
| 45.5 | -1. | 1. |
| 45.5 | -1. | 1. |
| 45. | -1.5 | 2.25 |
| 45. | -1.5 | 2.25 |
| 44.5 | -2. | 4. |
| 44. | -2.5 | 6.25 |
| 43.5 | -3. | 9. |
| 22 | 2. | 52.50 |

Mean

$$\bar{x} = g \pm \frac{(x-g)}{n}$$

$$\bar{x} = 46.5 \pm \frac{2}{22}$$

$$\bar{x} = 46.5 + .09$$

$$\bar{x} = 46.59$$

Standard Deviation

$$s = \sqrt{\frac{S(x-g)^2 - \frac{[S(x-g)]^2}{n}}{n-1}}$$

$$s = \sqrt{\frac{52.5 - \frac{(2)^2}{22}}{22-1}}$$

$$s = \sqrt{2.4913}$$

$$s = 1.58$$

HEIGHT FOR CHILDREN
ATTENDING EXTENDED SCHOOL CARE
September 1944

| (n) | (x-g) | $(x-g)^2$ |
|---|---|---|
| 52. | 4.5 | 20.25 |
| 51. | 3.5 | 12.25 |
| 47.5 | 0 | |
| 47.5 | 0 | |
| 47. | - .5 | .25 |
| 47. | - .5 | .25 |
| 45. | -2.5 | 6.25 |
| 7 | 4.5 | 39.25 |

Mean

$$\bar{x} = g \pm \frac{(x-g)}{n}$$

$$\bar{x} = 47.5 \pm \frac{4.5}{7}$$

$$\bar{x} = 48.14$$

Standard Deviation

$$s = \sqrt{\frac{S(x-g)^2 - \frac{[S(x-g)]^2}{n}}{n-1}}$$

$$s = \sqrt{\frac{39.25 - \frac{(4.5)^2}{7}}{7 - 1}}$$

$$s = \sqrt{6.0595}$$

$$s = 2.46$$

HEIGHT
SEPTEMBER 1944

(Children not attending extended school care and vice versa).

Comparison of Means of Two Groups

$$t = \bar{x}\sqrt{\frac{n_1\, n_2\, (n_1+n_2 - 2)}{(n_1+ n_2)\, sx^2}}$$

$$t = 1.55\sqrt{\frac{7x22\ (7+22 - 2)}{(7+22)\ 91.75}}$$

$t = 1.55 \times 1.25 = 1.94$

Probability .1+, Similar Groups.

| Children | Number (n) | Degrees of Freedom (d.f.) | Means ($\bar{x}$) | Sum of Squares ($sx^2$) |
|---|---|---|---|---|
| Attending Extended School Care | 7 ($n^1$) | 6 | 48.14 | 39.25 |
| Not Attending Extended School Care | 22 ($n^2$) | 21 | 46.59 | 52.5 |
| | | 27 | Diff. = 1.55 | Sum = 91.75 |

Note: $\bar{x}$ = Difference between the two means.

HEIGHT FOR CHILDREN
NOT ATTENDING EXTENDED SCHOOL CARE
June 1945

| (n) | (x-g) | $(x-g)^2$ |
|---|---|---|
| 50. | 2.5 | 6.25 |
| 49.5 | 2. | 4. |
| 49.5 | 2. | 4. |
| 49.5 | 2. | 4. |
| 49. | 1.5 | 2.25 |
| 49. | 1.5 | 2.25 |
| 49. | 1.5 | 2.25 |
| 48.5 | 1. | 1. |
| 48. | .5 | .25 |
| 48. | .5 | .25 |
| 48. | .5 | .25 |
| 47.5 | 0 | |
| 47.5 | 0 | |
| 47. | - .5 | .25 |
| 46.75 | - .75 | .5625 |
| 46.5 | -1. | 1. |
| 46.5 | -1. | 1. |
| 46. | -1.5 | 2.25 |
| 45.5 | -2. | 4. |
| 45.5 | -2. | 4. |
| 45. | -2.5 | 6.25 |
| 44.5 | -3. | 9. |
| 22 | 1.25 | 55.0625 |

Mean

$$\bar{x} = g \pm \frac{(x-g)}{n}$$

$$\bar{x} = 47.5 \pm \frac{1.25}{22}$$

$$\bar{x} = 47.56$$

Standard Deviation

$$s = \sqrt{\frac{S(x-g)^2 - \frac{[S(x-g)]^2}{n}}{n-1}}$$

$$s = \sqrt{\frac{55.0625 - \frac{(1.25)^2}{22}}{22-1}}$$

$$s = \sqrt{2.618641}$$

$$s = 1.62$$

HEIGHT FOR CHILDREN
ATTENDING EXTENDED SCHOOL CARE
June 1945

| (n) | (x-g) | $(x-g)^2$ |
|---|---|---|
| 52. | 3.5 | 12.25 |
| 52. | 3.5 | 12.25 |
| 48.5 | 0 | |
| 48.5 | 0 | |
| 48. | - .5 | .25 |
| 47.5 | -1. | 1. |
| 45.5 | -3. | 9. |
| 7 | 2.5 | 34.75 |

Mean

$$\bar{x} = g \pm \frac{(x-g)}{n}$$

$$\bar{x} = 48.5 \pm \frac{2.5}{7}$$

$$\bar{x} = 48.86$$

Standard Deviation

$$s = \sqrt{\frac{S(x-g)^2 - \frac{[S(x-g)]^2}{n}}{n-1}}$$

$$s = \sqrt{\frac{34.75 - \frac{(2.5)^2}{7}}{7-1}}$$

$$s = \sqrt{5.642857}$$

$$s = 2.38$$

HEIGHT
JUNE 1945

(Children not attending extended school care and vice versa).

Comparison of Means of Two Groups

$$t = \bar{x}\sqrt{\frac{n_1\ n_2\ (n_1 + n_2 - 2)}{(n_1 + n_2)\ sx^2}}$$

$$t = 1.3\sqrt{\frac{7 \times 22\ (7 + 22 - 2)}{(7 + 22)\ 89.8125}}$$

$$t = 1.3 \times 1.26 = 1.64$$

Probability .07, Similar Groups

| Children | Number (n) | Degrees of Freedom (d.f.) | Means ($\bar{x}$) | Sum of Squares ($sx^2$) |
|---|---|---|---|---|
| Attending Extended School Care | 7 ($n^1$) | 6 | 48.86 | 34.75 |
| Not Attending Extended School Care | 22 ($n^2$) | 21 | 47.56 | 55.0625 |
| | | Sum = 27 | Diff. = 1.3 | Sum = 89.8125 |

Note: $\bar{x}$ = Difference between the two means.

HEIGHT
FOR EXPERIMENTAL GROUP
SEPTEMBER 1945

| (n) | (x-g) | $(x-g)^2$ |
|---|---|---|
| 52.5 | 3.5 | 12.25 |
| 52. | 3. | 9. |
| 51. | 2. | 4. |
| 50.5 | 1.5 | 2.25 |
| 50.5 | 1.5 | 2.25 |
| 50. | 1. | 1. |
| 50. | 1. | 1. |
| 50. | 1. | 1. |
| 49.5 | .5 | .25 |
| 49.5 | .5 | .25 |
| 49.5 | .5 | .25 |
| 49. | 0 | |
| 49. | 0 | |
| 49. | 0 | |
| 48.5 | - .5 | .25 |
| 48.5 | - .5 | .25 |
| 48. | -1. | 1. |
| 48. | -1. | 1. |
| 48. | -1. | 1. |
| 47.5 | -1.5 | 2.25 |
| 47.5 | -1.5 | 2.25 |
| 47. | -2. | 4. |
| 47. | -2. | 4. |
| 47. | -2. | 4. |
| 46.5 | -2.5 | 6.25 |
| 46. | -3. | 9. |
| 46. | -3. | 9. |
| 46. | -3. | 9. |
| 46. | -3. | 9. |
| 45.5 | -3.5 | 12.25 |
| 44.5 | -4.5 | 20.25 |
| 43.5 | -5.5 | 30.25 |
| 43.5 | -5.5 | 30.25 |
| 43. | -6. | 36. |
| 34 | -36.5 | 224.75 |

Mean

$$\bar{x} = g \pm \frac{(x-g)}{n}$$

$$\bar{x} = 49 \pm \frac{(-36.5)}{34}$$

$$\bar{x} = 49 - 1.07$$

$$\bar{x} = 47.93$$

Standard Deviation

$$s = \sqrt{\frac{S(x-g)^2 - \frac{[S(x-g)]^2}{n}}{n-1}}$$

$$s = \sqrt{\frac{224.75 - \frac{(36.5)^2}{34}}{33}}$$

$$s = \sqrt{\frac{224.75 - 39.1838}{33}}$$

$$s = \sqrt{5.6232}$$

$$s = 2.37$$

HEIGHT FOR CONTROL GROUP
September 1944

| (n) | (x-g) | $(x-g)^2$ |
|---|---|---|
| 52. | 5. | 25. |
| 51. | 4. | 16. |
| 48.5 | 1.5 | 2.25 |
| 48.5 | 1.5 | 2.25 |
| 48.5 | 1.5 | 2.25 |
| 48. | 1. | 1. |
| 48. | 1. | 1. |
| 48. | 1. | 1. |
| 48. | 1. | 1. |
| 48. | 1. | 1. |
| 48. | 1. | 1. |
| 47.5 | .5 | .25 |
| 47.5 | .5 | .25 |
| 47. | 0 | |
| 47. | 0 | |
| 47. | 0 | |
| 47. | 0 | |
| 46.5 | - .5 | .25 |
| 46. | -1. | 1. |
| 46. | -1. | 1. |
| 46. | -1. | 1. |
| 45.5 | -1.5 | 2.25 |
| 45.5 | -1.5 | 2.25 |
| 45. | -2. | 4. |
| 45. | -2. | 4. |
| 45. | -2. | 4. |
| 44.5 | -2.5 | 6.25 |
| 44. | -3. | 9. |
| 43.5 | -3.5 | 12.25 |
| 29 | -1. | 101.50 |

Mean

$$\bar{x} = g \pm \frac{(x-g)}{n}$$

$$\bar{x} = 47 \pm \frac{-1}{29}$$

$$\bar{x} = 46.97$$

Standard Deviation

$$s = \sqrt{\frac{S(x-g)^2 - \frac{[S(x-g)]^2}{n}}{n-1}}$$

$$s = \sqrt{\frac{101.5 - \frac{(-1)^2}{29}}{29 - 1}}$$

$$s = \sqrt{3.623771}$$

$$s = 1.9$$

HEIGHT

Experimental Group of September 1945 vs Control Group of September 1944

Comparison of Means of Two Groups

$$t = \bar{x}\sqrt{\frac{n_1\, n_2\, (n_1 + n_2 - 2)}{(n_1 + n_2)\, sx^2}}$$

$$t = .96\sqrt{\frac{34 \times 29\, (34 + 29 - 2)}{(34 + 29)\, 326.25}}$$

$t = .96 \times 1.71 = 1.64$

Probability .1+ , similar groups.

| Children | Number (n) | Degrees of Freedom (d.f.) | Means ($\bar{x}$) | Sum of Squares ($sx^2$) |
|---|---|---|---|---|
| Experi. Group | 34 ($n_1$) | 33 | 47.93 | 224.75 |
| Control Group | 29 ($n_2$) | 28 | 46.97 | 101.5 |
| | | Sum = 61 | Diff. = .96 | Sum = 326.25 |

Note: $\bar{x}$ = Difference between the two means.

HEIGHT
FOR EXPERIMENTAL GROUP
June 1946

| (n) | (x-g) | $(x-g)^2$ |
|---|---|---|
| 54.5 | 4.5 | 20.25 |
| 54.5 | 4.5 | 20.25 |
| 54. | 4. | 16. |
| 53. | 3. | 9. |
| 53. | 3. | 9. |
| 53. | 3. | 9. |
| 53. | 3. | 9. |
| 52.5 | 2.5 | 6.25 |
| 52.5 | 2.5 | 6.25 |
| 52. | 2. | 4. |
| 52. | 2. | 4. |
| 52. | 2. | 4. |
| 52. | 2. | 4. |
| 51.5 | 1.5 | 2.25 |
| 51.5 | 1.5 | 2.25 |
| 51. | 1. | 1. |
| 51. | 1. | 1. |
| 51. | 1. | 1. |
| 50. | 0 | |
| 50. | 0 | |
| 50. | 0 | |
| 49.5 | - .5 | .25 |
| 49.5 | - .5 | .25 |
| 49.5 | - .5 | .25 |
| 49. | -1. | 1. |
| 49. | -1. | 1. |
| 49. | -1. | 1. |
| 49. | -1. | 1. |
| 48. | -2. | 4. |
| 48. | -2. | 4. |
| 47. | -3. | 9. |
| 46.5 | -3.5 | 12.25 |
| 46. | -4. | 16. |
| 46. | -4. | 16. |
| 34 | 20 | 194.50 |

**Mean**

$$\bar{x} = g \pm \frac{(x-g)}{n}$$

$$\bar{x} = 50 \pm \frac{(20)}{34}$$

$$\bar{x} = 50.59$$

**Standard Deviation**

$$s = \sqrt{\frac{S(x-g)^2 - \frac{[S(x-g)]^2}{n}}{n-1}}$$

$$s = \sqrt{\frac{194.50 - \frac{(20)^2}{34}}{34-1}}$$

$$s = \sqrt{5.5374}$$

$$s = 2.35$$

HEIGHT FOR CONTROL GROUP
June 1945

| (n) | (x-g) | $(x-g)^2$ |
|---|---|---|
| 52. | 4. | 16. |
| 52. | 4. | 16. |
| 50. | 2. | 4. |
| 49.5 | 1.5 | 2.25 |
| 49.5 | 1.5 | 2.25 |
| 49.5 | 1.5 | 2.25 |
| 49. | 1. | 1. |
| 49. | 1. | 1. |
| 49. | 1. | 1. |
| 48.5 | .5 | .25 |
| 48.5 | .5 | .25 |
| 48. | 0 | |
| 48. | 0 | |
| 48. | 0 | |
| 48. | 0 | |
| 48. | 0 | |
| 47.5 | - .5 | .25 |
| 47.5 | - .5 | .25 |
| 47.5 | - .5 | .25 |
| 47. | -1. | 1. |
| 46.75 | -1.25 | 1.5625 |
| 46.5 | -1.5 | 2.25 |
| 46.5 | -1.5 | 2.25 |
| 46. | -2. | 4. |
| 45.5 | -2.5 | 6.25 |
| 45.5 | -2.5 | 6.25 |
| 45.5 | -2.5 | 6.25 |
| 45. | -3. | 9. |
| 44.5 | -3.5 | 12.25 |
| 29 | -4.25 | 98.0625 |

**Mean**

$$\bar{x} = g \pm \frac{(x-g)}{n}$$

$$\bar{x} = 48 \pm \frac{-4.25}{29}$$

$$\bar{x} = 47.85$$

**Standard Deviation**

$$s = \sqrt{\frac{S(x-g)^2 - \frac{[S(x-g)]^2}{n}}{n-1}}$$

$$s = \sqrt{\frac{98.0625 - \frac{(-4.25)^2}{29}}{29 - 1}}$$

$$s = \sqrt{3.479989}$$

$$s = 1.87$$

HEIGHT

Experimental Group of June 1946 vs. Control Group of June 1945

Comparison of Means of Two Groups

$$t = \bar{x}\sqrt{\frac{n_1\ n_2\ (n_1 + n_2 - 2)}{(n_1 + n_2)\ sx^2}}$$

$$t = 2.74\sqrt{\frac{34 \times 29\ (34 + 29 - 2)}{(34 + 29)\ 292.5625}}$$

$t = 2.74 \times 1.81 = 4.96$

Probability less than .01, significantly different groups.

| Children | Number (n) | Degrees of Freedom (d.f.) | Means ($\bar{x}$) | Sum of Squares ($sx^2$) |
|---|---|---|---|---|
| Attending Extended School Care | 34 ($n_1$) | 33 | 50.59 | 194.5 |
| Not Attending Extended School Care | 29 ($n_2$) | 28 | 47.85 | 98.0625 |
| | | Sum = 61 | Diff. = 2.74 | Sum = 292.5625 |

Note: $\bar{x}$ = Difference between the two means.

# TIS QUICK-SCORING MENTAL ABILITY TESTS

| Scores | |
|---|---|
| onv. | |
| rbal | |
| otal | |

By Arthur S. Otis, Ph.D.
Formerly Development Specialist with Advisory Board,
General Staff, United States War Department

Alpha

A

## ALPHA TEST: FORM A

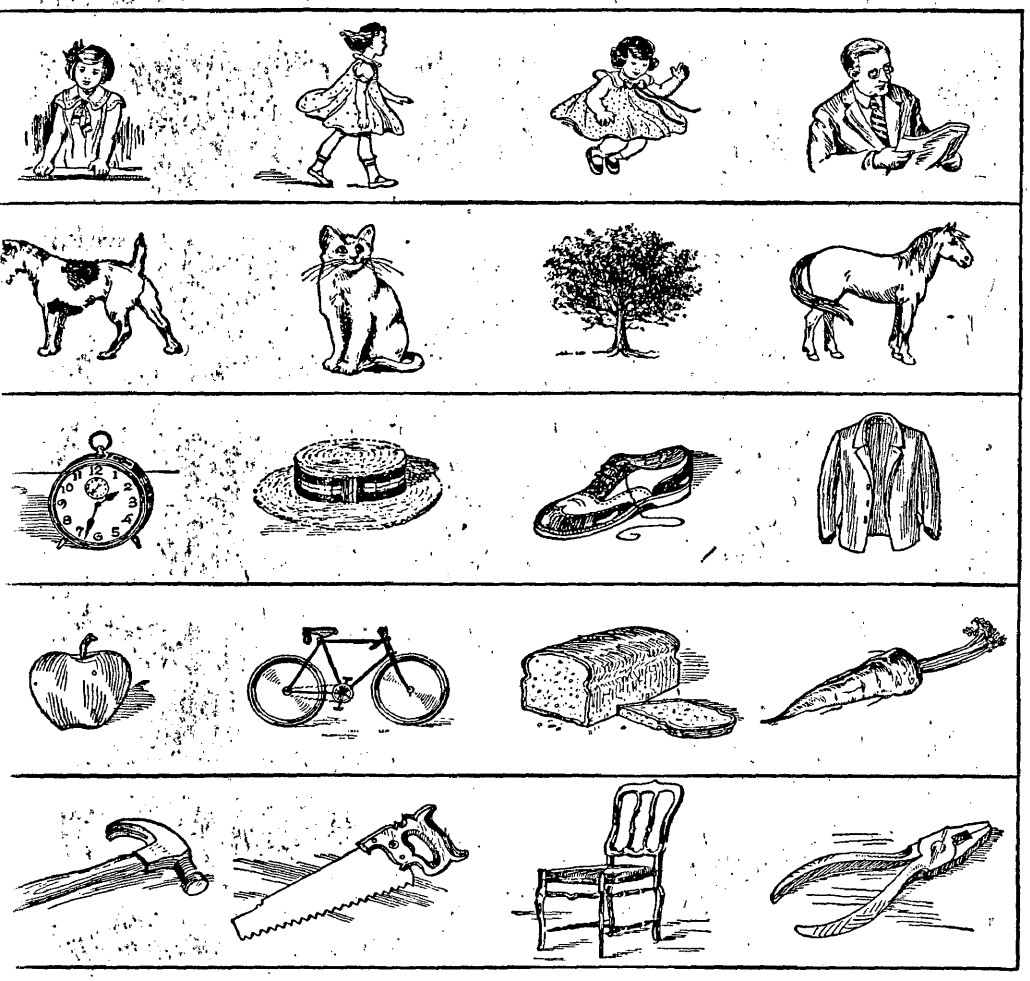
### For Grades 1–4

IQ.....

ne.....Age.....Grade....

cher.....Date.....19....

ool.....City.....

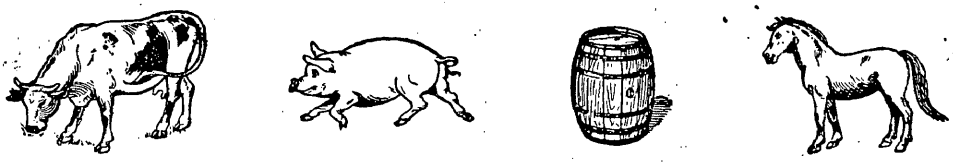


ublished by World Book Company, Yonkers-on-Hudson, New York, and Chicago, Illinois

# R

Otis Quick-Scoring: Alpha: A

1



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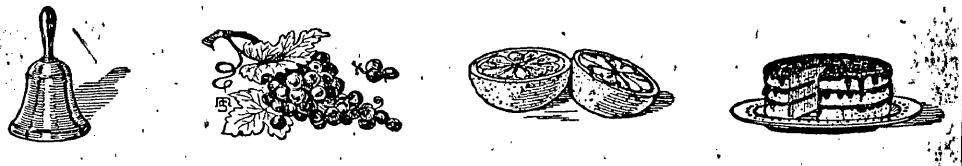

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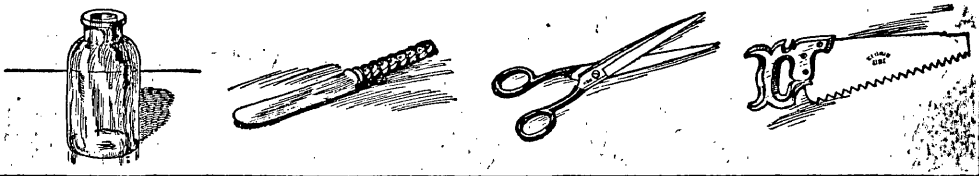

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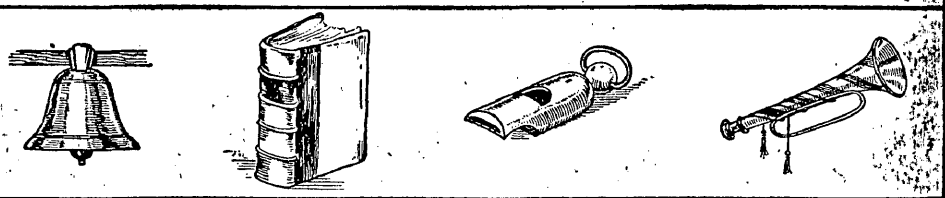

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**F**

10

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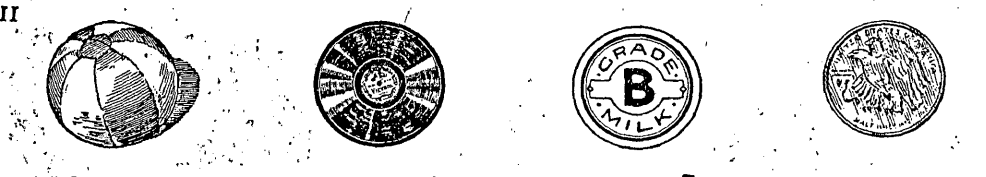


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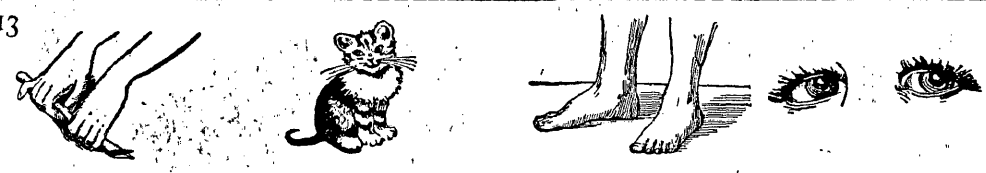

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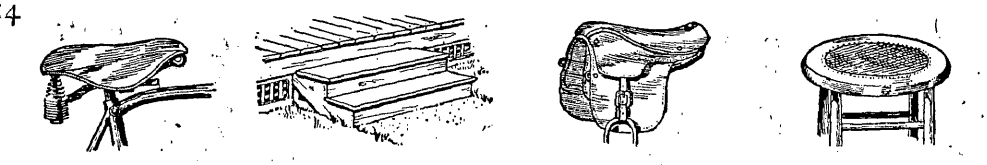

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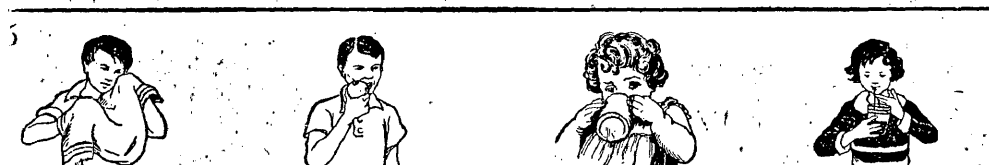

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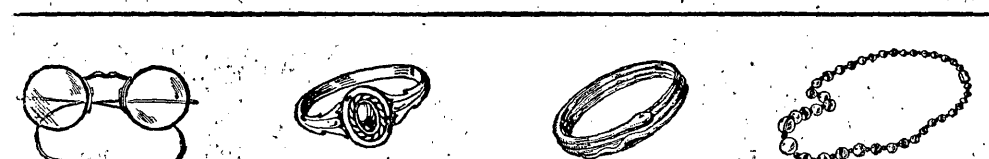

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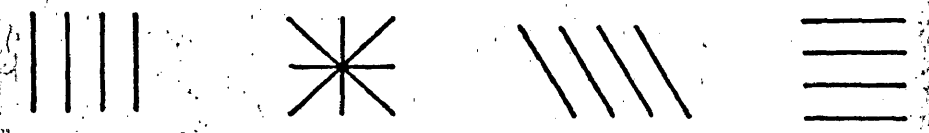

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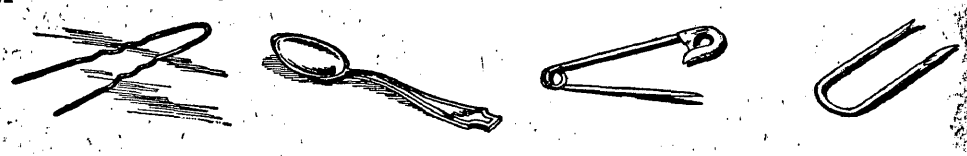

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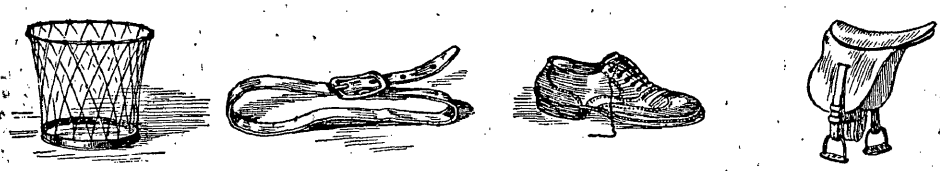

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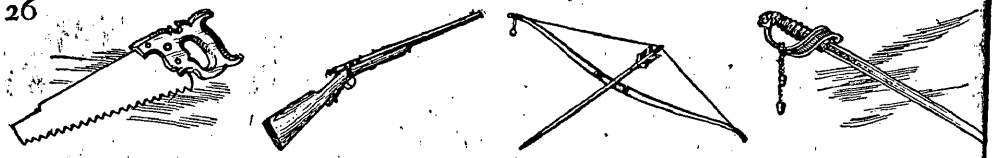

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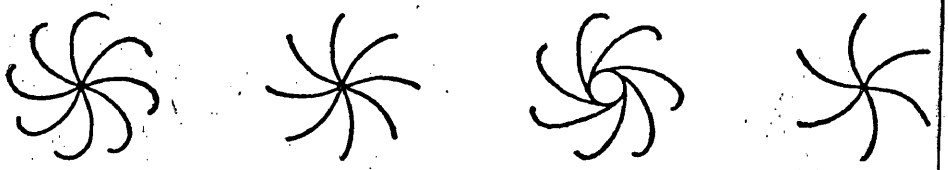

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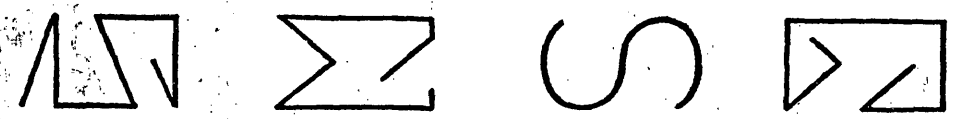

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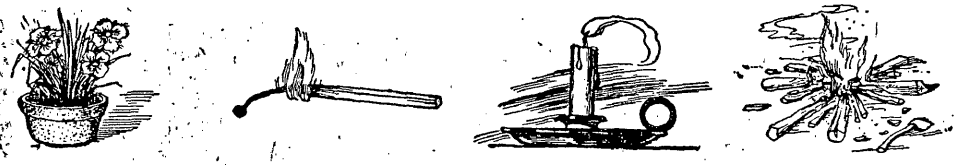

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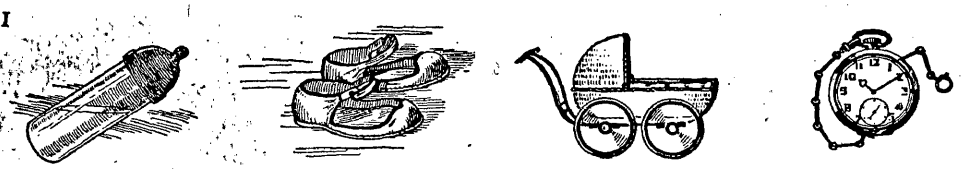

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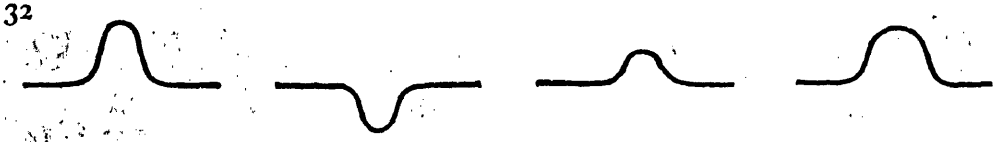

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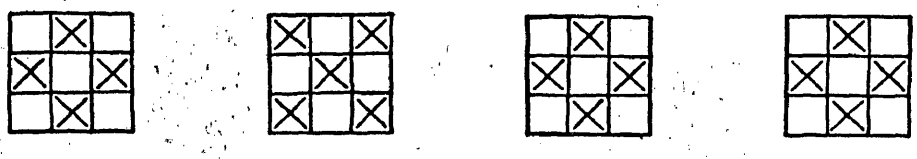

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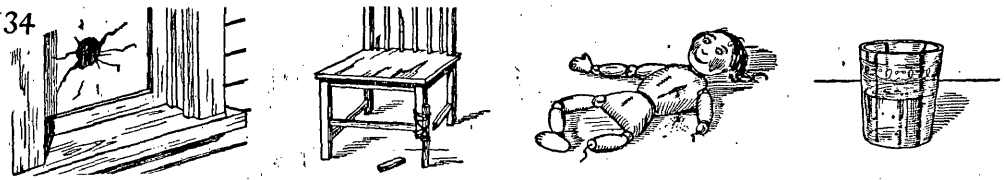

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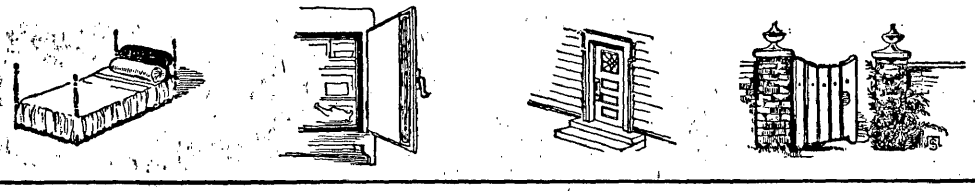

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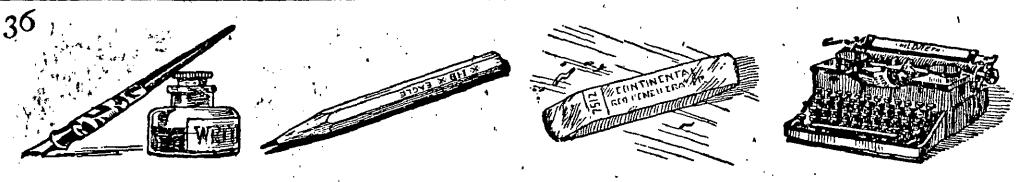

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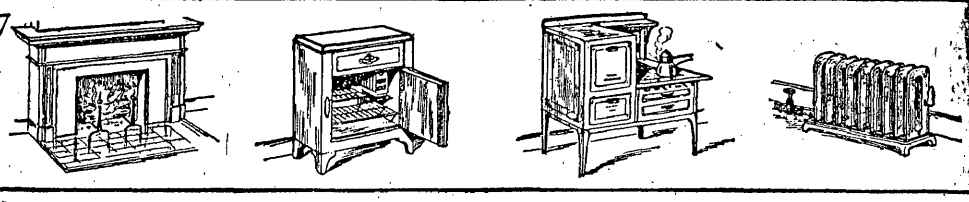

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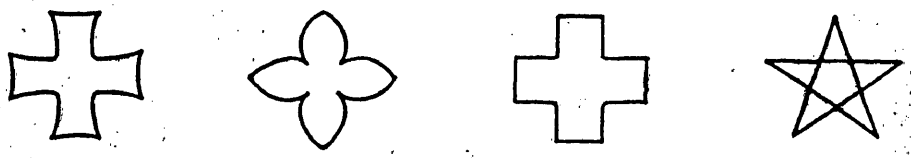

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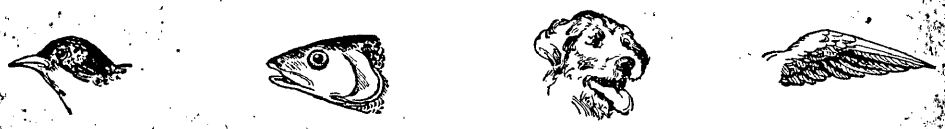

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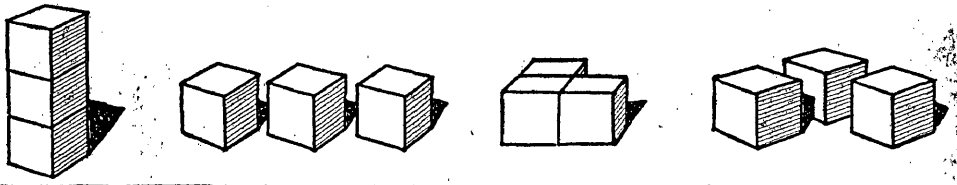

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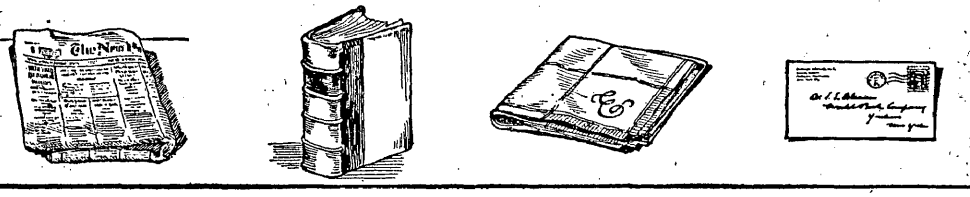

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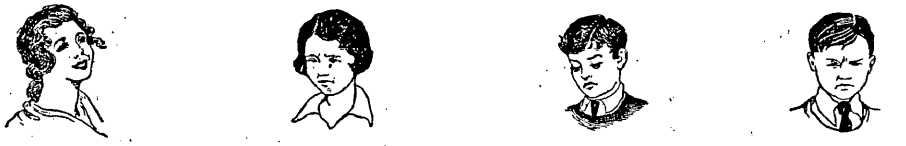

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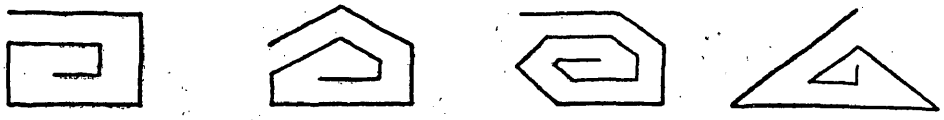

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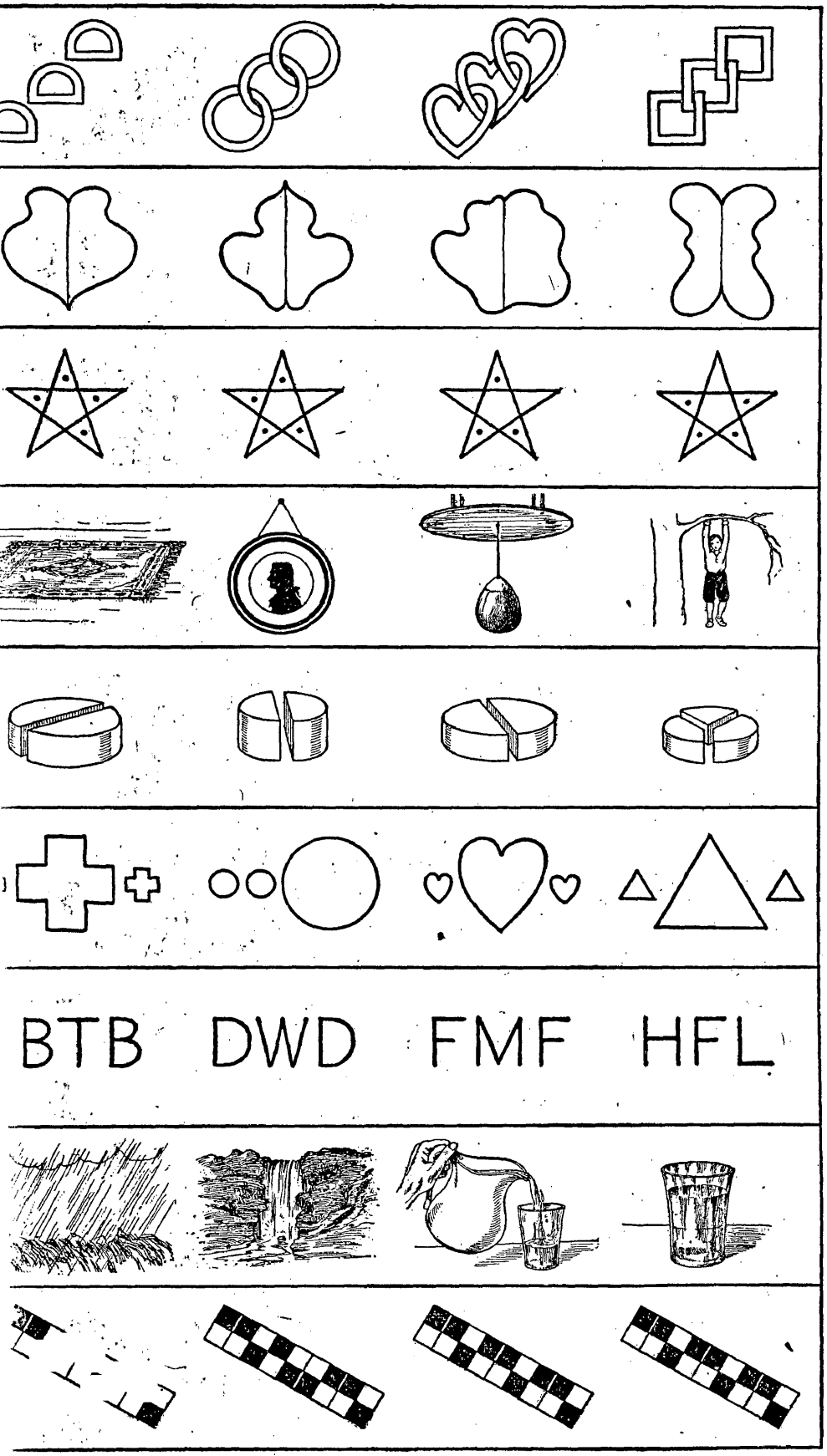

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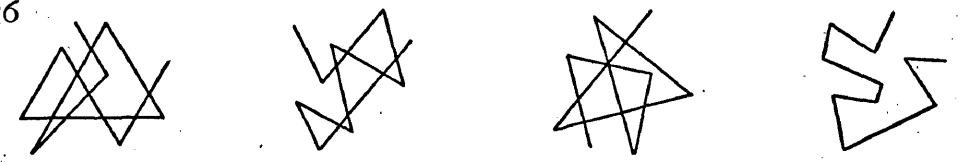

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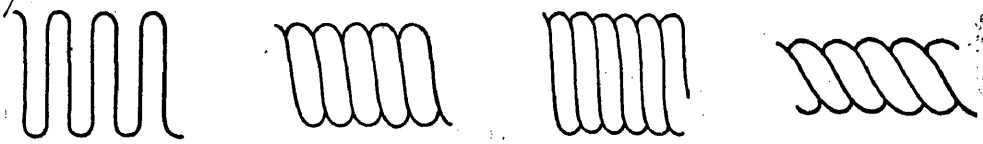

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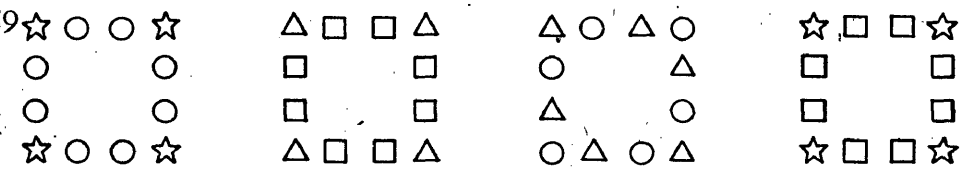

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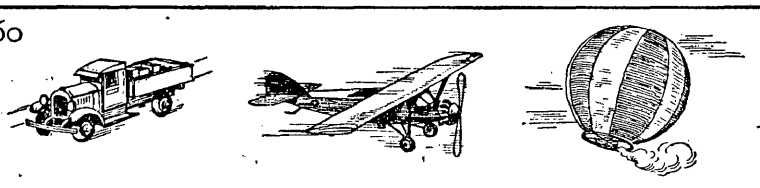

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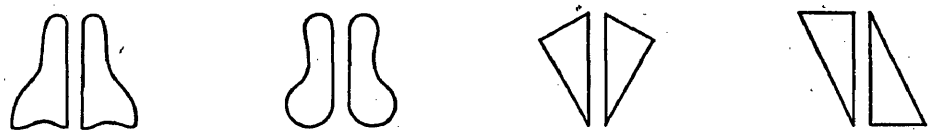

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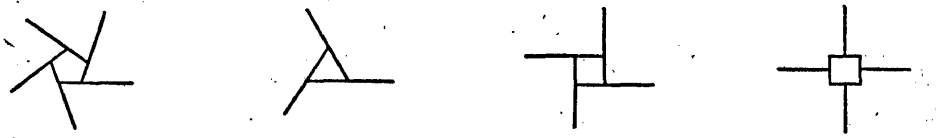

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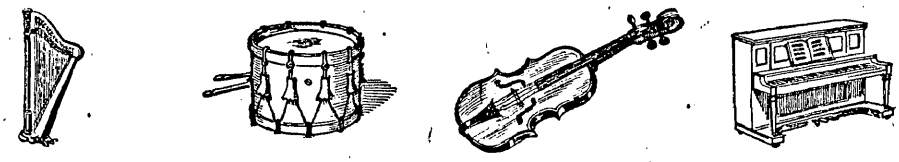

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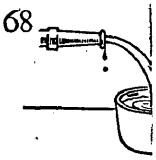

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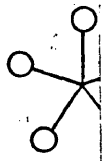

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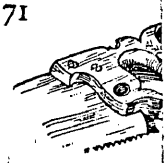

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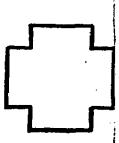

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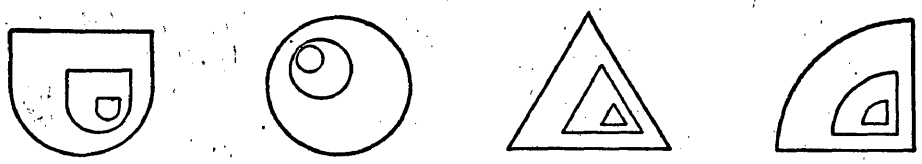

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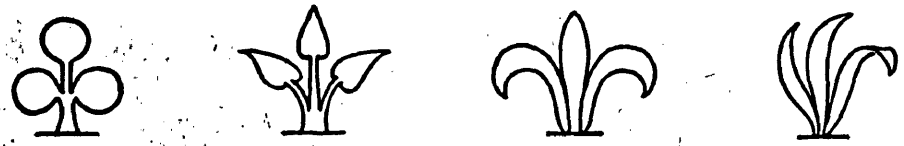

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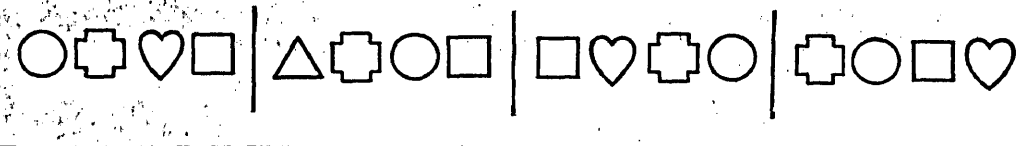

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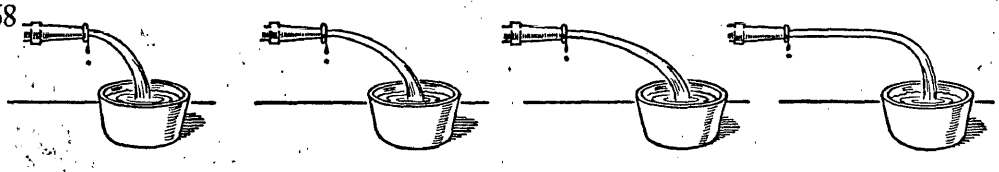

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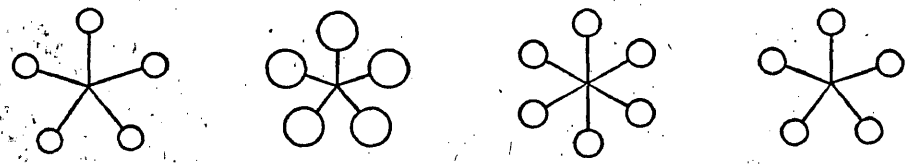

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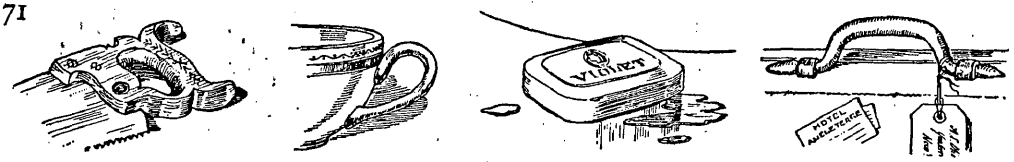


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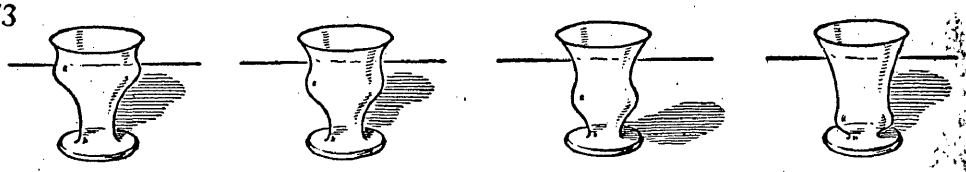

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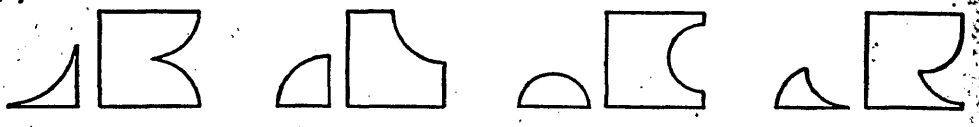

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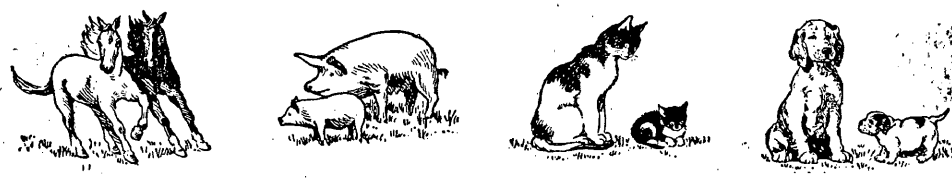

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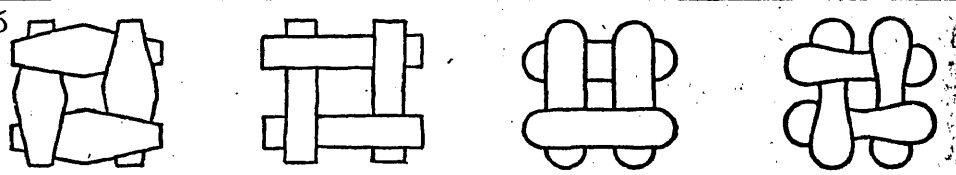

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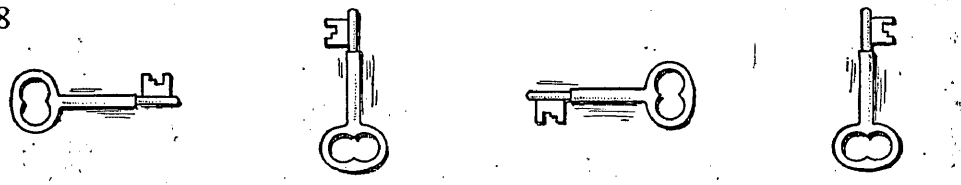

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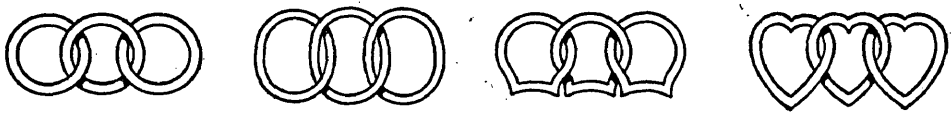

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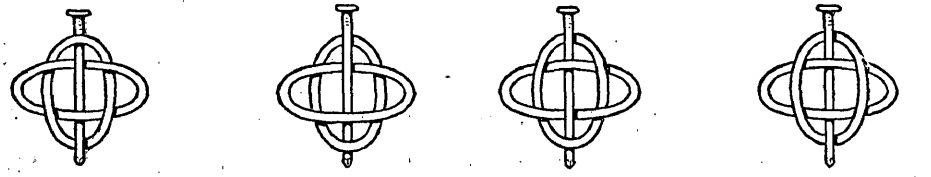

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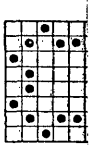

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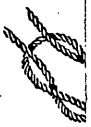

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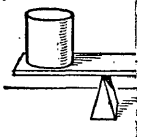

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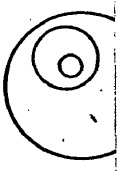

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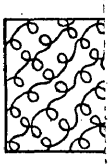

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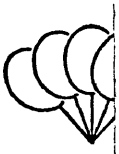

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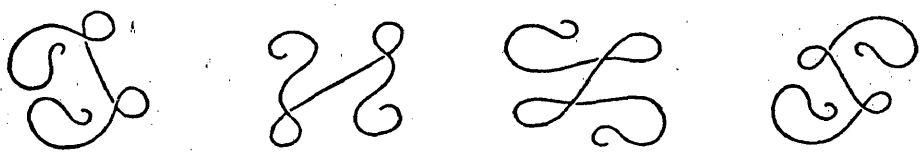

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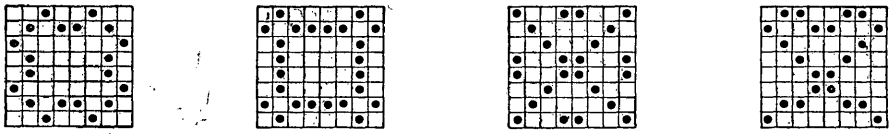

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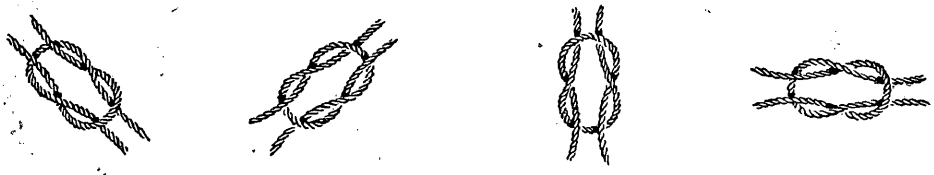

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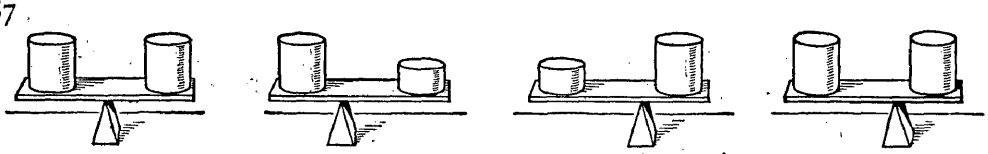

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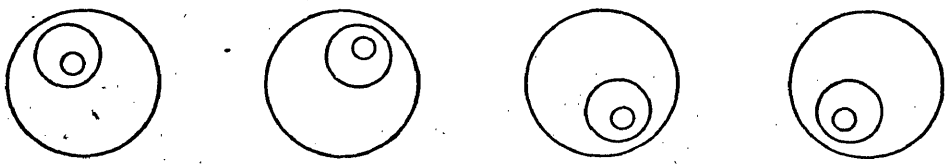
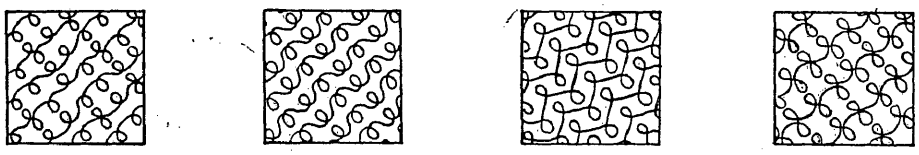
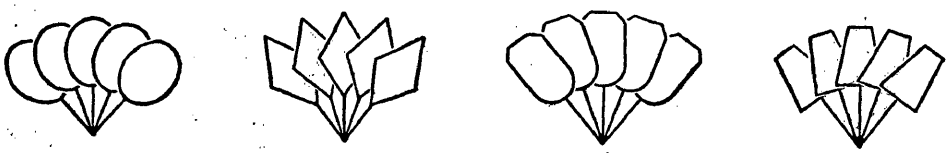


89



90



# METROPOLITAN ACHIEVEMENT TESTS

## PRIMARY I BATTERY: FORM A

## (*Revised*)

**Prim. I**

**A**

(*Revised*)

By GERTRUDE H. HILDRETH, PH.D.
Teachers College, Columbia University, New York

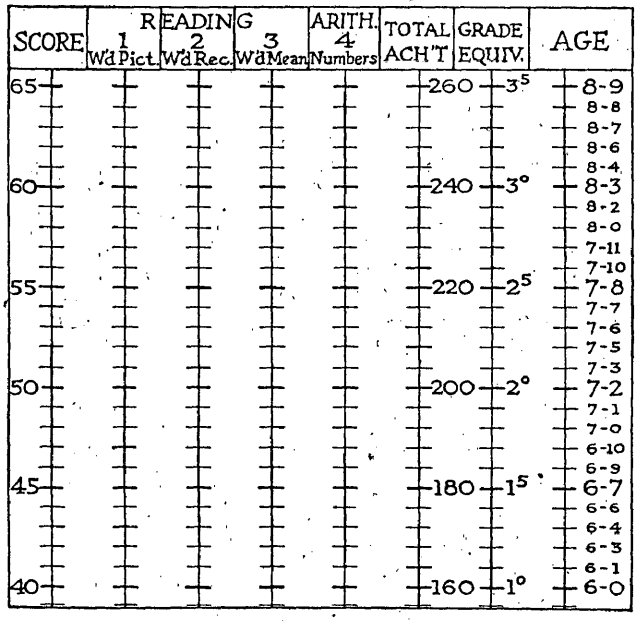
## For Grade 1

Name..... Date.....19...

Grade.....Age....yrs....mos. Teacher.....

School.....City.....State.....

| TEST | SCORE | GRADE EQUIVALENT |
|---|---|---|
| 1. WORD PICT. | | |
| 2. WORD RECOG. | | |
| 3. WORD MEAN. | | |
| AVER. READING | | |
| 4. NUMBERS | | |
| TOTAL ACH'T | | |




**The norms given in this booklet represent average achievement as determined from the scores of pupils in different school systems. To evaluate achievement for local purposes, it is preferable to express pupils' scores as grade equivalents in terms of local medians. See the Supervisor's Manual.**

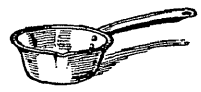


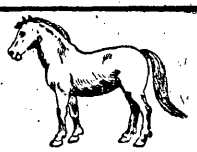
lished 1940 by World Book Company, Yonkers-on-Hudson, New York, and Chicago, Illinois


PRINTED IN U.S.A. MAT: PRIM. I: REV.: A-12

# TEST 1. READING — WORD PICTURE

a




cat
mouse
drum
pig

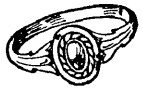


b





a little bear
a white rabbit
a pretty ring

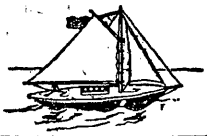


1–4

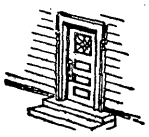




baby
nest
boat
chair


5–8

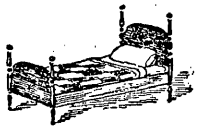




doll
egg
door
arm



9–12



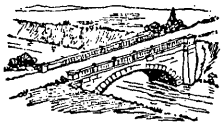



duck
head
house
kitten

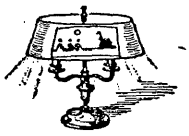


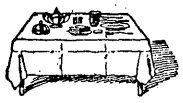

13–16



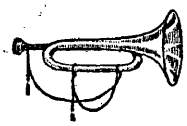



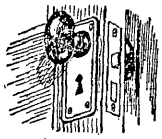
chicken
grapes
bridge
lunch



17–20



flag
barn
clock
horn

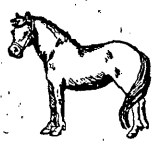



21–24

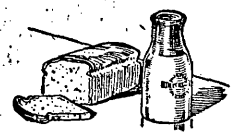
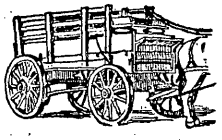



bowl
star
pony
seat






25–27


a smiling face
bread and milk
a small cart

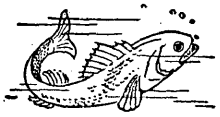


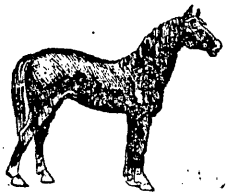
28–30



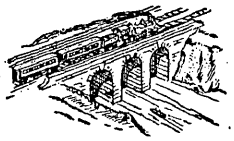


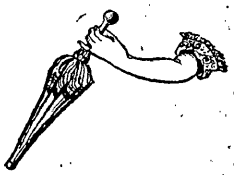
fish in a bowl
a girl is walking
the white horse



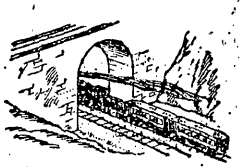


31–33




a pair of shoes
the man with a stick
a train under a bridge



34–36


37–39

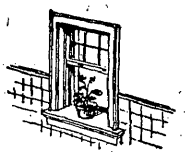


40–42



| No. RIGHT |
| --- |
| *Score* |
| No. RIGHT |
| *Score* |



the farmer and his cow
a child is eating apples
a robin at the window







a squirrel eating nuts
the farmer is digging
a house on a hill









a boy takes off his coat
a woman with an umbrella
children going to school

| GHT | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *41* | *41* | *41* | *42* | *42* | *43* | *43* | *44* | *44* | *45* | *45* | *46* | *46* | *47* | *47* | *48* | *48* | *48* | *49* | *49* | *50* | *50* | *51* | *52* | *52* | *53* | *53* | *54* | *55* | *55* |

| GHT | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *56* | *56* | *57* | *58* | *58* | *59* | *59* | *60* | *61* | *61* | *62* | *63* |

## TEST 2. READING — WORD RECOGNITION

| | | | | |
|---|---|---|---|---|
| *a.* | my | be | we | me |
| *b.* | pig | big | bid | dig |
| *c.* | go on | in to | go in | go up |
| 1. | ill | all | and | ball |
| 2. | his | has | her | here |
| 3. | are | were | arm | sir |
| 4. | here | hits | high | sign |
| 5. | cook | word | with | work |
| 6. | stay | start | cart | stand |
| 7. | water | enter | waste | waiter |
| 8. | kettle | litter | little | kitten |
| 9. | guarded | garden | gather | arbor |

10. willow winning wonder window

11. rowing right riding riders

12. catch search scratch watch

13. cabbages carriages vegetable valley

14. she is he is it is hers is

15. run away run play come away ran away

16. after him after them after her catch him

17. she comes he comes she came we came

18. help yours keep young keep yours kind sirs

19. small slices all pieces small pieces small peaches

20. baby girls big calves baby cows baby calves

21. come through slip through pig trough clip those

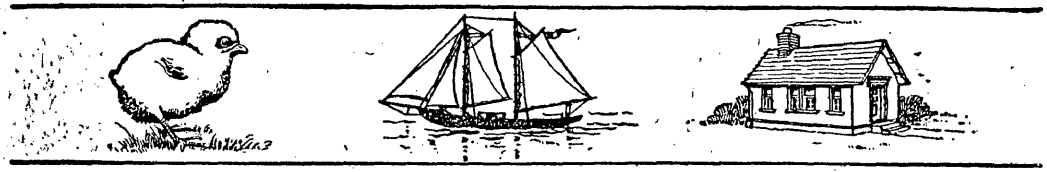
| No. RIGHT | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Score* | *41* | *41* | *42* | *42* | *43* | *43* | *44* | *45* | *45* | *46* | *47* | *48* | *49* | *50* | *51* | *52* | *54* | *55* | *57* | *60* | *63* |

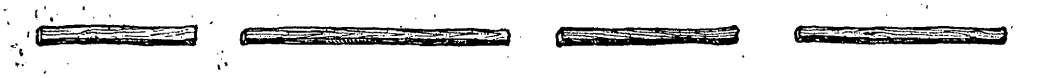
## TEST 3. READING — WORD MEANING

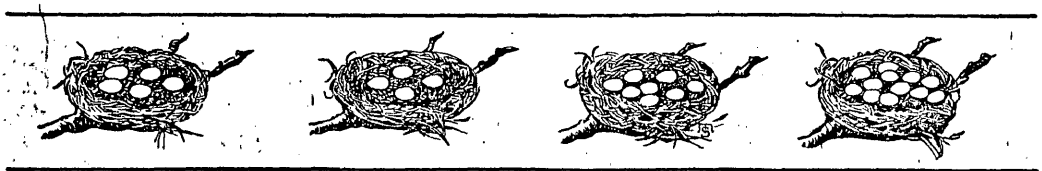
| | | | | | | |
|---|---|---|---|---|---|---|
| *a.* | house | boy | stone | mouse | man | eyes |
| *b.* | ball | meat | pin | doll | skates | rose |
| 1–3. | song | trees | chair | boys | bottle | flowers |
| 4–5. | mouth | milk | plate | bread | table | dress |
| 6–8. | blue | cow | sing | dog | horse | grass |
| 9–11. | house | fish | bird | ball | bee | airplane |
| 12–14. | beans | books | carrots | wagon | corn | car |
| 15–17. | run | green | paint | brush | blue | brown |
| 18–19. | tree | cup | bed | spoon | girl | nose |
| 20–22. | sheep | man | mother | flower | candy | Jane |
| 23–24. | very | four | here | late | wide | nine |
| 25–27. | little | far | large | big | city | every |
| 28–30. | lamp | runs | book | winter | sing | jump |
| 31–32. | this | mine | who | that | when | those |

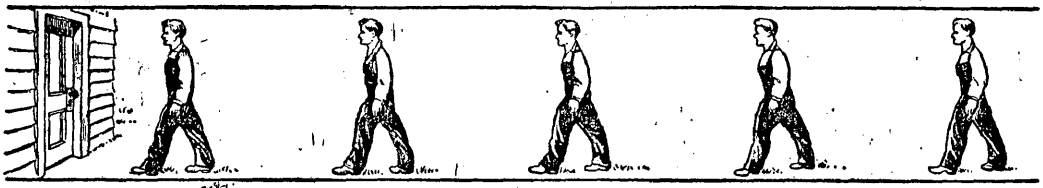
| Difference | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Score* | *41* | *42* | *42* | *43* | *43* | *44* | *44* | *45* | *45* | *46* | *46* | *47* | *48* | *48* | *49* | *50* | *51* | *52* | *53* | *54* | *55* | *56* | *57* | *58* | *59* | *60* | *61* | *62* | *64* | *65* | *67* | *68* |

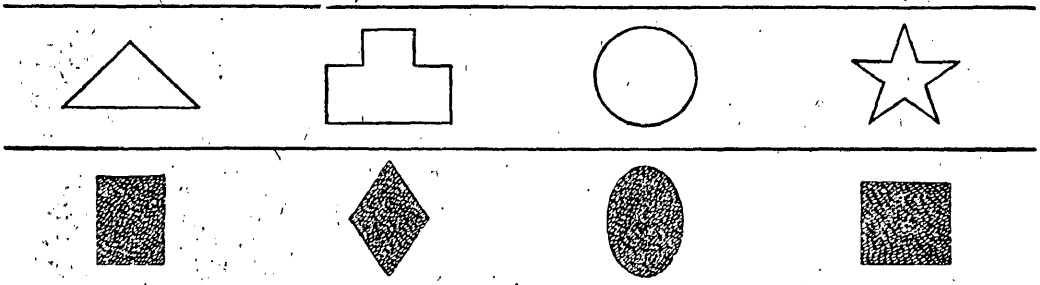
# TEST 4. NUMBERS

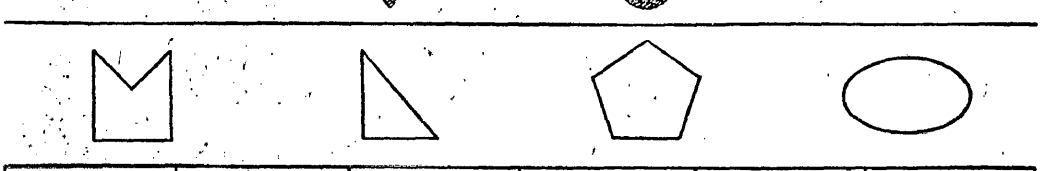


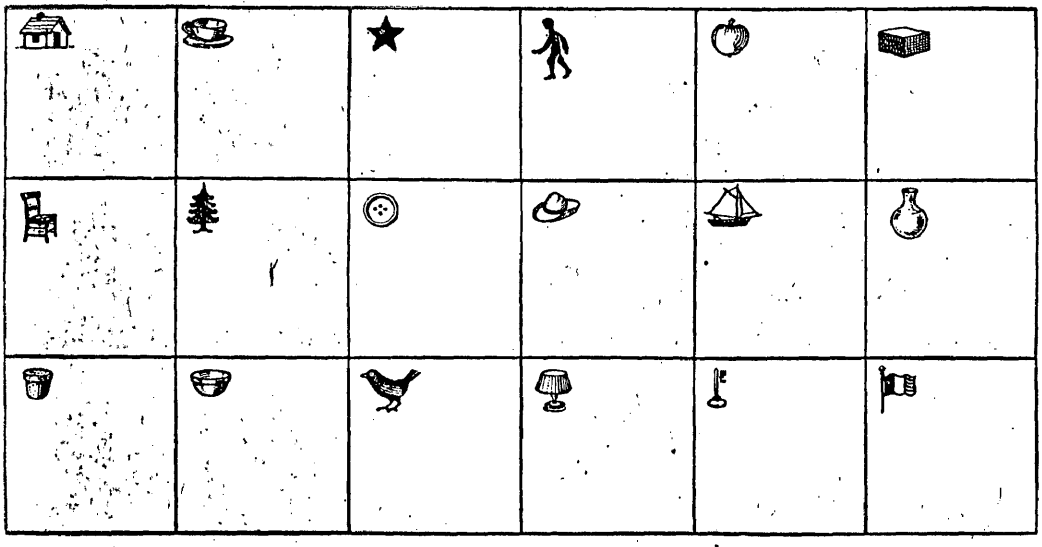


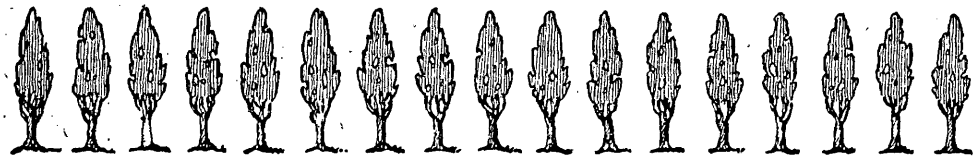


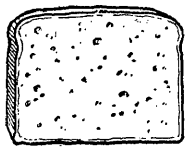


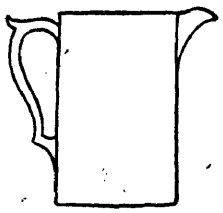








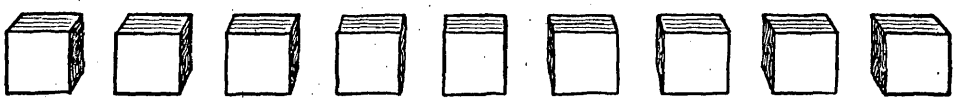



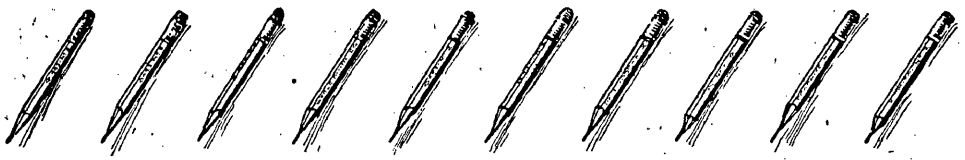


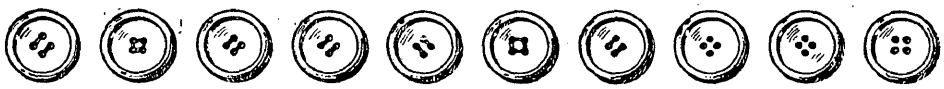
7 1 9 3 2 6

1 5 4 9 0 7

9 4 6 1 8 2







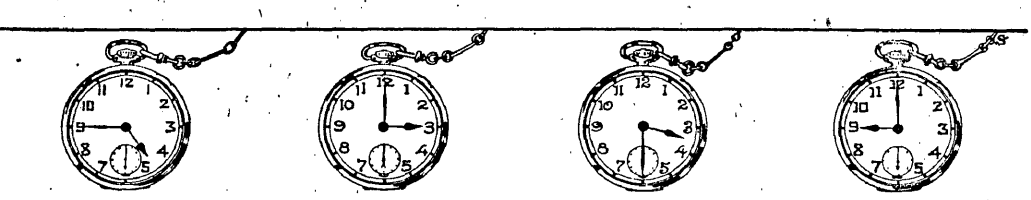
[ 10 ]

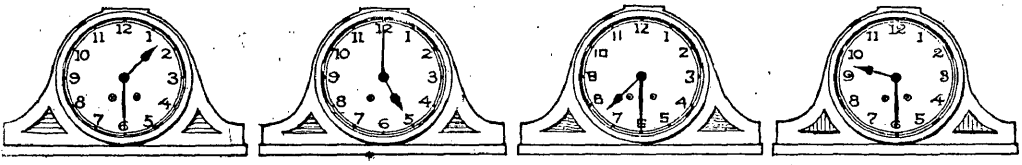
2 5 4 6 3

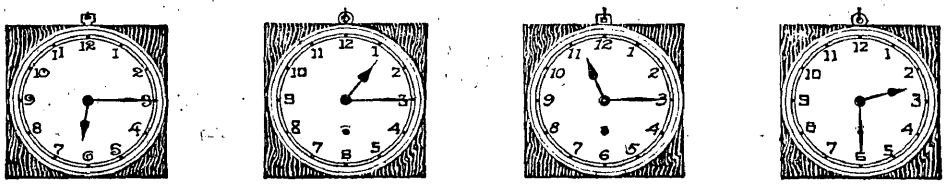
5 1 25 10 12

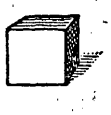
4 7 5 6 8

3 1 4 5 2

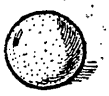








4 6 9 7 1 8 0



9 12 10 6 11 5 13

1 6 8 3 2 9 4

6 3 2 7 8 1 9

2 9 7 19 17

36 14 21 8 24

3 12 20 6 10

4 7 6 17 19

| | | | | |
|---|---|---|---|---|
| 3 + 1 = | 1 + 4 = | 2 + 1 = | 1 + 7 = | 3 + 2 = |
| 9 + 1 = | 4 + 2 = | 4 + 4 = | 6 + 2 = | 3 + 4 = |
| 4 + 0 = | 6 + 3 = | 0 + 2 = | 3 + 0 = | 5 + 4 = |

| | | | | |
|---|---|---|---|---|
| 8 − 1 = | 4 − 1 = | 7 − 1 = | 5 − 4 = | 9 − 8 = |

| No. RIGHT | 8 | 9 | 10 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Score* | *41* | *41* | *42* | *42* | *43* | *43* | *43* | *44* | *44* | *44* | *45* | *45* | *45* | *46* | *46* | *46* | *47* | *47* | *47* | *48* | *48* | *49* | *49* | *49* | *50* | *50* | *50* | *51* | *51* | *51* | *52* | *52* |
| No. RIGHT | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 |
| *Score* | *53* | *53* | *53* | *54* | *54* | *54* | *55* | *55* | *56* | *56* | *56* | *57* | *57* | *57* | *58* | *58* | *59* | *59* | *60* | *60* | *60* | *61* | *61* | *62* | *62* | *63* | *63* | *64* | *65* | *65* | *66* | *66* |

# METROPOLITAN ACHIEVEMENT TESTS

## PRIMARY II BATTERY: FORM A

## (*Revised*)

**Prim. II**

**A**

(*Revised*)

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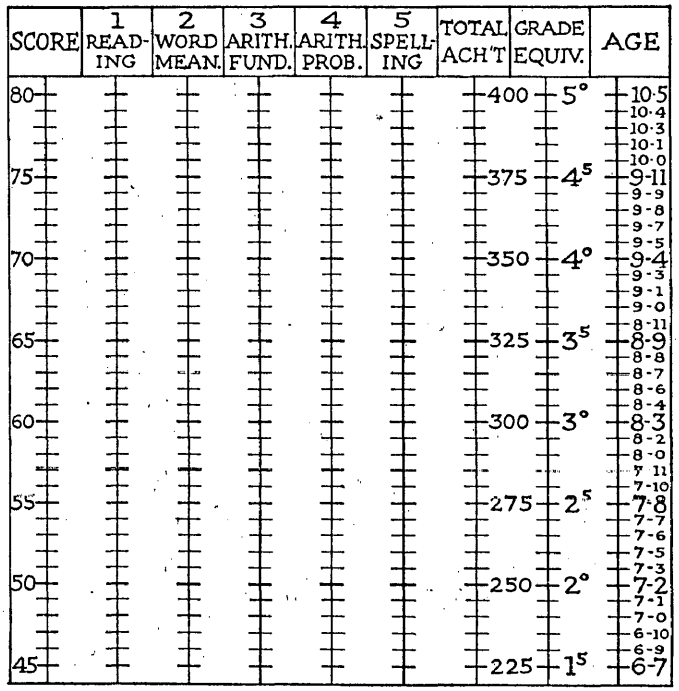
## For Grades $2^0$ to $3^5$

Name..... Date.....19...

Grade.....Age....yrs....mos. Teacher.....

School.....City.....State.....

| TEST | SCORE | GRADE EQUIVALENT |
|---|---|---|
| 1. READ. | | |
| 2. WORD MEAN. | | |
| AVER. READING | | |
| 3. ARITH. FUND. | | |
| 4. ARITH. PROB. | | |
| AVER. ARITH. | | |
| 5. SPELL. | | |
| TOTAL ACH'T | | |






Published 1940 by World Book Company, Yonkers-on-Hudson, New York, and Chicago, Illinois


PRINTED IN U.S.A. MAT: PRIM. II: REV.: A-7

## TEST 1. READING

a Mew mew, says the




b John writes with a

book pencil dish ball

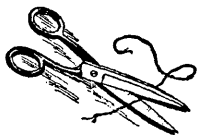
1 Bow wow, says the




2 I can see with my

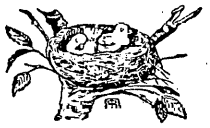



3 Mary eats

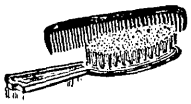
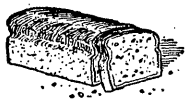



4 The birds are asleep in their



5 Mother baked some

6 The hen lays




Go right on to the next page.

The girl wheels her doll in a

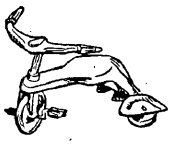



Mother bakes the cake in the



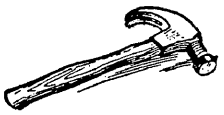

At Christmas we lighted the



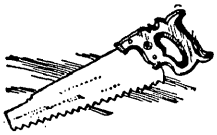
Father drives a big



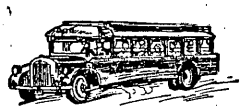



The farmer digs with his






I wear a hat on my

For Halloween we have a




We cook apples in a




**Go right on to the next page.**

15. The cow gives
eggs silk mush milk

16. The boy's name is
Jane Jack July Dot

17. It snows here in
Summer Winter June August

18. Jane built a big
house nose hose mouse

19. If he doesn't hurry, he will miss the
train clock mother slow

20. Even though the man was hurt when he fell, he can still
spell grow believe walk

21. I am big. I can grow. I have green leaves. I am a
girl house tree apple

22. Because he stayed out in the rain he caught a bad
cold boy wet fish

23. Whether we go or not depends upon the
picnic house weather pleasure

24. Even though the toast is scorched, it can still be
hot there done eaten

25. Whether she fails or not depends on how hard she
spends grows studies borrows

 Go right on to the next page.

We have some pretty fish. They swim in the bowl. Jane feeds the fish. The fish eat the green plants.

26. **The fish live in a**
basket box bowl house

27. **Who takes care of them?**
Jane Mother John baby

28. **What do they eat?**
bowl plants fish Jane

---

Laddie is my dog. I run and jump with him. One day I found a bone. I gave Laddie the bone. He hid it in the yard.

29. **The dog's name is**
Billie Rover Laddie Trix

30. **He had**
meat a bone a fish milk

---

Mother made the sandwiches. Donald and Paul got the lemonade ready. Betty went to the store to get some cookies. When the lunch was packed, the family started out.

31. **They were going**
to church on a picnic to school to a show

---

Martin has a new toy. It has four wheels and a handle. He can pull his sister in it.

32. **The toy is a**
wagon bicycle scooter roller skate

33. **Martin is a**
baby father boy policeman

 **Go right on to the next page.**

Sue found a present for herself under the tree. It was flat with square corners. It was wrapped in red paper.

**34. The present was a**
book plate doll balloon

**35. The time was**
New Year's Halloween Fourth of July Christmas

---

We went to the store to buy some grapes. The groceryman was out in front. He showed us all the grapes. We chose some large bunches. The man put all our grapes into a large basket. We took the grapes to school to make jelly.

**36. The store was a**
hardware store drug store grocery basket shop

**37. The man sold us some**
jelly apples grapes baskets

**38. We carried the fruit in a**
pan dish paper basket

**39. We used the fruit for**
juice jelly candy a salad

---

Every spring I go to the country to visit my grandmother. One day I planted a garden. I planted corn and beans and peas. Next day I went out to see the garden. Some chickens had scratched up all the seeds. I must put a fence around my garden.

**40. Grandmother lives in**
the city a village the country a park

**41. The garden was spoiled by**
Grandmother the farmer the corn the chickens

**42. My garden needs**
water a fence weeding chickens

**43. In my garden I was going to raise some**
vegetables fruit flowers trees

 **Go right on to the next page.**

We go to the market. The farmers come in their trucks. They bring in their vegetables. They sell them to the grocerymen. We said, "Farmer, what do you sell?" "I sell beans and corn and cabbages," said the farmer.

**At the market we saw the**
grocery store fruit farmers horses

**The grocerymen buy the**
fruit beans bread meat

**The farmers ride to market in**
trains wagons carts trucks

**We spoke to a**
farmer groceryman truck driver gardener

---

One day we had a post office at our house. John played postman. Billy worked at the post office. We wrote letters to Betty and Jane and put them in a toy mail box. The postman took the letters to the post office. Billy sent the letters to our friends at school.

**We played post office**
at school downtown at home at the mail box

**A letter was sent to** Betty John Carl Billy

**The letters were taken to the post office by**
John Billy Betty Jane

---

Many persons try to attract birds to their farms and orchards because they are useful in keeping insects in check. Other persons, who give little thought to the value of their feathered friends, provide homes for them and feed them because they enjoy watching them and listening to their songs.

**This story is about**
insects orchards farms birds

**Insects are kept in check by**
birds homes songs other persons

**Often persons feed birds because of their**
flying insects singing feathers

 **Go right on to the next page.**

One morning I was on my way to school. I looked down the street and saw puffs of smoke rolling up to the sky. I knew in a minute there must be a fire at the grocery. Ding, dong, clang! Soon the fire engine came rushing down the street. The hose truck came after it. In a minute the firemen had the hose out of the wagon. Streams of water came from the hose. I did not see what was left of the building until the next day. Most of the store windows were broken and the building was still black with smoke.

**54. The fire burned a** school station store church

**55. First came the**
groceryman fire chief hose truck fire engine

**56. Next day I saw that**
the building was damaged nothing was hurt
the fire was still burning the windows were fixed

**57. The dark color of the building after the fire was caused by**
water smoke broken glass hose

---

In the early days the people who were known as cave men found dry, warm caves in which to live. They found it much safer to live in caves than on the open plains. Their chief enemies were wild beasts. They found that the wild animals were afraid of fire. So at night the cave men kept a fire before the door. With the fire burning they knew they were safe from dangerous animals. Today people use fire for cooking food, heating houses, and making tools.

**58. Long ago people avoided danger by dwelling in**
towers huts tents caves

**59. They had to defend themselves from**
wild men wild beasts fires giants

**60. They used fire for** keeping out animals heating their houses cooking their food lighting their houses

**Go right on to the next page.**

| No. RIGHT | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Score* | *48* | *48* | *49* | *49* | *50* | *50* | *50* | *51* | *51* | *51* | *52* | *52* | *53* | *53* | *53* | *54* | *54* | *54* | *54* | *55* | *55* | *56* | *56* | *56* | *57* | *57* | *57* | *58* | *58* | *59* | *59* | *59* | *60* | *60* | *6* |

In order to keep birds around, it is well to provide shelves and shelters where they may procure food in winter. Various birds will take food from a shelf just outside a window. During a snow storm they will hide under a shed that is open on one side, preferably toward the south. Such a place makes a good feeding ground when the earth is covered with snow. If the birds are in danger from cats, the front of the shed should be covered with poultry netting of two-inch mesh.

**The enemy against which birds need protection is the**
cow mouse cat dog

**Birds need most help in the**
spring winter fall summer

**Birds can be attracted in winter through the provision of**
nests screens snow sheds

**It is best to have the shed open toward the**
ground south frost snow

---

Canals can be dug in almost any level plain, but they cost so much that it pays to build a canal only where there is sure to be a large amount of freight. Canal traffic is always slow; for if fast steamboats were used, the waves which they cause would soon wear away the banks, and fill the canals. Often barges are used in great numbers, and are slowly drawn by tugboats, horses, donkeys, or even men. In China, Japan, and Europe even such slow transportation is important.

**Canals are most profitable** in thickly populated regions
in mountain districts through deserts in warm climates

**Vessels most commonly used in canals are**
steamboats barges ocean liners fast freighters

**One disadvantage of canal traffic is that it is**
level important freight slow

***STOP.***

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 |
| 51 | 61 | 61 | 62 | 62 | 63 | 63 | 64 | 64 | 65 | 65 | 66 | 66 | 67 | 67 | 68 | 69 | 69 | 70 | 71 | 72 | 73 | 74 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 81 | 82 |

## TEST 2. WORD MEANING

*a.* house boy stone coat man eyes
*b.* ball meat pin doll skates rose

1. run green paint brush blue brown
2. blue cow sing dog horse grass
3. very four here late wide nine
4. June winter Christmas Easter picnic ride
5. house fish bird ball bee airplane
6. beans books carrots wagon corn car
7. grass orange peach ink silver knife
8. blocks street bread ball bird well
9. song trees chair boys bottle flowers
10. pie milk water apple ice lemonade
11. bell soup dish candy drum puppy
12. tree cup bed spoon girl nose
13. this mine who that when those
14. silver cent spend dime nickel candy
15. little far large big city every
16. chair window stool lamp door bench
17. cloud mountain tree star pole moon
18. ball chair catch tag hat tree
19. rock coal wood cotton wool pillow
20. going dozen three night race fifteen
21. daisy Grace tulip blue leaf radish
22. doctor desk paper nurse medicine noise
23. costume bushel mask bundle hawk hotel
24. sober theater coward pattern thief eastern
25. lamp go book walk winter throw
26. here move there time beyond round
27. stroll stand lie sit wander swing
28. impolite generous false courteous timid hood
29. danger truth crime poverty knowledge life

*STOP.*

| Difference | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Score* | *49* | *50* | *50* | *50* | *51* | *51* | *51* | *51* | *52* | *52* | *52* | *53* | *53* | *53* | *53* | *54* | *54* | *54* | *55* | *55* | *55* | *55* | *55* | *56* | *56* | *56* | *57* | *57* | *57* | *58* | *58* | *58* |
| Difference | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 |
| *Score* | *58* | *59* | *59* | *60* | *60* | *60* | *60* | *60* | *60* | *61* | *61* | *61* | *62* | *62* | *63* | *63* | *64* | *64* | *65* | *65* | *65* | *65* | *66* | *66* | *67* | *68* | *69* | *70* | *70* | *70* | *71* | *72* |
| Difference | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | | | | | | | | | | | | | | | | | | | | |
| *Score* | *73* | *74* | *76* | *77* | *78* | *79* | *80* | *81* | *82* | *83* | *84* | *85* | | | | | | | | | | | | | | | | | | | | |

## TEST 3. ARITHMETIC FUNDAMENTALS

nd 1 are _____ 8 and 1 are _____

nd 3 are _____ 10 and 6 are ___ _

| | | | | | | |
|---|---|---|---|---|---|---|
| 5 | 7 | 2 | 6 | 8 | 5 | 4 |
| +2 | +3 | +9 | +3 | +3 | +6 | +5 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 6 | 8 | 6 | 7 | 4 | 7 | 9 |
| +7 | +5 | +9 | +2 | +8 | +9 | +9 |

| | | | | |
|---|---|---|---|---|
| 6 | 25 | 47 | 40 | 97 |
| +58 | +64 | +34 | +20 | +56 |

| | | | |
|---|---|---|---|
| | | 6 | |
| 4 | | 8 | |
| 3 | 5 | 0 | 36 |
| 2 | 3 | 7 | 42 |
| 1 | 8 | 3 | 21 |

ıct

om 5 leaves _____ 2 and _____ are 4

om 7 leaves _____ 7 and _____ are 9

Subtract

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4 − 1 | 3 − 2 | 5 − 4 | 6 − 3 | 7 − 2 | 9 − 3 | 8 − 7 | 9 − 6 |
| 11 − 7 | 10 − 9 | 12 − 8 | 13 − 9 | 15 − 9 | 16 − 7 | 14 − 8 | 17 − 9 |
| 26 − 3 | 37 − 14 | 43 − 5 | 56 − 28 | 54 − 4 | 162 − 74 | | |

Multiply

3 twos are _____ 4 3's are _____

3 times 3 is _____ 6 times 5 is _____

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4 × 2 | 5 × 2 | 5 × 1 | 6 × 3 | 5 × 5 | 4 × 4 | 1 × 6 | 2 × 7 |
| 6 × 5 | 5 × 4 | 6 × 0 | 7 × 7 | 3 × 8 | 6 × 9 | 8 × 8 | 7 × 9 |

One half of 12 is _____ One fourth of 20 is _____

Divide

$2\overline{)14}$ $3\overline{)18}$ $3\overline{)27}$ $7\overline{)7}$ $1\overline{)4}$ $4\overline{)16}$

*STOP.*

| No. right | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Score* | *46* | *47* | *48* | *49* | *50* | *51* | *52* | *53* | *54* | *54* | *54* | *55* | *55* | *55* | *55* | *55* | *56* | *56* | *56* | *56* | *57* | *57* | *57* | *57* | *57* | *58* | *58* | *58* | *58* | *58* | *58* | *58* |
| No. right | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 |
| *Score* | *59* | *59* | *59* | *59* | *59* | *60* | *60* | *60* | *60* | *60* | *61* | *61* | *61* | *61* | *61* | *61* | *61* | *62* | *62* | *62* | *62* | *62* | *63* | *63* | *63* | *63* | *63* | *63* | *63* | *63* | *64* | *64* |
| No. right | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | | | | | | | | | | | |
| *Score* | *64* | *64* | *65* | *65* | *65* | *65* | *66* | *66* | *66* | *66* | *66* | *67* | *67* | *68* | *68* | *68* | *69* | *69* | *69* | *70* | *71* | | | | | | | | | | | |

## TEST 4. ARITHMETIC PROBLEMS

Mother gave me 2 cakes.
My sister gave me 3 more cakes.
Then I had how many cakes? ☐ cakes

Father gave me 12 cents.
I spent 5 cents.
How many cents should I have now? ☐ cents

Ten children will be at my party.
I need a paper cap for each child.
I have only 6 paper caps. How many more do I need? ☐ caps

My lunch cost 7 cents and my brother's cost 13 cents.
Both lunches together cost how much? ☐ cents

We had 10 kittens and gave away 6. We had how many kittens left? ☐ kittens

I bought an apple for 5 cents, a bottle of milk for 9 cents, and a cracker for 2 cents.
All the food cost how many cents? ☐ cents

My aunt has 10 chickens. She is going to give me half of them. Then I will have how many? ☐ chickens

My father gave me 25 cents. I spent 5 cents for a post card and 10 cents for a ride on the bus. Then I had how many cents left? ☐ cents

I have 4 cents and want a book that costs 15 cents. I need how many more cents to buy the book? ☐ cents

 **Go right on to the next page.**

**10.** 3 children are coming to my party. I am going to give each one of them 4 pieces of candy. I must get how many pieces for them all?

pieces

**11.** A boy started on a 275-mile trip. He rode 100 miles the first day. How many more miles did he have to travel?

miles

**12.** An airplane went 90 miles the first hour and 105 miles the second hour. How far did it fly in the 2 hours?

miles

*STOP.*

| No. right | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Score* | *51* | *55* | *56* | *57* | *58* | *59* | *60* | *62* | *63* | *65* | *69* | *75* |

## TEST 5. SPELLING

MPLE. He _____ my brother.

---

The _____ has kittens.

The children ate _____ of the cakes.

I have a new story _____.

He drives his _____.

The _____ looks like a baby.

A top is a _____.

The _____ loves her child.

The boy can _____ a race.

She can _____ the piano.

It is _____ ten o'clock.

She will be a big _____.

This was _____ house.

They _____ to the country yesterday.

Mary made an _____ pie.

The boy will _____ on the pony.

He was in the third _____.

Can you _____ the first page?

At _____ the stars come out.

 **Go right on to the next page.**

19. They went to the country _____.

20. She washes with warm _____.

21. See the flowers in our _____.

22. He is flying a _____.

23. There is time to play _____ lunch.

24. I write with a lead _____.

| No. RIGHT | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Score* | *47* | *48* | *49* | *49* | *50* | *50* | *51* | *51* | *52* | *52* | *53* | *54* | *55* | *56* | *57* | *58* | *59* | *60* | *61* | *63* | *64* | *67* | *70* | *76* |

## TEST 6. HANDWRITING