

ON THE LOSS OF KNOWLEDGE BY JUNIOR HIGH
PUPILS OVER THE SUMMER VACATION

by

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A THESIS

submitted to the

OREGON STATE AGRICULTURAL COLLEGE

in partial fulfillment of
the requirements for the
degree of

MASTER OF SCIENCE

August 1935

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Acknowledgments

No acknowledgments of mine can commensurately show my obligations to Dr. H. R. Laslett who has assisted me in this study. To him, I am indebted for suggesting the study, for guiding me during the progress of the experiments, and for aiding me in the interpretation of the results.

To the pupils of Corvallis Junior High School, I am indebted for their cheerful co-operation in the taking of the tests. To the superintendent of the Corvallis schools, Mr. H. W. Adams, and the principals of the junior and senior high schools, Mr. S. T. Brannock and Mr. H. S. Parker, I am indebted for their co-operation in making the study possible. To Mr. J. J. Houser, I am indebted for administering the tests to those pupils who had entered the high school at the time the last experiment was being completed.

M. F. S.

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Chapter I

A Historical Summary of the Problem

Among many educators, before the depression years of 1929 to 1935 especially, there was a very considerable movement toward the twelve-month school year or the year-round school with longer vacations than are now customary at Christmas and at Easter and with a shorter vacation than is usual at the present time in the summer. They proposed to substitute three or four two or three-week vacations for the present three months of summer vacation which is combined with much shorter vacations at Christmas and at Easter. In this plan, the educators were supported, for one reason or another, by a considerable number of parents. Many arguments, some worthy and some of questionable validity, were advanced for and against this plan. The purpose of this thesis is the study of the reasons advanced in support of and in opposition to this plan, especially the reason advanced in its support that the amount of information lost by the pupils over the long summer vacation is large enough to require an extensive period for re-learning the work of the last preceding semester.

Historically, the long summer vacation is a heritage from the colonial days in this country when schools were opened intermittently in this locality and that as there were enough pupils to make the holding of a school feasible. The enrollment depended upon the

willingness of the parents to release the children from the work of the farms during the period of lighter work in the winter months and their willingness to pay the tuition charges which supported the teacher of the school to the point of allowing him or, more rarely, her to continue in the work of education, such as it was. The serious business of life with these pioneer people was the clearing of the forests, the building of houses and barns, the tilling of the fields, and the tending of cattle and hogs. Attendance at school was for all except the youngest children a kind of recreation and a vacation from the fields. Life, in those days, was simple, direct, and clear-cut. The business of living was that of remaining alive.

As the population of the established communities increased and as the farms and other enterprises became better established, there was more time for the education of the children and young people. In many cases, they were no longer needed to assist in the support of the family. In others, they were spared from all except the periods of hardest work and the hottest months. From time to time, immigrants and returned travelers brought with them accounts of the European school plans of year-round sessions with approximately month-long vacations at more or less quarterly intervals. These accounts did not make much impression on the American people until the beginning of the present century although the population has always contained a certain percentage of people who have retained or have developed an admiration for European institutions. With

some, this admiration has a reasonable basis; with others not.

A considerable number of school administrators favored the year-round school plan because they had (a) honest beliefs that it would be possible to realize the values of speed in education. Whether they understood these values fully or not is open to more than little doubt. Many were sincere in their beneficent beliefs that it would be possible to teach the pupils more material, to teach them more thoroughly, or to graduate them in fewer years by such a year-round plan of school sessions than was being done. These are worthy aspirations if those who hold them take into consideration the mental and social maturity of the pupils in terms of their mental ages, their abilities to assimilate the material as well as the pupils who are older chronologically, and the possible emotional cost of the worry that may result from emphasis on speed or from unusualness of performance in many pupils, especially the young. This worry may, rather easily, go so far as to create serious emotional disturbances. The nervously inclined child under too much pressure often develops a dislike for school and for the program it emphasizes. He invents ways and means to escape school and often becomes a problem case as a consequence. Stammering and hysteria in pupils often are the direct result of too much nervous stress on performance or achievement in school. The plans of these educators should take into consideration the vocational placements of these young people who were or are to be deviates from the present norms of rate of progress through the

schools. They should consider, also, the attitude of a large part of the American public toward taking the work of schools too seriously. In addition, much of the talk about modern speed, in schools and out of schools, is only hysteria and stage-dressing. Too often administrators seek their own renown through the unusual performances of the pupils in the schools over which they preside. Teachers, too, are not always opposed to the attainment of some prestige by being able to show that their pupils have high rates of performance on the various standardized tests. Such high rates of performance are altogether desirable as long as they do not urge pupils beyond the rates that are optimal to them. Oftentimes, these performances cost the pupils too much in health, in emotional disturbances or in attitudes. Sometimes parents, who have not reached the social recognition they desire, are guilty of forcing their children along the educational highway at an undesirable rate in order to try to secure for their children the recognition that they, themselves, have not secured.

Other social administrators wanted the school organization changed to longer sessions in order to (b) get the youngsters off the streets and out of the alleys. This was an altogether worthy desire. In some slum districts, there were schools that were already in session eight hours a day in order to give the youngsters as much as possible of a better environment than either the streets or their homes afforded. The pupils in these schools were in classes only the usual number of hours each day. The remaining

hours were spent on the playground, in the auditorium, or in "shops" of various kinds. These schools worked out fairly well in some cases and not so well in others in accordance with the spirits and the abilities of the people directly in charge of them, and with the support which they received from the higher administrative authorities of the school systems and from the general public.

Perhaps these idealists, excellent though their aims may have been, should not have sought and should not seek to go too fast. There is always the possibility that they may get too far ahead of public opinion and of public monetary support, no matter whether they are on the right track or the wrong. Perhaps the school administrators have been wrong about the importance of the schools in making over the youth of the nation, especially under the more or less current conditions. Without much question, they have been wrong in undertaking such extensive programs as they have undertaken without having the personal courage to demand adequate financial support for these programs so that they can be conducted in a dignified manner and without taking such heavy toll of the teachers that many of the best teachers who attempt to carry out thoroughly and honestly the programs laid out are leaving the schools and others are breaking down physically.

Without much question, the administrators have been wrong in believing that much of what has been taught in civics, hygiene, and character education has had any great effect upon the lives of

the pupils, especially when these subjects are taught with the restrictions and under the general conditions under which they must be taught in the majority of schools at present. In most schools, teachers must not teach current concrete material in civics, for example, In character education and in civics, the rewards of virtues are extolled dutifully, but the youngsters know that on more than single occasions some of the least virtuous citizens own the best homes and automobiles and occupy the most important local political offices. What is taught the youngsters in these courses is so often true in a total and long-time setting, yet frequently contrary to the popular belief, desire, and practice, which holds a partial view and is noticeably shortsighted and selfish.

A part of the support of this movement for long sessions came from parents who (c) were unable or unwilling to give the time or the thought to the training and the care of their children which they, the children, should have and which they, their parents, wanted for them. Of course, there are and were camps, private special classes, and public playgrounds. These, however, were and are usually expensive or required planning and making adaptation of plans which a unitary and uniform system of public "child parking" institutions did not require.

In addition to these, there is the belief that (d) pupils forget over the long summer vacation a great deal of the material learned during the previous school year. There are several reported studies on this problem. Some of them appear to have been worked

out carefully. Some of them include an adequate number of pupils for the drawing of general conclusions, but others do not. Some of these studies are of doubtful value. All of these studies that could be located are reported here in the chronological order of their appearance.

Chapter II

A Survey of the Studies Made on the Loss
of Knowledge over the Summer Vacation

The earliest recorded study in connection with the loss of knowledge over the summer vacation is, probably, that of Kirby (4:1-6) published in 1913. His study was made during the years of 1911 and 1912, in the schools of the Children's Aid Society of New York City. According to his account, 1350 pupils from the third and fourth grades were used in the entire study but, in the part of the study which relates to the loss of knowledge over the summer vacation, he dealt with much smaller numbers. As far as it was possible to do so, the study was carried on under normal conditions.

Two different experiments were made. One applied to addition and the other to division as fundamental processes in arithmetic. These children had been taught these processes and the facts involved in them as they were outlined by the course of study in the New York City School System. To secure the measure of the "permanence of association during the summer vacation" (4:71-92), he compared the scores made in addition and division at the beginning of September with those made by the same pupils in June. In these experiments, he used the "Thorndike Addition Sheets" for the addition study and the "Exercises in Arithmetic," worked out by Thorndike, in the division project. In the addition study, he

states that of the 152 children who were retested in September, the median change was a loss of seventeen per cent. In other words, seventeen per cent of the ability to add which the group had had in June was lost during the vacation. The lower twenty-five per cent of the group lost thirty-two per cent and the upper twenty-five per cent lost six per cent, according to the addition scores in June. Kirby does not state what manner of arrangement or selection he used to obtain his lower and upper twenty-five per cents. In division, the 221 pupils retested in September showed a median loss for the group of eighteen and three-tenths combinations or problems. About ninety per cent of the group lost during vacation. The upper twenty-five per cent of the group lost ten or fewer combinations. The amount that the lower twenty-five per cent lost was not stated in any way. Again, he does not state the arrangement of the pupils by which his upper and lower twenty-five per cents were chosen.

This study further included an experiment on the length of practice required for these pupils to regain the abilities to add and to divide which they had possessed in June. It was discovered that there was a wide difference in the amounts of time required by the different classes or divisions into groups to reach their former efficiencies. The statement is made that, in the field of addition, "30 minutes of practice were required to bring this group approximately to the efficiency which it reached as a result of 60 minutes practice the preceding year (4:87)."

With this amount of practice, the group did not reach quite as high a median score of efficiency as it had in the preceding practice period. The thirty minutes of practice restored the median ability of the group to within one and eight-tenths columns of that reached in June, however.

"The median gain (4:87) in accuracy for this group at the end of 30 minutes of practice over its accuracy in the initial practice-period was -2 per cent. The loss of the group during the experiment was 3.1 per cent. Hence, so far as accuracy of performance is concerned, the condition of the group was practically the same at the end of the 30 minutes of practice in September as at the end of the experiment (in June)."

In division, only 163 of the children included in the testing in June could be reassembled for the experiment in September. The average practice time for this group in September was thirty minutes where it had been fifty minutes the preceding spring. This period of practice showed a deficiency of three and nine-tenths combinations in restoring the group to the proficiency it had reached in June. In accuracy, in the second practice period, or the one in September, the group failed to make the gain it had made in the practice period in June by four-tenths per cent. More than three-fifths as much time was required in September to regain the point reached in the experiment of the previous school year, but there is no definite statement as to the number of days used at that time.

If one is to judge from the conclusions written in this experiment, the long vacation is a mistake as far as the retention of acquired skills in arithmetic is concerned. Yet the argument is scarcely conclusive that the long vacation is, as a consequence, undesirable. The data offered are somewhat misleading as they are converted into per cents, but these per cents must be thought of in terms of thirty, fifty, and sixty minute periods for an un-stated number of days. These experiments, also, dealt only with the so-called skills which would naturally suffer from lack of use. It is highly probable that few of these children had any occasion to use these highly developed skills in their home lives during any part of the vacation or would at any time in after life, for that matter, have much use for them except as a school course demanded them. In accuracy, the loss was so slight that, for all purposes of life, the skill acquired would function adequately in all except school conditions.

Another reported study was that of Patterson (7) who, in 1925, did research work on the effect of the summer vacation on the retention of arithmetic and reading. "The data, from which the material for use in this study was selected, was obtained in a representative city school in New York State. The number of children tested was 149. In cases where a pupil was absent from one of the tests in the subject, the other test was of no use, so the number of cases differs in the various subjects. All the children present in each class were tested." The tests used (7)

were: "The Haggerty Intelligence Examination, Delta 2, in Grades IV-VIII: Thorndike-McCall Silent Reading Test in Grades IV-VIII: Woody-McCall Mixed Fundamentals in Grades I-VI: Woody Multiplication Scale B in Grades VII-VIII. These tests were given in the middle of June, and the same tests were given to the same children by the same person in the middle of September, so practically no instruction was given between them. All tests were scored three times."

The pupils in this study were grouped according to their native abilities into three classes, the supernormal, having I.Q.'s of 110 or more; normal, having I.Q.'s of 90 to 110; and subnormal, having I.Q.'s below 90.

The recorded findings (7) follow: "The supernormal made a gain in median of 6.833 points in intelligence and suffered a loss of .254 in median in reading. Grades 4-6 lost 1.2 and Grades 7-8 of this group gained .429 in median in arithmetic."

"The subnormal group made a gain of 4.5 in median in reading-- Grades 4-6 lost 1 in median in arithmetic and Grades 7-8 of that group also lost 1 in median in their arithmetic."

One conclusion (7) drawn is "that the summer vacation seemed to have a beneficial effect on the intelligence of all the children, especially those of the lower grades, little effect on the reading ability, but was detrimental to the arithmetic ability of all grades." A second conclusion is "that the normal group of children gained most in intelligence during the summer vacation,

the supernormal group less, and the subnormal least."

Theoretically, intelligence signifies native capacity to learn. Just how there could be a gain in native capacity during the summer vacation is difficult to understand. It would be significant to know what is implied in this study by the term "intelligence", as used here. In connection with these conclusions, it would be interesting to know the numbers of pupils included in each group. If the 149 pupils considered in the study are the normal group, it is quite likely that the supernormal and subnormal groups are too small to justify the drawing of the above general conclusions or any general conclusions, especially as the whole number was scattered through two to five grades. It would be worthy of note that these subnormal and supernormal groups were in learning situations in which due recognition was given to these two extreme abilities. Only too often the slow are ignored as being unworthy of time, thought, and effort until they become veritable drifters in school because the work given them is beyond their abilities and interests. Vacation, then, gives them a chance to catch up with themselves and their interests. The superior group, on the other hand, too often finds little challenge in the work submitted to them in school so they lose interest in the studies offered and seek interest in special enterprises, often of a social or scientific nature, and enter only half-heartedly into the compulsory school duties as a consequence.

This study (7) gave evidence of such hurried or careless work that it seems to offer questionable evidence on either side of the problem. The findings of the amounts of retention in silent reading ability do not coincide with those of Elder (3), Morgan (6), and Breune (2). The report (7) contains at least two distinctly contradictory statements.

The third study dealing with the loss or gain made by children in the long vacation was that of Elder (3) in 1927. This study was made to determine the effects of the summer vacation on the silent-reading abilities of pupils in the intermediate grades. It is based on "B scores" made on Monroe's Standardized Silent Reading Test. Form 2 of this test was given in Grades Three, Four, Five, and Six on May 4, 1926, and Form 1 was given to the same pupils on September 15, 1926. Both tests were given to 203 pupils. In May, there were forty-two pupils in the third grade, forty-six in the fourth grade, fifty-five in the fifth grade, and sixty in the sixth grade. No emphasis was given to reading as an activity between the dates of the tests except as the pupils read during vacation through their own desires.

Of the third grade pupils, twenty-five or approximately sixty per cent were below the standard B score at the time of the May test, but in the September test only fourteen were below standard. Eleven more pupils were above standard in September than in May. Only one pupil passed from above standard to below that mark during the summer. Of the twenty-five pupils who were below

standard in May, only eleven, or forty-four per cent, actually lost or made no progress during vacation. Of the seventeen who were above the standard in May, eight or forty-seven per cent, lost in reading ability or made no progress.

Of the fourth grade children tested by Elder (3) thirty-four out of the forty-six were below standard at the time of the May test. Twelve pupils passed from below standard in May to above standard in September and two pupils passed from above standard to below standard, making twenty-four of the forty-six pupils below standard in September. Of the thirty-four below standard in May, only nine or twenty-six per cent had made no progress or had lost ground according to the September test, while four of the twelve that were above standard in May lost in reading ability during the summer.

A summary of the findings for the entire group of 203 children tested shows that:

- (1) Fifty-nine per cent of the pupils improved during the vacation.
- (2) Twenty-seven per cent were less proficient in September than in May.
- (3) Fifteen per cent scored the same in both tests.
- (4) Seventeen per cent passed from below standard to above standard during the vacation period.
- (5) The average gain per pupil during the vacation period was forty-five per cent of a school grade.

Fifty-nine per cent of the pupils studied in this experiment improved in reading ability through their own voluntary reading during the summer vacation while fifteen per cent scored the same in September as in May. With them the vacation was, perhaps, a period of catching-up with themselves, an assimilation period, in which they were able to comprehend more fully what had been given them in school but what had not functioned fully until their leisure period gave them time to digest it so that they could work with it. Of the twenty-six who lost in ability to read, it is quite probable that there were many who had been forced to work above their mental ages and who had lost enough interest in school affairs, for one reason or another, to want none of the activities of the school in their vacation time. It is quite possible that their experiences in reading at school had not been pleasant and, as a consequence, they were reacting normally by finding activities less irksome to them. From this study, it is safe to conclude that the reading skill does not suffer materially as the result of a long vacation. If school systems were better able to take care of the individual differences of their pupils so that fewer of them were forced to go at speeds and to perform on levels for which they are not equipped mentally, the records made by the pupils might be more conclusive than is this one that the long vacation is not detrimental to reading skills.

Kramer (5) made a study in 1927 on the forgetting of children during the summer vacation. Her study included the subjects of

arithmetic and reading, and was based on 150 pupils who were tested in February, June, and September. The pupils were placed, according to I.Q.'s into three groups of fifty each. The pupils having I.Q.'s of 110 or more were classed as the X group; those having I.Q.'s between 88 and 109 were grouped as Y pupils; and those having I.Q.'s of less than 88 were placed in the Z group.

This group of 150 children did not confirm the hypothesis that pupils forget arithmetic at such an alarming rate as that seemingly revealed by the study made by Kirby (4:71-92). On the other hand, the study showed that the rate of forgetting was so small that the spending of much time on reviews carried to an interest-killing point in the fall is unnecessary. The X group made five per cent lower scores in the September test, the Y group four and one-half per cent, and the dull group, though they scored very low in both tests, showed no signs of forgetting the arithmetic learned prior to June when they were retested in September.

In reading, the same 150 pupils had a median in June of eleven and one-tenth and in September of eleven and seventeen-hundredths. The bright group made a gain in median of ten per cent over their June accomplishment. This gain was held to represent the equivalent of six weeks in school. The average group lost seven-tenths of a point, or about three-weeks work, while the dull group gained three per cent over their original scores. It is possible that this gain is due to the maturation or

the growth of the pupils during the vacation. It may also be due to reading practice during their leisure time. At any rate, they did not lose their skill in reading and in arithmetic during their long period of release from school. Although the number of cases is rather small, 150 in all, it should have been a representative sampling since it was selected from all the schools in which the pupils had had both the June and September tests.

Breune (2) experimented in 1927 with fourth, fifth, and sixth grade children to determine the rate of forgetting during the summer vacation. The Stanford Achievement Test was used, Form A in May and Form B in September. Fifteen children from the fourth grade, twenty-six from the fifth grade, and twenty-eight from the sixth grade were tested. In answer to the question, "Do children lose in achievement during the summer vacation?" the author concluded that the group tested lost the equivalent of six months of school work in arithmetic computation. In arithmetic reasoning, the loss was a negligible one, amounting to about six-tenths of a school month. In reading, a positive gain resulted. In nature study and science, a slight gain was made. A small loss was found in knowledge of history, literature, language usage, and spelling.

Another phase of this experiment was the study of the part which intelligence played in the retention or loss of achievement during the summer vacation. For this study the sixty-nine pupils were divided into two groups, designated as high and low. Those having I.Q.'s of 110 or above were placed in a higher group and

those rating below 110 in I.Q.'s in a lower group. After this division, there were twenty-nine in the higher group and forty in the lower.

The findings for the two groups indicate that those of the higher group lose more of their acquired knowledge in arithmetic than do those of the lower group, but they gain decidedly more in reading and slightly more in spelling than do the lower groups. These findings, though startling, are not at all conclusive. As they are presented on a percentage basis, the difference in the size of the groups puts the higher group at a disadvantage, at least in the wide changes that a single case or subject makes. Then, too, if the whole group is an average or normal group, the classification which places all pupils below 110 I.Q. in the lower group, puts the majority of the forty pupils who should have had at least average intelligence in the lower group. This would make the lower group only slightly less able intellectually than the higher group in all probability. This should do much to negate the division of the pupils into higher and lower groups. The actual I.Q.'s are not given.

Another research problem dealing with loss in learning during the summer vacation was carried on by Morgan (6) in 1929. In this study, two groups of sixth grade pupils, numbering seventy-eight in all, were used. The study included fundamentals of arithmetic, problem-solving, and reading. Both groups gained in reading ability, lost only slightly in problem-solving skill, and lost

somewhat more in their skill with the fundamental processes in arithmetic. These findings do not indicate that the long vacation is highly detrimental to the retention or to the rate of learning or of relearning.

The latest recorded study is that relating to the effect of the summer vacation on the ability to typewrite made by Schroeder (8) in 1934. His study is of little general value since it concerns only twenty pupils, but it corroborates the findings of the others to the extent that the summer vacation had very little effect upon the pupils' speed in typewriting. In the first test after the summer vacation, which was given before they had had any regular practice periods in class, the average speed of the class was equal to the best average of the single semester of previous training in typewriting which they had had. In the third week of school in the fall, only one had failed to surpass his best mark of the preceding semester. In accuracy, the average was the same in the first test in the fall as in the last test in the spring. The average score of the three best typists was almost the same for the first test in the fall as for the last test in the spring and remained fairly constant over a period of days. The three poorest typists showed signs of being irregular still in their performances but not quite so variable as during their first semester of training. More pupils wrote with greater speed in the fall than in the last test in the spring. In general, this study seems to show that the vacation period had little or no harmful effect on either speed

or accuracy of typewriting when the pupils had had only one semester's training before the vacation began. This was to be expected, since many studies, for example Book's (1) as an outstanding study, show that predominantly motor skills are generally lost more slowly than predominantly mental skills.

In order that the findings of these studies may be evaluated more fully the outstanding conclusions from them have been summarized as follows:

1. Pupils above the upper quartile in skill on the June tests are stated to have lost during the vacation period decidedly less in skill of performance in addition than did those of the lowest quartile.

2. Silent reading skill seems to improve or increase during the summer vacation, with no other urge than a voluntary desire to read at random. The brighter pupils seem to make greater gains than do those of lower mentality.

3. Arithmetic, as a whole, does not suffer a serious loss during the vacation period. In fact, the loss is too slight to make a strenuous review in the fall a profitable performance. The groups performing at high rates of skill seem, in computation, to forget somewhat more in terms of percentage of their earlier performances than do those who perform on a lower level. This may indicate that the level upon which the pupils are obliged to perform in arithmetic so far exceeds their known needs in life that retention of the skill to perform is too difficult to make it

satisfying. On the other hand, it is a weakness of the percentage method of presentation of facts that makes some of the gains and losses seem as large as they appear to be.

4. Problem-solving in arithmetic is lost only in negligible amounts in the vacation and this loss may, in part, be due to the loss in skill with the fundamental processes. Since the loss of fundamental processes is largely a loss of speed rather than accuracy, this again may be an indication that pupils are urged to perform on levels of speed that are too high to be desirable or even economical, both from the standpoint of an efficient school program and from that of a pupil's growth and development.

5. Typewriting skill suffers no noticeable loss during the long vacation either in speed or accuracy even though the training period has been of no greater length than one semester.

Chapter III

Data on the Effect of the Summer Vacation
on Retention of Acquired Knowledge
by Junior High School Pupils

Each succeeding fall as the new school year opens, teachers are prone to stage vigorous reviews in the various subjects for which the elementary schools provide the background because pupils are supposed to forget during the long play period much of what they learned the preceding year. Only too often is the eagerness of the pupils for their new school experiences dampened by these monotonous, wearing, and interest-killing drills. They are contrary to the laws of training because they consist of putting heavy and uninteresting loads on pupils who are physically and mentally out of training for the tasks. The writer has often questioned the advisability of this practice. This study was planned, in part, as a means of ascertaining, if possible, the importance of the material that pupils forget during the summer vacation in comparison with what they have previously known.

An attempt is made in these studies to answer the following questions:

1. Does the summer vacation take a heavy toll of the knowledge acquired the preceding year?
2. Do all children forget alike, that is, do children of higher mental ability forget at the same rate as do those of lower mental ability?

3. Do the so-called drill subjects suffer greater losses than do the content subjects?

With these questions in mind two experiments were undertaken in the Junior High School in Corvallis, Oregon. One was a study dealing only with arithmetic. Both fundamentals and reasoning in arithmetic were studied, however, as exemplifying the drill and the content subjects. For this study the Los Angeles Diagnostic Tests: Fundamentals of Arithmetic, Form 1, and Reasoning in Arithmetic, Form 2, were used. These tests served as tools in the preliminary experiment. Pupils in the eighth grade were chosen. They were tested in April and again at the opening of school in September. Only those pupils were included in the final results who were present at both tests. In the fundamentals, fifty-one pupils took both tests, and in the reasoning, seventy-four pupils took both tests.

No effort was made between the April test and the September test to stimulate these pupils in the retention of number facts and relations. Prior to its administration, nothing was said at any time about a second test. No summer school was offered to any of these pupils. What they retained was wholly through voluntary effort.

In the two tables which follow, the pupils are ranked by mental ages. These mental ages were secured from the files of the school. At the entrance of pupils to the Junior High School, they are given the "Otis S. A. Intelligence Test" to secure these data

for the school files. All of the tests employed in this study were administered carefully and scored according to the rules by individuals trained in the giving and scoring of tests.

TABLE I sets forth the findings of the experiment in the fundamentals of arithmetic. The pupil, numbered "1," has a mental age of seventeen years and eight months, made a score of 110 in arithmetic fundamentals in April, and a score of 131 in the same test in September, or a gain of twenty-one points. All changes in the loss or gain column are marked with pluses to indicate gains or minuses to indicate losses in the second scores over the first scores, that is, September scores in comparison with June scores. The total gain of the fifty-one pupils is eighty score points, and the total loss in score points is 377.

TABLE I Fundamentals in Arithmetic

Pupils	M.A.	April	Sept.	Gain or Loss	
1	17- 8	110	131	+21	
2	17- 6	149	141		- 8
3	17- 1	128	117		-11
4	17- 0	139	139	0	
5	16- 9	136	138	+2	
6	16- 3	115	127	+12	
7	15-11	132	132	0	
8	15-11	127	119		- 8
9	15- 9	127	122		- 5
10	15- 9	138	127		-11
11	15- 8	134	133		- 1
12	15- 6	138	129		- 9
13	15- 6	146	142		- 4
14	15- 4	123	132	+9	
15	15- 2	125	126	+1	
16	15- 1	147	139		- 8
17	15- 0	133	124		- 9
18	14-10	129	133	+ 4	
19	14-10	124	113		-11
20	14-10	118	108		-10
21	14- 8	134	126		- 8
22	14- 8	98	93		- 5
23	14- 8	133	119		-14
24	14- 7	117	111		- 6
25	14- 7	108	97		-11
26	14- 6	106	109	+ 3	
27	14- 4	138	138	0	
28	14- 3	143	143	0	
29	14- 3	125	121		- 4
30	14- 2	138	130		- 8
31	14- 0	125	124		- 1
32	13-11	110	92		-18
33	13-11	124	115		- 9
34	13-11	151	135		-16
35	13- 9	131	139	+ 8	
36	13- 9	107	99		- 8
37	13- 8	137	149	+12	
38	13- 8	123	106		-17
39	13- 7	119	111		- 8
40	13- 6	126	110		-16
41	13- 6	108	90		-18
42	13- 6	111	89		-22
43	13- 4	110	95		-15
44	13- 2	84	91	+ 7	
45	13- 1	110	102		- 8
46	13- 0	104	85		-19
47	13- 0	97	98	+ 1	
48	12- 6	93	85		- 8
49	12- 6	88	77		-11
50	12- 5	104	81		-23
51	12- 1	98	89		- 9
				<u>+80</u>	<u>-377</u>

The mean change is $-6.463 \pm 8.73^{(1)}$. Eleven pupils out of the fifty-one in the whole group gained and four neither gained or lost. The upper half of the group in terms of mental age lost ninety-four points and the lower half 207. The number of pupils who made gains is six and the number who lost is seventeen, while two did not gain or lose. In the lower half of the group in mental age, the number of gains is five, the number of losses is nineteen, and the number remaining constant is two. The upper decile group in mental age gained a total of four score points while the lowest decile group lost a total of fifty points. The gains and losses, however, are not clearly parallel with the differences in mental age. The mean mental age of the group was fourteen years and seven and three-tenths months, with a standard deviation of one year and four and four tenths months.

TABLE I indicates rather clearly that the fundamental facts of arithmetic are poorly retained during a long period of inactivity. The upper half in the mental ages appears to retain number facts considerably better than do those in the lower half in terms of mental age. These conclusions are, however, drawn from too small a group to be wholly reliable and should be regarded as indications rather than as proofs.

TABLE II deals with the second part of the first study, namely, reasoning in arithmetic. Again, the ranking is by mental

(1) The standard deviation is not larger than the mean because the scores do not progress in one direction from zero, but in both directions.

ages. The mean mental age of this group was fourteen years and nine months with a standard deviation of one year and four and five-tenths months. The total number of pupils included here is seventy-four. The pupil, numbered "1," has a mental age of seventeen years and nine months and made a score of twenty-nine points in April and twenty-eight in September, with a loss of one score point. Again, all gains are indicated with pluses and all losses with minuses in the column marked "gain or loss". The total gain of the group in test score points is 147 and the total loss in test score points is 136. Forty-one pupils gained during the vacation, thirty lost, and four did not gain or lose.

TABLE II Reasoning in Arithmetic

Pupils	M.A.	April	Sept.	Gain or Loss
1	17- 9	29	28	-1
2	17- 8	31	28	-3
3	17- 6	44	50	+6
4	17- 5	39	41	+2
5	17- 5	42	43	+1
6	17- 2	28	33	+5
7	17- 1	40	44	+4
8	17- 0	43	44	+1
9	16- 9	36	41	+5
10	16- 5	38	33	-5
11	16- 5	42	43	+1
12	16- 3	43	45	+2
13	16- 2	37	42	+5
14	16- 0	36	39	+3
15	16- 0	39	34	-5
16	15-11	42	41	-1
17	15-11	28	22	-6
18	15-10	26	25	-1
19	15-10	34	43	+9
20	15- 9	42	45	+3
21	15-9	46	49	+3
22	15- 8	35	44	+9
23	15- 6	35	40	+5

TABLE II Reasoning in Arithmetic (Cont.)

Pupils	M.A.	April	Sept.	Gain or Loss
24	15- 6	32	26	- 6
25	15- 6	36	42	+6
26	15- 4	32	41	+9
27	15- 4	34	29	- 5
28	15- 2	37	36	- 1
29	15- 2	24	26	+2
30	15- 2	30	32	+2
31	15- 2	30	34	+4
32	15- 1	44	46	+2
33	15- 1	29	28	- 1
34	15- 0	34	39	+5
35	14-10	27	29	+2
36	14-10	42	38	- 4
37	14-10	38	39	+1
38	14- 8	33	16	-17
39	14- 8	34	29	- 5
40	14- 8	36	38	+2
41	14- 8	40	33	- 7
42	14- 7	32	29	- 3
43	14- 7	34	39	+5
44	14- 6	28	26	- 2
45	14- 6	44	42	- 2
46	14- 3	21	26	+5
47	14- 3	33	35	+2
48	14- 2	24	24	0
49	14- 2	31	32	+1
50	14- 0	38	39	+1
51	13-11	28	29	+1
52	13-11	34	34	0
53	13-10	28	30	+2
54	13- 9	34	34	0
55	13- 9	28	22	- 6
56	13- 8	42	31	-11
57	13- 8	36	40	+4
58	13- 7	33	29	- 4
59	13- 6	37	42	+ 5
60	13- 6	36	42	+6
61	13- 4	28	23	- 5
62	13- 4	39	34	- 5
63	13- 2	23	19	-4
64	13- 1	25	26	+1
65	13- 0	34	30	- 4
66	13- 0	20	20	0
67	12-11	26	29	+3

TABLE II Reasoning in Arithmetic (Cont.)

Pupils	M.A.	April	Sept.	Gain or Loss	
68	12-10	29	25		- 4
69	12-10	25	30	+ 5	
70	12- 6	26	24		- 2
71	12- 6	23	27	+ 4	
72	12- 5	34	29		- 5
73	12- 1	23	26	+ 3	
74	11-10	25	24		- 1
			Total	+147	-126

The mean change for the group is $-.135 \pm 4.70$.⁽¹⁾

The upper half in mental age made a net gain of fifty-eight points while the lower half had a net loss of forty-seven points making a difference of 105 score points between the two groups in favor of the upper half. The upper decile in mental age made a net gain of fourteen score points while the lower decile remained constant. Of the upper half in mental age, twenty-five pupils made gains in reasoning ability and twelve lost while in the lower half only sixteen gained, seventeen lost, and four remained constant. From Table II it is evident that the upper decile retained more than the lower decile in that it has five people who gained in ability and only two who lost against three of the lowest decile who gained and four who lost.

As far as reasoning ability is concerned, the long vacation does not prove a serious handicap in retention if this group is representative of junior high school groups. Nearly sixty per cent either gained or remained the same. With fifty-four per

(1) The standard deviation is not greater than the mean because the gain and loss scores extend in both directions from zero.

cent of the pupils, the summer vacation was a period of positive growth. It is quite probable that part of the loss can be accounted for by a loss in the fundamental processes rather than in ability to reason in arithmetic. Here, as in the fundamental process, the pupils rating in the higher levels of mentality retained their acquired knowledge of arithmetic facts better than did those of the lower levels. Those who labored at a mental disadvantage or who were working beyond the normal rates of pupils of their mental ages and who, perhaps, understood only partially the significance of the reasoning processes were unable to retain what they acquired to a considerable extent by rote memory as well as did those who were more capable. It is probable that more capable pupils comprehended the principles involved better and did not have to exert as much energy to retain them.

The next year, that of 1934, the project undertaken dealt with the seventy-two eighth-grade pupils and as many pupils of the ninth-grade in the Corvallis Junior High School as had available free periods to give to the proposed study. This time the New Stanford Achievement Test, Advanced Examination, Form W, was used in May, and Advanced Examination, Form V, in September. Again, every attempt was made to follow instructions carefully, both in giving and in scoring the tests. In this project, forty-nine of the ninth-grade pupils tested in May were secured for a retest in September. The tests were given the last week in May and during the first week after school opened in September. It was difficult

to get in touch with the former ninth-grade pupils in September for they had gone on to the Senior High School and were now scattered throughout the various classes of that school. A number of them had to be asked to write the test after school hours, but they did this voluntarily. It is altogether possible that these pupils were too tired to do full justice to themselves under these conditions. However, the facts and scores recorded here are the results as they were found, regardless of the handicaps. No pupil knew until September that he was to be tested again. There was no opportunity for any of these pupils to attend summer school. Any retention of acquired knowledge or any gain of additional knowledge was made without external stimulus being given to any of the pupils from the school.

The Advanced Examination of the New Stanford Achievement Test is rather extensive in its measurements. By a fairly long sub-test of word meaning and another sub-test on paragraph meaning, it measures their training in spelling by a dictation test and their abilities in the use of good English by a language usage test. There are other sub-tests in literature, in history-civics, in geography, and one in physiology-hygiene. It contains one sub-test in arithmetic computation and another in arithmetic reasoning. In all, each pupil gave the allotted amount of working time to each of the ten tests in May and to an additional ten in September.

TABLE III records the findings from the eighth grade pupils in reading. In the first line of the table are shown the facts

that the pupil, numbered "1," had a mental age of seventeen years and ten months, a score of 122 in paragraph meaning in May and 131 in September, with a gain of nine paragraph-meaning points. In word meaning, his score was 116 for both May and September and his gain was no test-score points. In this table, the ranking of the pupils is by mental age from the highest to the lowest. The mental age was determined from the Otis S. A. Intelligence Test. All gains in achievement test scores are indicated by plus signs and all losses by minus signs.

A word of explanation perhaps is needed before the findings are taken up. As a class, the eighth-grade group was low in reading ability and in spelling, and decidedly low in language usage when they entered the grade in the fall of 1933. The interest of the class was won and a definite campaign was staged to bring their ratings up to standard. In this program, the writer had the cooperation of the school librarian, Mrs. Evelyn Jacobs, who tried in every way possible to interest the pupils in outside reading. In the classroom work, daily drills to increase the rate of reading and to improve the comprehension of the two groups rating lowest were conducted with a great deal of interest on the parts of the pupils. As a consequence, they showed much improvement. Many of the pupils formed the habit of reading at leisure hours through this intensive program which, in many cases, carried over into the vacation period. Many of these former pupils were proud to bring to the writer lists of the books they had read during the vacation

period. It is more than probable that the appearance of the table showing the reading scores of the lower mental rank can, in part at least, be attributed to the reading interest that was stimulated during the year's program that preceded the tests made in **this** experiment.

TABLE III Reading Score in Paragraph Meaning
and Word Meaning--Eighth Grade

Pupils	M.A.	Paragraph Meaning			Word Meaning			
		May	Sept.	Gain or Loss	May	Sept.	Gain or Loss	
1	17-10	122	131	+9	116	116	0	
2	17- 8	109	110	+1	109	114	+5	
3	17- 5	120	107		-13	107	108	+1
4	17- 2	109	110	+1		99	103	+4
5	17- 2	106	113	+7		118	114	-4
6	17- 2	124	124	0		118	114	-4
7	16-11	126	126	0		121	121	0
8	16-11	122	122	0		118	118	0
9	16-11	114	122	+8		119	119	0
10	16- 8	105	103		- 2	103	107	+4
11	16- 6	126	126	0		110	110	0
12	16- 6	114	122	+8		110	116	+ 6
13	16- 6	103	108	+5		105	105	0
14	16- 6	118	109		- 9	107	108	+1
15	16- 3	111	116	+5		118	118	0
16	16- 3	118	116		- 2	108	110	+2
17	16- 3	109	104		- 5	108	104	-4
18	16- 1	118	122	+4		121	123	+2
19	15-11	102	108	+6		99	103	+4
20	15-11	114	108		- 6	111	110	-1
21	15-11	106	103		- 3	104	104	0
22	15- 2	118	103		-15	105	102	-3
23	15- 2	104	106	+2		110	106	-4
24	15- 2	105	102		- 3	94	98	+4
25	15- 1	122	124	+2		112	114	+2
26	14-10	103	102		- 1	108	108	0
27	14-10	110	111	+1		109	108	-1
28	14- 8	98	100	+2		91	93	+2
29	14- 8	113	110		- 3	112	119	+7
30	14- 6	108	110	+2		107	103	-4
31	14- 4	99	104	+5		98	97	-1
32	14- 4	100	84		-16	101	102	+1
33	14- 2	102	100		- 2	101	97	-4
34	14- 2	101	107	+6		97	96	-1
35	14- 2	104	107	+3		100	98	-2
36	14- 0	110	108		- 2	96	101	+5
37	14- 0	118	116		- 2	121	121	0
38	14- 0	109	106		- 3	99	104	+5
39	14- 0	105	100		- 5	78	91	+13
40	14- 0	100	99		- 1	102	105	+3
41	14- 0	98	94		- 4	94	102	+8
42	13-10	104	92		-12	71	73	+2

TABLE III (Cont.)

Pupils	M.A.	Paragraph Meaning				Word Meaning			
		May	Sept.	Gain	Loss	May	Sept.	Gain	Loss
43	13-10	105	103		-2	98	104	+6	
44	13-10	98	101	+ 3		97	99	+2	
45	13- 7	106	103		-3	98	103	+5	
46	13- 7	101	106	+ 5		102	106	+4	
47	13- 7	104	101		-3	101	107	+6	
48	13- 7	99	99	0		94	98	+4	
* ¹ 49	13- 6	87	97	+10		96	91		-5
50	13- 3	98	102	+ 4		94	97	+3	
51	13- 3	107	104		-3	96	89		-7
52	13- 3	104	97		-7	78	83	+5	
53	13- 2	106	90		-16	100	88		-12
54	13- 1	108	101		-7	98	99	+1	
* ² 55	12-11	87	100	+13		87	101	+14	
56	12-10	101	81		-20	79	83	+ 4	
57 ⁿ	12- 8	101	103	+ 2		102	103	+ 1	
58	12- 8	82	88	+ 6		93	97	+ 4	
59	12- 8	90	85		-5	77	83	+ 6	
60	12- 8	101	85		-16	91	87		- 4
61	12- 6	98	100	+ 2		96	104	+ 8	
62	12- 6	109	110	+ 1		97	108	+11	
63	12- 2	104	102		-2	94	99	+ 5	
64	12- 1	106	90		-16	81	92	+11	
65	12-0	94	87		- 7	96	93		- 3
66	11-10	109	105		- 4	100	102	+ 2	
67	11- 6	88	103	+15		94	91		- 3
68	11- 6	100	99		- 1	86	96	+10	
69	11- 5	85	95	+10		83	87	+ 4	
* ³ 70	10-10	94	104	+10		90	93	+ 3	
* ⁴ 71	9-10	87	97	+10		90	89		- 1
72	9- 3	74	72		- 2	64	79	+15	
		Totals		+169	-223			+215	-68

*¹ Pupil Number 49 disliked reading. Throughout the last semester of the year, every attempt was made to cultivate a taste for reading. It was not until in April that he wanted to read. From then on, he read willingly and made much progress.

*² Pupil Number 55 was a poor pupil, largely because he disliked reading. It was not until the end of the year that the writer was able to interest him in reading for pleasure. From then on, he read willingly and made outstanding progress during vacation.

*³ Pupil Number 70 was in poor health throughout his ninth grade year. He underwent a sinus operation early in May and improved vastly in health. He put in his summer in extensive reading which accounts for his growth.

*⁴ Pupil 71 was urged to read because his standing as an eighth grader was very low.

The mean change in the word-meaning scores is $+1.733 \pm 4.65^{(1)}$.
 The mean change in the paragraph-meaning scores is $-.767 \pm 7.56^{(1)}$.

From TABLE III, it may be observed that reading, from the standpoint of word meaning, suffered no loss over the vacation as the group as a whole had a net gain of 147 score points after the vacation. In paragraph meaning, the entire group had a loss of only fifty-four score points. The upper half in mental age lost four of these points while the lower half lost fifty points. In word-meaning, the upper half in mental age made a net gain of seventeen score points and the lower half gained 130 points. The mean mental age of this group was fourteen years and three and seven-tenths months, with a standard deviation of two years and fifteen-hundredths months.

Since it was with the lower mentality groups that the reading campaign was staged, it is highly probable that some of the gain of the lower group over the upper mentality group can be accounted for in this way. The upper decile group in mental age gained two points in word meaning and the lowest decile gained thirty. In the upper decile group there were three pupils who gained, two who made no change, and two who lost. In the lowest decile group there were five gains and two losses. In paragraph meaning, the lowest decile group had a net gain of thirty-eight score points in contrast with a net gain of five points made by the upper decile group.

(1) The standard deviation is not larger than the mean, as the scores on which the mean is based progress in both directions from zero.

It can be predicted with considerable safety that reading ability does not wane materially during the period when the schools are closed, especially when the pupils have been interested in reading as an avocation. The findings, however, do not bear out the assumption with any decisive results that the upper mentality groups are able to retain their reading ability better than do the lower group, but the greater efforts throughout the year to interest the group who were low in reading achievement had some influence on this situation.

TABLE IV records the scores made by the eighth grade in dictation and language usage in May and in September. In these subjects, too, a strenuous program was carried on throughout the year, 1933-1934, to improve the records of the pupils as spellers and as users of English. The lower mentality groups measured far below the standard performance rating for eighth grade pupils on entrance into the eighth grade. The interest of the groups toward improving their scores was highly pleasing. However, had the intensive program been distributed throughout the eighth and several preceding grades in a more even distribution, the learning, no doubt, would have been more thorough and, therefore, more lasting. The same manner of showing the data is used in TABLE IV as was used in the preceding tables.

TABLE IV Dictation and Language Usage Scores
 Made on the New Stanford Achievement Test
 Eighth Grade

Pupils	M.A.	Dictation				Language Usage			
		May	Sept.	Gain	Loss	May	Sept.	Gain	Loss
1	17-10	113	115	+2		121	125	+4	
2	17- 8	97	98	+1		104	106	+2	
3	17- 5	96	98	+2		99	109	+10	
4	17- 2	98	101	+3		111	107		-4
5	17- 2	106	109	+3		109	109	0	
6	17- 2	106	108	+2		111	121	+10	
7	16-11	95	95	0		113	125	+12	
8	16-11	118	119	+1		111	115	+ 4	
9	16-11	114	114	0		107	110	+ 3	
10	16- 8	92	99	+7		119	121	+ 2	
11	16- 8	110	106		-4	113	111		-2
12	16- 6	112	118	+6		107	111	+ 4	
13	16- 6	114	108		-6	111	107		-4
14	16- 6	90	96	+6		115	103		-12
15	16- 3	114	112		-2	111	113	+ 2	
16	16- 3	106	107	+1		117	117	0	
17	16- 3	102	101		-1	113	121	+ 8	
18	16- 1	116	119	+3		125	125	0	
19	15-11	103	113	+10		103	106	+ 3	
20	15-11	112	110		-2	104	111	+ 7	
21	15-11	71	89	+18		101	106	+ 5	
22	15- 2	96	97	+ 1		106	99		-7
23	15- 2	83	85	+ 2		93	109	+16	
24	15- 2	85	86	+ 1		93	99	+ 6	
25	15- 1	113	115	+ 2		115	125	+10	
26	14-10	104	107	+ 3		115	113		-2
27	14-10	109	108		-1	115	107		-8
28	14- 8	92	97	+ 5		95	97	+ 2	
29	14- 8	93	92		-1	117	117	0	
30	14- 6	100	99		-1	109	111	+ 2	
31	14- 4	103	107	+ 4		99	106	+ 7	
32	14- 4	91	96	+ 5		99	91		-8
33	14- 2	88	87		-1	103	107	+ 4	
34	14- 2	91	92	+ 1		115	108		-7
35	14- 2	99	98		-1	109	104		-5
36	14- 0	89	88		-1	107	115	+ 8	
37	14- 0	118	115		-3	115	125	+10	
38	14- 0	89	91	+ 2		115	107		-8
39	14- 0	101	101	0		93	95	+ 2	
40	14- 0	96	97	+1		111	107		-4
41	14- 0	88	87		-1	81	78		-3
42	13-10	77	76		-1	75	93	+18	
43	13-10	103	110	+7		106	100		-6

TABLE IV (Cont.)

Pupils	M.A.	Dictation				Language Usage			
		May	Sept.	Gain	Loss	May	Sept.	Gain	Loss
44	13-10	102	106	+4		107	113	+6	
45	13- 7	92	88		-4	99	97		-2
46	13- 7	82	85	+3		103	106	+3	
47	13- 7	86	87	+1		95	106	+11	
48	13- 7	97	94		-3	93	93	0	
49	13- 6	82	79		-3	63	69	+6	
50	13- 3	98	96		-2	98	89		-9
*51	13- 3	99	74		-25	75	89	+14	
52	13- 3	77	83	+6		87	81		-6
53	13- 2	83	87	+4		83	95	+12	
54	13- 1	104	107	+3		103	99		-4
55	12-11	87	89	+2		101	108	+ 7	
56	12-10	85	84		-1	60	75	+15	
57	12- 8	95	98	+3		111	111	0	
58	12- 8	86	86	0		93	89		-4
59	12- 8	86	85		-1	110	81		-29
60	12- 8	82	81		-1	85	85	0	
61	12- 6	93	89		-4	95	108	+13	
62	12- 6	96	100	+4		103	111	+8	
63	12- 2	89	96	+7		95	95	0	
64	12- 1	84	80		-4	104	89		-15
65	12- 0	97	96		-1	85	73		-12
66	11-10	106	110	+4		107	97		-10
67	11- 6	85	85	0		91	103	+12	
68	11- 6	86	82		-4	85	90	+5	
69	11- 5	86	94	+8		103	101		-2
70	10-10	90	87		-3	83	93	+10	
71	9-10	82	77		-5	85	91	+6	
72	9- 3	72	62		-10	44	44	0	
				+148	-97			+289	-173

* Pupil numbered 51 was sadly lacking in the power to retain. Unless he was very highly motivated when learning spelling words, he would forget them from one day to the next. As a consequence, he was much discouraged in trying to learn to spell and made little earnest effort.

The mean change in the scores on the dictation test was $+1.164 \pm 4.96^{(1)}$. The mean change in the scores on the language usage test was $+1.379 \pm 7.92^{(1)}$. The total gains of the group in (1) The standard deviation is not larger than the mean since the scores on which the mean is based extend in both directions from zero.

dictation was 148 test score points. The total loss of the group was ninety-seven points. This made a net gain of fifty one score points in dictation or spelling. The results of the test are not indicative of any great loss of knowledge of spelling except in a few cases. It is hardly to be expected that a great amount of learning would occur in the ordinarily uninteresting study of spelling during the vacation period, yet thirty-eight pupils improved in their scores and five showed no change. The twenty-nine who lost ninety-seven score points as a group experienced an average loss of three and three-tenths points which could hardly be considered a serious loss. The most surprising fact is that a greater loss was not encountered from the summer vacation, following as it did a very intensive year of work in which the pupils tried very hard to overcome their deficiencies in this subject.

The upper half in mental age gained eighty-nine points in spelling over the vacation time and lost twenty-one points, leaving a net gain of sixty-eight points, whereas the lower half had a net loss of seventeen points. Of the upper group twenty-three pupils increased their scores and two showed no change. Eleven pupils lost a total of twenty-one score points. Of the lower half, fifteen pupils gained, three remained constant, and eighteen lost in their ability to spell. Of the seventy-six points lost, twenty-five were lost by one unfortunate individual, leaving fifty-one to be shared among the other seventeen pupils of this group. While the

loss in neither group is a heavy one, yet the upper group had fewer cases who lost and more cases who improved their scores during the vacation. The upper decile group gained thirteen points and lost none while the lowest decile had a net loss of ten points. The upper decile had six individuals who increased their scores and one who made the same score in both tests. In the lower decile there were two who gained, four who lost, and one who remained constant. All in all, the indications are rather emphatic in that the upper mental group has the greater advantage as far as spelling ability is concerned in the long vacation for that group retained more and made greater growth.

TABLE IV shows that, in language usage, there was a total gain in score points of 289 and a total loss of 173, or a net gain for the group of 116 score points. There were thirty-nine individuals who increased their ability to use the language correctly, nine who experienced no change, and twenty-four who lost in their ability in this subject. For the group as a whole the change was a positive one.

The mentally more mature had the advantage for they retained more and gained more good English habits than did the more inferior group. Where the upper half made a net gain of seventy-two points, the lower half had a net gain of forty-four points. Twenty-two of the mentally more mature gained in ability while only seventeen of the lower half made gains. Parents who appreciate the value of good English usage surround their children with

English practices that encourage the formation of good English habits. In addition, it is altogether probable that the influence of good reading matter is more evident among the more mature group intellectually. Both of these conditions are conducive to the development of better language habits. In the upper decile in mental age, a net gain of thirty-four score points was made while in the lowest decile there was a net gain of twenty-one score points. TABLE IV gives rather conclusive evidence that the individuals who have a higher mental equipment are likely to gain more in spelling and in ability to use English correctly by their own volition in vacation time than do those of lower mental ability and they are likely to retain more of what they have previously acquired.

In TABLE V are recorded the findings from the two tests given to the eighth-grade pupils in literature and history. Here, as in reading, their inability to read well played a part. There were too many pupils who disliked to read, and, therefore, had painstakingly avoided all activities that involved reading. Throughout their eighth-grade work real efforts were made to interest them in literature by telling them fragments of interesting stories and leaving them to find the outcomes through their own reading efforts. In this way, many of the pupils were guided toward reading before the year was over. It is quite possible that many of these pupils cultivated sufficient taste for reading to turn to it in their leisure periods. This reaction may have colored the results of the tests.

TABLE V Literature and History Scores Made
on the New Stanford Achievement Test Form W
Eighth Grade

Pupils	M.A.	Literature				History			
		May	Sept.	Gain	Loss	May	Sept.	Gain	Loss
1	17-10	110	109		-1	110	105		-5
2	17- 8	95	91		-4	107	109	+2	
3	17- 5	106	111	+5		109	103		-6
4	17- 2	77	93	+16		79	98	+19	
5	17- 2	105	112	+7		118	125	+7	
6	17- 2	105	106	+1		86	103	+17	
7	16-11	106	103		-3	111	109		-2
8	16-11	108	110	+2		125	126	+1	
9	16-11	106	109	+3		103	109	+6	
10	16- 8	91	100	+9		105	106	+1	
11	16- 8	101	100		-1	119	115		-4
12	16- 6	107	103		-4	107	109	+2	
13	16- 6	95	88		-7	96	98	+2	
14	16- 6	103	105	+2		106	111	+5	
15	16- 3	98	105	+7		115	122	+7	
16	16- 3	98	94		-4	98	105	+7	
17	16- 3	92	91		-1	96	97	+1	
18	16- 1	115	112		-3	122	122	0	
19	15-11	87	93	+6		91	89		-2
20	15-11	105	102		-3	115	118	+3	
21	15-11	102	103	+1		111	112	+1	
22	15- 2	75	94	+19		97	100	+3	
23	15- 2	100	88		-2	107	118	+11	
24	15- 2	70	90	+20		89	106	+17	
25	15- 1	98	100	+2		107	111	+4	
26	14-10	118	108		-10	107	105		-2
27	14-10	105	103		-2	103	101		-2
28	14- 8	95	94		-1	88	97	+9	
29	14- 8	97	90		-7	108	107		-1
30	14- 6	102	105	+3		128	120		-8
31	14- 4	95	88		-7	107	102		-5
32	14- 4	79	85	+6		89	88		-1
33	14- 2	89	95	+6		93	89		-4
34	14- 2	86	89	+3		88	91	+2	
35	14- 2	100	102	+2		100	99		-1
36	14- 0	81	87	+6		96	86		-10
37	14- 0	106	104		-2	109	109	0	
38	14- 0	93	93	0		95	101	+6	
39	14- 0	91	94	+3		94	102	+8	
40	14- 0	92	99	+7		90	83		-7
41	14- 0	91	87		-4	116	115		-1
42	13-10	70	92	+22		86	88	+2	

TABLE V (Cont.)

Pupils	M.A.	Literature		Gain	Loss	History		Gain	Loss
		May	Sept.			May	Sept.		
43	13-10	99	93		-6	106	108	+2	
44	13-10	60	75	+15		89	89	0	
45	13- 7	90	92	+2		106	106	0	
46	13- 7	63	90	+27		101	92		-9
47	13- 7	100	97		-3	103	102		-1
48	13- 7	83	79		-4	90	93	+3	
49	13- 6	67	89	+22		88	88	0	
50	13- 3	85	79		-6	91	88		-3
51	13- 3	97	83		-14	103	95		-8
52	13- 3	72	75	+ 3		88	84		-4
53	13- 2	93	87		-6	92	92	0	
54	13- 1	79	86	+7		98	96		-2
55	12-11	90	87		-3	108	110	+2	
56	12-10	72	70		-2	84	72		-12
57	12- 8	91	97	+6		92	96	+4	
58	12- 8	94	96	+2		101	102	+1	
59	12- 8	88	95	+7		88	98	+10	
60	12- 8	92	79		-13	75	88	+13	
61	12- 6	100	87		-13	98	110	+12	
62	12- 6	98	94		-4	91	92	+1	
63	12- 2	91	88		-3	88	80		-8
64	12- 1	77	85	+8		88	81		-7
65	12- 0	91	75		-16	86	88	+2	
66	11-10	92	99	+7		107	109	+2	
67	11- 6	93	83		-10	91	80		-11
68	11- 6	81	77		-4	89	87		-2
69	11- 5	88	85		-3	93	92		-1
70	10-10	57	90	+33		81	88	+7	
71	9-10	85	87	+2		90	89		-1
72	9- 3	38	83	+45		62	38		-24
				<u>+344</u>	<u>-176</u>			<u>+202</u>	<u>-154</u>

The mean change in the scores of the group on the literature test was $+2.676 \pm 9.96^{(1)}$. The mean change in the scores on the history test was $+.50 \pm 6.88^{(1)}$.

(1) The standard deviation is not larger than the mean, as the scores on which the mean is based extend in both directions from zero.

The summer vacation proved profitable in acquiring knowledge of literature as a net gain of 168 points resulted. Thirty-seven pupils increased their reading scores during the summer. The upper half in mental age made a net gain of eighty-six score points in the literature test while the lower half made 102 points. However, seventy-eight of those points were made by two individuals who carried on rather intensive reading programs during the summer. These two stated that they had read more books during this one vacation than they had read throughout their whole lifetimes before. Since the records of these two fall in the lowest decile group in mental age, this group made the greatest gain in the test. The upper half has the advantage of having more individual gains in the group and fewer losses. Omitting the two individuals who made the large gains in the lowest decile, the lower half is at a disadvantage. This group learned fewer new facts and retained less of the previously acquired literature facts than did the more mature group.

The change in scores on the history tests is negligible as far as gain in knowledge is concerned but it is worthwhile to note that the vacation was not injurious to the pupils knowledge of history. Half of the group increased its knowledge during the summer, six remained at a standstill, and thirty pupils lost 154 score points.

The upper half in mental age made a net gain of seventy-four points against a new loss of twenty-six points for the lower half. Where twenty-one made gains in the upper half, there were fifteen

in the lower half. Where fourteen experienced losses in the upper group, sixteen showed decreased scores in the lower half. The pupils of the upper decile group were decidedly more fortunate than those in the lowest decile group. The upper group experienced a net gain of thirty-four history points in contrast with a net loss of thirty score points for the lowest decile group. Again, the mentally more mature group appears to have a significant advantage over the less mature group in self-imposed learning.

TABLE VI shows the results obtained from the scores made by the eighth-grade pupils in geography and in physiology and hygiene. In Oregon, geography is not taught as a subject in the eighth grade. It is only as geography is related to and included in literature, history, and in general reading that any change in knowledge of geography results during the eighth-year work. In the main, the knowledge of geography measured in this study is the knowledge retained from seventh-grade study or that gained from general reading.

TABLE VI Geography and Physiology-Hygiene Scores
 Made on Stanford Achievement Tests Form W
 Eighth Grade

Pupils	M.A.	Geography				Physiology-Hygiene			
		May	Sept.	Gain	Loss	May	Sept.	Gain	Loss
1	17-10	116	127	+11		109	113	+4	
2	17- 8	124	124	0		109	109	0	
3	17- 5	117	117	0		97	109	+12	
4	17- 2	119	124	+5		101	113	+12	
5	17- 2	127	117		-10	114	122	+8	
6	17- 2	123	123	0		117	120	+3	
7	16-11	118	123	+5		122	123	+1	
8	16-11	123	127	+4		119	113	+6	
9	16-11	116	117	+1		130	123		-7
10	16- 8	117	103		-14	129	130	+1	
11	16- 8	118	116		-2	116	120	+4	
12	16- 6	111	119	+8		104	114	+10	
13	16- 6	94	97	+3		106	98		-8
14	16- 6	129	123		-6	108	101		-7
15	16- 3	124	127	+3		94	105	+11	
16	16- 3	117	119	+2		113	126	+13	
17	16- 3	109	94		-15	87	94	+ 7	
18	16- 1	130	130	0		116	126	+10	
19	15-11	106	111	+5		108	106		-2
20	15-11	123	121		-2	119	122	+3	
21	15-11	130	128		-2	100	101	+1	
22	15- 2	111	111	0		98	105	+7	
23	15- 2	124	117		-7	97	102	+5	
24	15- 2	109	116	+7		86	83		-3
25	15- 1	121	113		-8	134	126		-8
26	14-10	116	103		-13	97	97	0	
27	14-10	107	100		-7	101	105	+4	
28	14- 8	103	113	+10		92	95	+3	
29	14- 8	103	105	+ 2		99	94		-5
30	14- 6	105	119	+14		101	94		-7
31	14- 4	103	98		-5	100	98		-2
32	14- 4	88	97	+9		102	117	+15	
33	14- 2	101	99		-2	94	96	+2	
34	14- 2	102	94		-8	100	92		-8
35	14- 2	102	101		-1	113	105		-8
36	14- 0	87	97	+10		96	97	+1	
37	14- 0	111	116	+5		117	127	+10	
38	14- 0	101	107	+6		105	104		-1
39	14- 0	105	117	+12		91	88		-3
40	14- 0	96	94		-2	95	104	+9	
41	14- 0	123	124	+1		88	91	+3	
42	13-10	81	85	+4		81	97	+16	

TABLE VI Continued

Pupils	Geography				Physiology-Hygiene				
	M.A.	May	Sept.	Gain	Loss	May	Sept.	Gain	Loss
43	13-10	109	110	+1		104	117	+13	
44	13-10	88	87		-1	91	102	+11	
45	13- 7	113	113	0		95	95	0	
46	13- 7	100	101	+1		102	98		-4
47	13- 7	85	94	+9		91	86		-5
48	13- 7	109	121	+12		95	101	+6	
49	13- 6	102	101		-1	99	97		-2
50	13- 3	101	96		-5	81	91	+10	
51	13- 3	121	117		-4	92	100	+8	
52	13- 3	83	85	+2		91	88		-3
53	13- 2	88	85		-3	100	98		-2
54	13- 1	94	98	+4		88	84		-4
55	12-11	121	116		-5	123	105		-18
56	12-10	73	67		-6	71	80	+9	
57	12- 8	109	109	0		109	113	+4	
58	12- 8	114	114	0		86	94	+8	
59	12- 8	97	101	+4		92	99	+7	
60	12- 8	105	103		-2	73	78	+5	
61	12- 6	106	116	+10		94	105	+11	
62	12- 6	87	80		-7	80	90	+10	
63	12- 2	87	94	+7		104	111	+7	
64	12- 1	98	105	+7		90	87		-3
65	12- 0	93	88		-5	101	101	0	
66	11-10	103	97		-6	81	87	+6	
67	11- 6	97	97	0		87	89	+2	
68	11- 6	96	85		-11	95	90		-5
69	11- 5	90	83		-7	83	94	+11	
70	10-10	86	86	0		91	94	+3	
71	9-10	99	100	+1		84	84	0	
72	9- 3	75	68		-7	69	76	+7	
		Totals		+185	-174			+313	-121

The mean change in scores on the geography test was $+.166 \pm 6.54^{(1)}$.

The mean change on the physiology-hygiene test was $+2.885 \pm 7.14^{(1)}$.

(1) The standard deviation is not greater than the mean as the scores on which the mean is based extend in both directions from zero.

The seventy-two pupils tested added to the knowledge which they had in May a net gain of eleven score points. This change is not worthy of much note except that the change made is on the positive side. Of the seventy-two pupils participating, thirty-two made a gain and ten remained constant. The thirty pupils, losing the 174 score points, had an average loss of five and eight-tenths points. These losses and gains were equally distributed between the upper and lower halves when ranked by mental age, each having sixteen individuals who made gains, fifteen who made losses, and five who made the same scores in both tests.

When the upper half, as a whole, is contrasted with the lower half the more mature mentally had no advantage over the lower group in geography when the period of retention was more than a year in length. However, when the upper decile group is compared with the lowest decile, a difference does appear. The upper decile group made a net gain of five points while the lowest decile group had a net loss of sixteen points. In the upper decile group three pupils gained, one lost, and three made no change, whereas in the lowest decile group one pupil made a gain, four lost, and two made no change. This would indicate that even over a year's time, the retention of geography facts and the volitional gaining of new facts is done slightly more successfully by the more mature pupils than by those less advanced in mental equipment.

In physiology and hygiene, only a few pupils had had formal teaching of any kind in their eighth-grade year. Due to a difficult program situation, a small group of girls was given a class of physiology-and-hygiene as a makeshift provision in the eighth grade. The teaching of the subject was rather inadequate because it was used as a way out of a difficult situation. In the main, then, the knowledge of the pupils in physiology and hygiene was changed from their knowledge of this general subject gained in the seventh and early grades only by the teaching which they received in general science, perhaps, and by general learning secured through reading, discussion, and general maturing during the eighth-grade year. The effect of the long vacation on physiology-and-hygiene facts shows an increase of 313 score points and a loss of 121 points, leaving a net gain of 192 points.

In the comparison of the upper half in mental age with the lower half, the lower group has the advantage in net gain. As in the geography results, the superior pupils at the top of the lower half group seem to color the findings for the lower half. The upper decile group leads the lowest decile group in net gain, in number of gains, and in fewer losses. Again, when the period of retention extends over a longer period of time, that is, more than a year the upper group does not seem to have a great advantage over the lower group and may even be at a disadvantage.

TABLE VII shows the findings made in arithmetic by the eighth grade, both in reasoning and in computation.

TABLE VII Computation and Reasoning in Arithmetic
Scores Made on the New Stanford Achievement
Tests Advanced Form W
Eighth Grade

Pupils	M.A.	Arithmetic Reasoning				Arithmetic Computation			
		May	Sept.	Gain	Loss	May	Sept.	Gain	Loss
1	17-10	107	105		-2	113	112		-1
2	17- 8	104	108	+4		111	103		-8
3	17- 5	91	98	+7		113	113	0	
4	17- 2	116	108		-8	113	115	+2	
5	17- 2	117	119	+2		116	113		-3
6	17- 2	104	102		-2	114	114	0	
7	16-11	94	107	+13		114	103		-11
8	16-11	113	105		-8	115	113		-2
9	16-11	108	110	+2		114	114	0	
10	16- 8	111	108		-3	113	113	0	
11	16- 8	114	116	+2		115	114		-1
12	16- 6	111	110		-1	106	103		-3
13	16- 6	108	108	0		115	114		-1
14	16- 6	107	113	+6		113	115	+2	
15	16- 3	116	120	+4		115	115	0	
16	16- 3	104	98		-6	115	114		-1
17	16- 3	98	94		-4	106	92		-14
18	16- 1	119	120	+1		114	115	+1	
19	15-11	104	104	0		114	106		-8
20	15-11	119	119	0		113	111		-2
21	15-11	104	107	+3		113	113	0	
22	15- 2	102	91		-11	114	101		-13
23	15- 2	98	94		-4	112	101		-11
24	15- 2	89	87		-2	113	112		-1
25	15- 1	111	114	+3		115	115	0	
26	14-10	105	113	+8		113	112		-1
27	14-10	107	111	+4		123	114		-9
28	14- 8	78	87	+9		98	77		-21
29	14- 8	104	110	+6		112	111		-1
30	14- 6	102	108	+6		103	109	+6	
31	14- 4	104	102		-2	111	98		-13
32	14- 4	81	85	+4		94	98	+4	
33	14- 2	91	102	+11		111	101		-10
34	14- 2	89	94	+5		98	103	+5	
35	14- 2	94	107	+13		113	113	0	
36	14- 0	122	98		-24	114	113		-1
37	14- 0	94	107	+13		111	113	+2	
38	14- 0	108	110	+ 2		113	113	0	
39	14- 0	111	114	+ 3		114	116	+2	
40	14- 0	102	94		-8	109	109	0	
41	14- 0	107	105		-2	112	112	0	
42	13-10	98	87		-11	92	79		-13
43	13-10	105	98		-7	106	112	+6	

TABLE VII (Continued)

Pupils	Arithmetic Reasoning				Arithmetic Computation				
	M.A.	May	Sept.	Gain	Loss	May	Sept.	Gain	Loss
44	13-10	108	107		-1	114	111		-3
45	13-10	104	102		-2	111	113	+2	
46	13- 7	113	107		-6	114	113		-1
47	13- 7	98	108	+10		113	106		-7
48	13- 7	111	110		-1	113	109		-4
49	13- 6	102	89		-13	111	111	0	
50	13- 3	98	98	0		115	103		-12
51	13- 3	89	94	+5		81	101	+20	
52	13- 3	94	89		-5	111	112	+1	
53	13- 2	87	83		-4	98	81		-17
54	13- 1	102	85		-17	92	96	+4	
55	12-11	102	107	+5		98	114	+16	
56	12-10	91	85		-6	96	92		-4
57	12- 8	78	89	+11		98	103	+5	
58	12- 8	98	98	0		106	111	+5	
59	12- 8	87	85		-2	109	94		-15
60	12- 8	91	91	0		109	113	+4	
61	12- 6	91	87		-4	94	98	+4	
62	12- 6	98	104	+6		114	111		-3
63	12- 2	87	87	0		114	103		-11
64	12- 1	71	68		-3	96	63		-33
65	12- 0	87	71		-16	109	84		-25
66	11-10	98	89		-9	103	96		-7
67	11- 6	71	71	0		59	71	+12	
68	11- 6	102	104	+2		98	103	+5	
69	11- 5	85	85	0		96	79		-17
70	10-10	94	98	+4		101	109	+8	
71	9-10	91	87		-4	75	64		-11
72	9- 3	69	81	+12		75	64		-11
		Totals		+186	-198			+116	-330

The mean change in scores on the tests in arithmetic reasoning was $+0.052 \pm 7.12^{(1)}$. The mean change in scores on the tests in arithmetic computation was $-2.53 \pm 8.10^{(1)}$. The total score points gained were 186, against 198 score points lost. Again, some of this

(1) The standard deviation is not greater than the mean, as the scores on which the mean is based extend in both directions from zero.

loss in ability to reason may be attributed to a loss of power in computation. As the findings of others who have worked in this field have shown, the summer vacation does not handicap pupils seriously in solving problems on their return in the fall. As in the preceding tests, the upper half in mental age showed the greater development during the vacation period. This half made a net gain of thirty-six points. On the other hand, the lower half experienced a net loss of thirty-four points. A similar advantage is noted in the comparison of the two extreme deciles. The highest decile group had a net gain of fourteen points against a net loss of one point for the lowest decile group. Throughout this test, the indications are that pupils with higher mental ages retained their skills in reasoning ability in arithmetic better during a long inactive period than did those of lesser mental age, and they showed greater growth through assimilation and maturing than did those of the lower rank.

TABLE VII also gives the results made by the eighth grade in computation in arithmetic. In computation, the group showed a decided loss. Only twenty-one pupils increased their scores, with a total gain of 116 score points. The thirty-nine pupils who lost in ability to compute lost a total of 330 score points for an average loss of 8.2 points. The other twelve pupils made no change.

In this test of arithmetic computation, the lower half in mental age showed better retention and more ability to learn voluntarily or to assimilate facts voluntarily than did the upper

half. This is true in the comparison of the upper half against the lower half and the highest decile group against the lowest decile group. The lower half had a smaller net loss by eighteen points, had nine more individuals who acquired more skill during vacation, and had five fewer pupils showing a loss of skill to compute. These results differ from those found with the group used in the preliminary test in the fundamentals of arithmetic. In the preliminary study, the margin was a small one in favor of the upper group.

In TABLE VIII, the scores and results made by the ninth grade in reading, both paragraph-meaning and word-meaning are recorded.

TABLE VIII Scores in Reading in Paragraph Meaning
and Word Meaning Made on the New Stanford
Achievement Test Advanced Form W -- Ninth Grade

Pupils	M.A.	Paragraph Meaning				Word Meaning			
		May	Sept.	Gain	Loss	May	Sept.	Gain	Loss
1	17- 5	117	120	+3		118	122	+4	
2	17- 0	118	124	+6		114	111		-3
3	17- 0	118	122	+4		118	118	0	
4	16-10	118	115		-3	120	122	+2	
5	16- 9	115	117	+2		112	114	+2	
6	16- 6	109	113	+4		110	111	+1	
7	16- 5	111	117	+6		115	117	+2	
8	16- 5	112	124	+12		103	110	+7	
9	16- 5	105	103		-2	99	97		-2
10	16- 3	107	106		-1	98	96		-2
11	16- 3	105	110	+5		103	101		-2
12	16- 3	106	106	0		104	110	+6	
13	16- 2	114	118	+4		111	117	+6	
14	16- 2	110	106		-4	111	117	+6	
15	16- 0	111	114	+3		112	120	+8	
16	16- 0	117	112		-5	117	120	+3	
17	16- 0	122	120		-2	106	111	+5	
18	16- 0	109	117	+8		107	110	+3	
19	16- 0	109	112	+3		102	104	+2	
20	16- 0	107	109	+2		102	104	+2	
21	15-10	114	105		-9	106	103		-3
22	15-10	112	113	+1		106	110	+4	
23	15-10	107	117	+10		101	105	+4	

TABLE VIII (Continued)

Pupils	M.A.	Paragraph Meaning				Word Meaning			
		May	Sept.	Gain	Loss	May	Sept.	Gain	Loss
24	15- 8	104	109	+5		101	102	+1	
25	15- 8	114	114	0		111	117	+6	
26	15- 6	112	110		-2	105	111	+6	
27	15- 6	105	105	0		101	103	+2	
28	15- 4	112	118	+6		115	109		-6
29	15- 2	110	100		-10	97	107	+10	
30	15- 2	103	106	+3		102	100		-2
31	15- 2	109	107		-2	103	102		-1
32	15- 2	105	112	+7		107	106		-1
33	15- 0	114	111		-3	106	106	0	
34	15- 0	91	103	+12		102	106	+4	
35	14-10	105	99		-6	97	103	+6	
36	14- 8	105	110	+5		103	105	+2	
37	14- 6	102	111	+9		100	105	+5	
38	14- 4	109	107		-2	98	93		-5
39	14- 4	97	102	+5		92	97	+5	
40	14- 4	86	106	+20		95	89		-6
41	14- 2	107	115	+8		106	106	0	
42	14- 2	100	103	+3		89	88		-1
43	14- 0	109	106		-3	88	92	+4	
44	14- 0	99	102	+3		90	92	+2	
45	13-10	95	101	+6		96	98	+2	
46	13- 5	102	104	+2		99	102	+3	
47	13- 3	100	100	0		92	96	+4	
48	12-10	103	102		-1	94	97	+3	
49	12- 8	100	102	-2		84	97	+13	
Totals				+169	-55			+145	-34

The mean change in scores on the paragraph-meaning test was $+2.544 \pm 5.16^{(1)}$. The mean change in score on the word-meaning test was $+2.684 \pm 3.84^{(1)}$.

(1) The standard deviation is not larger than the mean, as the scores on which the mean was based extend in both directions from zero.

Reading skill does not seem to wane in a long period of inactivity from school work. In paragraph meaning, the group made a net gain of 114 score points. Only fifteen out of the forty-nine pupils tested show a decline in skill, and these fifteen have an average loss of only three and six-tenths points. The twenty-four pupils having the highest mental ages show very little gain over the lower twenty-four except in the number of pupils who gained in ability to read.

TABLE VIII, in the word meaning test, shows an improvement in the September over the May findings, the mean gain being $+2.684$ test score points. A net gain of 111 score points was made, with thirty-four pupils increasing their ability to comprehend words. Only thirty-four score points were lost, with twelve pupils sharing an average loss of two and eight-tenths points. Here, as in paragraph meaning, the results indicate that pupils of the lower rank in mental age have equal ability with the upper ranks in the retention of reading skill, and they seem to acquire additional skill as readily when on their own initiative as do the upper group. Never-the-less, a group of forty-nine pupils is too small a number upon which to base definite general conclusions. They are indicative, however. The mean mental age of this group is fifteen years and five and eighteen-hundredths months, plus or minus one year and one month.

TABLE IX gives the results of the dictation and language usage tests written by the forty-nine members of the ninth grade group that were used in this experiment.

TABLE IX Scores in Dictation and Language Usage
 Made by the Ninth Grade on the New Stanford
 Achievement Test Advanced Form W

Pupils	M.A.	Dictation		Gain	Loss	Language Usage			
		May	Sept.			May	Sept.	Gain	Loss
1	17- 5	101	100		-1	120	118		-2
2	17- 0	110	111	+1		120	120	0	
3	17- 0	107	101		-6	123	118		-5
4	16-10	103	108	+5		133	127		-6
5	16- 9	114	112		-2	109	106		-3
6	16- 6	104	106	+2		108	125	+17	
7	16- 5	101	110	+9		120	123	+3	
8	16- 5	106	102		-4	109	116	+7	
9	16- 5	88	86		-2	116	106		-10
10	16- 5	98	100	+2		116	111		-5
11	16- 3	104	108	+4		103	111	+8	
12	16- 3	95	90		-5	108	109	+1	
13	16- 2	96	100	+4		101	101	0	
14	16- 2	92	88		-4	109	108		-1
15	16- 0	114	115	+1		114	111		-3
16	16- 0	110	112	+2		127	123		-4
17	16- 0	97	91		-6	108	104		-4
18	16- 0	109	106		-3	127	120		-7
19	16- 0	97	103	+6		106	109	+3	
20	16- 0	101	102	+1		104	109	+5	
21	15-10	108	107		-1	120	118		-2
22	15-10	99	108	+9		104	130	+26	
23	15-10	100	99		-1	112	119	+7	
24	15- 8	108	112	+4		102	106	+4	
25	15- 8	94	97	+3		118	109		-9
26	15- 6	102	106	+4		106	109	+3	
27	15- 6	96	94		-2	114	111		-3
28	15- 4	98	104	+6		106	106	0	
29	15- 2	84	91	+7		111	113	+2	
30	15- 2	107	104		-3	101	104	+3	
31	15- 2	111	108		-3	112	108		-4
32	15- 2	107	107	0		117	108		-9
33	15- 0	108	109	+1		120	116		-4
34	15- 0	100	100	0		101	93		-8
35	14-10	85	90	+5		99	99	0	
36	14- 8	94	91		-3	106	103		-3
37	14- 6	102	104	+2		109	104		-5
38	14- 4	87	90	+3		109	103		-6

Table IX (Continued)

Pupils	M.A.	Dictation				Language Usage			
		May	Sept.	Gain	Loss	May	Sept.	Gain	Loss
39	14- 4	92	97	+5		108	106		-2
40	14- 4	95	95	0		103	108	+5	
41	14- 2	95	103	+8		118	116		-2
42	14- 2	83	87	+4		104	99		-5
43	14- 0	84	78		-6	97	96		-1
44	14- 0	89	90	+1		82	97	+15	
45	13-10	111	111	0		112	120	+8	
46	13- 5	106	109	+3		102	104	+2	
47	13- 3	101	102	+1		103	106	+3	
48	12-10	94	96	+2		108	116	+8	
49	12- 8	94	90		-4	97	89		-8
		Totals		+105	-56			+130	-121

The mean gain in scores on the dictation test was $+.94 \pm 3.66^{(1)}$.

The mean change in scores on the language usage test was $-.14 \pm 6.51^{(1)}$.

Dictation was not forgotten appreciably by them during the summer, for the group made a net gain of forty-nine score points or a mean gain of $+.94$. Of the twenty-eight who made gains, fourteen belonged to the lower half. The same situation is borne out by the lowest decile group in comparison with the upper decile. These findings are in variance with those of the eighth grade group.

It may be that the lateness of the hour at which the upper group wrote their tests affected this particular result. At any rate, the results differ from those of the eighth grade group and, before any definite conclusions can be drawn, more research on

(1) The standard deviation is not larger than the mean, as the scores on which the mean is based extend in both directions from zero.

this problem needs to be done. The eighth grade group showed consistent gains for the superior pupils, but in the ninth grade group the inferior group broke even with the superior group and even held an occasional lead.

TABLE IX also shows the scores made by this ninth-grade group in the test on language usage. Here, as in the eighth-grade group, the knowledge acquired of good language practices up to May of that year underwent little change during vacation time, taking the group as a whole. The mean change with the ninth-grade group was $-.14$ test-score points, while with the eighth-grade it was slightly positive. Had the ninth grade had the same ease in writing the September test as did the eighth-grade group, the results might have been slightly on the positive side, as well. As it was, nineteen of the forty-nine pupils made a gain of 130 points, an average of seven score points per pupil, and four made no change.

There is no marked contrast between the upper twenty-four and the lower, ranked by mental ages, in their ability to retain and acquire knowledge of good English practices although the upper half made a little better showing. Never-the-less, the lowest decile group was better than the highest decile in having a greater number of individuals who gained in knowledge, in having fewer who lost, and in having gained the greater number of score points. With four exceptions, all of the upper half in mental age had all of their sittings in taking the September test after school hours

and these were held during the first week of school. How much their fatigue affected the scores, it is impossible to say, but it is quite probable it did lower the quality of their performance. The long session taxed their endurance and dampened their interest quite obviously. It may, however, have had no effect on the scores of the group as a whole since the superior pupil generally is spurred on by slight handicaps and rises above them.

TABLE X shows the scores made in the literature and in the history-civics tests by the ninth-grade group.

TABLE X Scores in Literature and History-Civics
Made by the Ninth Grade on the New Stanford
Achievement Test -- Advanced Form W

Pupils	M.A.	Literature				History-Civics			
		May	Sept.	Gain	Loss	May	Sept.	Gain	Loss
1	17- 5	109	113	+4		117	121	+4	
2	17- 0	101	106	+5		106	113	+7	
3	17- 0	102	103	+1		103	102		-1
4	16-10	126	126	0		101	107	+6	
5	16- 9	121	124	+3		119	121	+2	
6	16- 6	109	107		-2	110	116	+6	
7	16- 5	107	118	+11		89	99	+10	
8	16- 5	103	103	0		113	130	+17	
9	16- 5	106	102		-4	124	104		-20
10	16- 5	77	85	+8		93	95	+2	
11	16- 3	93	94	+1		85	89	+4	
12	16- 3	101	104	+3		113	111		-2
13	16- 2	105	112	+7		108	117	+9	
14	16- 2	105	100		-5	113	107		-6
15	16- 0	113	110		-3	113	117	+4	
16	16- 0	108	103		-5	110	125	+15	
17	16- 0	104	112	+8		117	119	+2	
18	16- 0	101	105	+4		102	98	-4	-4
19	16- 0	90	89		-1	89	94	+5	
20	16- 0	96	99	+3		105	106	+1	
21	15-10	98	99	+1		95	104	+9	
22	15-10	103	95		-8	103	107	+4	
23	15-10	91	91	0		93	102	+9	

TABLE X (Continued) Scores in Literature and History-Civics

Pupils	Literature				History-Civics				
	M.A.	May	Sept.	Gain	Loss	May	Sept.	Gain	Loss
24	15- 8	64	94	+30		91	99	+8	
25	15- 8	94	105	+11		91	82		-9
26	15- 6	96	102	+6		94	107	+13	
27	15- 6	110	105		-5	111	108		-3
28	15- 4	95	95	0		91	92	+1	
29	15- 2	107	102		-5	101	104	+3	
30	15- 2	99	99	0		112	121	+9	
31	15- 2	91	91	0		89	95	+6	
32	15- 2	94	85		-9	105	111	+6	
33	15- 0	88	97	+9		93	89		-4
34	15- 0	86	86	0		102	98		-4
35	14-10	86	77		-9	93	103	+10	
36	14- 8	93	99	+6		90	96	+6	
37	14- 6	86	77		-9	101	93		-8
38	14- 4	69	90	+21		99	100	+1	
39	14- 4	86	82		-4	93	93	0	
40	14- 4	72	58		-14	89	90	+1	
41	14- 2	98	98	0		101	96		-5
42	14- 2	86	93	+7		102	102	0	
43	14- 0	95	93		-2	97	101	+4	
44	14- 0	98	96		-2	102	105	+3	
45	13-10	98	101	+3		92	93	+1	
46	13- 5	96	101	+5		103	105	+2	
47	13- 3	93	95	+ 2		91	90		-1
48	12-10	91	87		-4	91	93	+2	
49	12- 8	82	82	0		105	106	+1	
		Totals		+159	-91			+193	-67

The mean change for the group in the literature test was $+1.385 \pm 6.75^{(1)}$. The mean change in the history-civics test was $+2.859 \pm 6.02^{(1)}$.

(1) The standard deviation is not greater than the mean since the scores on which the mean was based extend in both directions from zero.

The group as a whole gained 159 score points in knowledge of literature during the summer. Twenty-three individuals shared in the gains and made an average gain of approximately seven score points. Of the forty-nine pupils, nine retained only as much as they had acquired before but seventeen pupils had a total loss of ninety score points or an average loss of five and three-tenths score points.

In literature, the greater growth on the part of the superior pupils is noticeable in the greater number of score points gained, in the greater number of individuals who made gains, and in the smaller number of pupils who lost part of the knowledge they had previously acquired. This holds true when contrasting the upper half with the lower half or the upper decile group with the lowest decile. Where the upper group made a net gain of sixty-one score points, the lower group had a net loss of four points. The upper group not only retained more literature facts but gained more voluntarily during the summer vacation than did the inferior group.

The history-test scores recorded in TABLE X show history to be a subject that is not readily lost over a period of vacation from school. Of the forty-nine ninth-grade pupils in this study, thirty-five gained 193 points or an average of five and five-tenths points, two made no change, and twelve lost a total of sixty-seven points or an average loss of five and four-tenths points. Vacation periods bring about no undesirable effects on knowledge of history facts learned previously; in fact, they seem

conducive to the learning of new facts with only the stimulation of a voluntary urge needed to bring about the learning situation.

In the history test, the more developed group made greater gains in score points, had more individuals who increased their scores, and had fewer pupils who lost ground. This indication of superiority is true in the comparison of the upper decile group with the lowest decile and the upper half with the lower half. The superior group, at least, made desirable improvement in knowledge of history-facts during the summer's release from school duties.

The test scores in geography and in physiology-hygiene are recorded in TABLE XI.

TABLE XI Scores in Geography and Physiology-Hygiene
Made by the Ninth Grade on the
New Stanford Achievement Test Advanced Form W

Pupils	M.A.	Geography			Physiology-Hygiene				
		May	Sept.	Gain	Loss	May	Sept.	Gain	Loss
1	17- 5	121	121	0		126	121		-5
2	17- 0	120	123	+3		127	123		-4
3	17- 0	110	112	+2		110	110	0	
4	16-10	116	109		-7	130	132	+2	
5	16- 9	127	123		-4	117	127	+10	
6	16- 6	125	119		-6	121	122	+1	
7	16- 5	105	106	+1		108	104		-4
8	16- 5	125	121		-4	132	129		-3
9	16- 6	109	106		-3	101	105	+4	
10	16- 5	76	79	+3		100	105	+5	
11	16- 3	78	79	+1		91	96	+5	
12	16- 3	123	118		-5	119	110		-9
13	16- 2	123	125	+2		100	105	+5	
14	16- 2	125	113		-12	103	102		-1
15	16- 0	125	129	+4		113	117	+4	
16	16- 0	127	120		-7	109	121	+12	
17	16- 0	123	128	+5		100	116	+16	
18	16- 0	105	109	+4		105	105	0	
19	16- 0	109	109	0		110	95		-15
20	16- 0	117	116		-1	97	119	+22	

TABLE XI (Continued)

Pupils	Geography				Physiology-Hygiene				
	M.A.	May	Sept.	Gain	Loss	May	Sept.	Gain	Loss
21	15-10	121	128	+7		127	127	0	
22	15-10	120	117		-3	119	113		-6
23	15-10	101	104	+3		103	104	+1	
24	15- 8	92	96	+4		109	99		-10
25	15- 8	100	91		-9	104	92		-12
26	15- 6	110	117	+7		113	109		-4
27	15- 6	117	123	+6		138	110		-28
28	15- 4	96	98	+2		99	109	+10	
29	15- 2	120	116		-4	113	113	0	
30	15- 2	113	121	+8		114	114	0	
31	15- 2	101	95		-6	101	78		-23
32	15- 2	105	109	+4		96	97	+1	
33	15- 0	104	95		-9	123	105		-18
34	15- 0	95	99	+4		109	102		-7
35	14-10	102	100		-2	97	96		-1
36	14- 8	113	117	+4		105	109	+4	
37	14- 6	102	99		-3	101	102	+1	
38	14- 4	110	113	+3		113	95		-18
39	14- 4	120	116		-4	94	95	+1	
40	14- 1	89	87		-2	99	86		-13
41	14- 2	108	128	+20		120	108		-12
42	14- 2	101	112	+11		94	103	+9	
43	14- 0	101	101	0		98	99	+1	
44	14- 0	105	109	+ 4		123	106		-17
45	13-10	97	106	+ 9		110	103		-7
46	13- 5	112	111		-1	113	108		-5
47	13- 3	100	117	+17		106	106	0	
48	12-10	81	81	0		96	96	0	
49	12- 8	113	123	+10		102	110	+8	
		Totals		+148	-92			+122	-222

The mean change in the scores on the geography tests was $+.910 \pm 5.76^{(1)}$. The mean change in the scores on the physiology-hygiene tests was $-2.68 \pm 8.90^{(1)}$. This group of forty-nine

(1) The standard deviation is not larger than the mean, as the scores on which the mean is based extend in both directions from zero.

ninth-grade pupils made a total gain of 148 test score points in geography, made a loss of ninety-two test score points, or a net gain of fifty-six score points. In this group, twenty-six pupils had an average gain of five and seven-tenths points, four made no change, and nineteen lost a total of ninety-two points. Since sixty-one per cent of the group experienced no loss and fifty-three per cent made a large gain, the summer vacation is not too disastrous from the standpoint of geography facts.

As it was with the eighth grade program of teaching, so it was with the ninth. Geography learning is only a by-product in these two grades, for the subject is not taught formally in either grade. The information which the pupils had was largely a hold-over from their seventh-year work plus general development resulting from reading and travel. It was, therefore, a sort of "endurance test" in retention of acquired knowledge, for the ninth-grade pupils were, at the time of the September test, two years removed from their formal learning experiences in geography. In the eighth-grade findings, the upper half in mental age showed very little gain over the lower half after being removed more than a year from the main learning experience although the two extreme ends of the group, ranked by mental age, gave a considerable lead to the upper end.

TABLE XI shows that a total gain of 185 score points in geography was made by thirty-two individuals of the ninth grade group. The upper and lower halves in mental age share these

thirty-two individuals evenly. They also share evenly those who lost. The upper half had a net loss of thirteen points while the lower half had a net gain of seventy-eight score points. When the period of retention extends over a year or more the lower mentality group seems to excel the superior group both in retention and in acquiring new facts.

From the scores in TABLE XI made in the physiology-hygiene test by the ninth-grade group, one may infer that newly acquired facts in this field are not well retained. The mean loss for the whole group is -2.68, with a net loss of one hundred test-score points. The upper half in mental age and the upper decile show markedly superior ability to retain facts in physiology-hygiene and to gain additional facts by their own initiative over the lower groups in each case.

TABLE XII shows the arithmetic scores made by the ninth-grade group in reasoning and in computation.

TABLE XII Scores in Arithmetic Reasoning and
Arithmetic Computation of the Ninth Grade Made on
the New Stanford Achievement Test
Advanced Form W

Pupils	M.A.	Arithmetic Reasoning				Arithmetic Computation			
		May	Sept.	Gain	Loss	May	Sept.	Gain	Loss
1	17- 5	119	119	0		116	117	+1	
2	17- 0	102	112	+10		98	111	+3	
3	17- 0	114	120	+6		115	113		-2
4	16-10	104	112	+8		110	107		-3
5	16- 9	110	112	+2		114	114	0	
6	16- 6	109	104		-5	90	86		-4
7	16- 5	112	114	+2		114	113		-1
8	16- 5	96	96	0		95	92		-3
9	16- 5	105	102		-3	113	110		-3
10	16- 5	107	109	+2		120	110		-10
11	16- 3	102	105	+3		114	104		-10
12	16- 3	105	109	+4		104	88		-16
13	16- 2	100	96		-4	101	95		-6
14	16- 2	114	105		-9	115	95		-20
15	16- 0	105	98		-7	107	104		-3
16	16- 0	102	104	+2		107	86		-21
17	16- 0	110	109		-1	115	109		-6
18	16- 0	100	96		-4	115	104		-11
19	16- 0	109	105		-4	114	114	0	
20	16- 0	96	98	+2		88	90	+2	
21	15-10	110	104		-6	101	115	+14	
22	15-10	100	104	+4		112	115	+3	
23	15-10	102	104	+2		104	113	+9	
24	15- 8	105	107	+2		104	110	+6	
25	15- 8	88	88	0		104	98		-6
26	15- 6	98	96		-2	95	90		-5
27	15- 6	102	105	+3		107	107	0	
28	15- 4	109	102		-7	95	107	+12	
29	15- 2	102	107	+5		109	114	+5	
30	15- 2	104	100		-4	113	96		-17
31	15- 2	102	98		-4	112	90		-22
32	15- 2	98	100	+2		110	104		-6
33	15- 0	104	110	+6		109	98		-11
34	15- 0	83	91	+8		73	80	+7	
35	14-10	110	109		-1	112	110		-2
36	14- 8	94	104	+10		114	114	0	
37	14- 6	91	94	+3		101	92		-9
38	14- 4	100	98		-2	101	88		-13

TABLE XII (Continued)

Pupils	M.A.	Arithmetic Reasoning				Arithmetic Computation			
		May	Sept.	Gain	Loss	May	Sept.	Gain	Loss
39	14- 4	96	96	0		111	96		-15
40	14- 4	105	104		-1	101	109	+8	
41	14- 2	96	100	+4		113	107		-6
42	14- 2	104	91		-13	95	96	+1	
43	14- 0	98	94		-4	86	74		-12
44	14- 0	100	85		-15	88	88	0	
45	13-10	85	88	+3		107	110	+3	
46	13- 5	85	88	+3		76	88	+12	
47	13- 3	85	85	0		83	71		-12
48	12-10	88	80		-8	80	70		-10
49	12- 8	100	102	+2		96	96	0	
		Totals		+98	-104			+86	-265

The mean change in scores on the arithmetic reasoning test was $-.245 \pm 4.95^{(1)}$. The mean change in the scores on arithmetic computation was $-4.146 \pm 8.19^{(1)}$.

Here, as with the other two studies, the indications are that reasoning ability suffers no material loss through a period of inactivity from school work but computation does. In reasoning, twenty pupils showed a loss of training effects against twenty-nine who lost in ability to compute.

In arithmetic reasoning, the ninth-grade group bears out the same findings that were indicated by the eighth-grade group. The upper half in mental age shows a greater number of individuals who increased their ability and fewer who showed a decrease in

(1) The standard deviation is not larger than the mean, as the scores on which the mean is based extend in both directions from zero.

ability. The same relation exists between the upper and lower decile groups.

In computation, the reverse is true just as it was with the eighth-grade group. The lower half in mental age had a slightly greater net loss but fewer individuals who showed a loss of training. In decile comparison, the two extremes show the same number of pupils making gains, the same number experiencing losses, and the same number of pupils remaining constant with the greatest gain of score points for the lower as well as the greatest losses.

A summary of the gains or losses by the different groups is shown in TABLE XIII.

TABLE XIII A Summary of the Gains and Losses

Made by the Pupils in this Experiment

Table No.	Tests and Subtests	Mean Change	S.D. of Change
	Los Angeles Diagnostic Tests		
I	Fund. of Arith., Form 1	-6.463	8.73 ⁽¹⁾
II	Reason. in Arith., Form 2	- .135	4.70
	Stanford Achievement Test, Forms V & W Eighth Grade: 72 cases		
III	Paragraph Meaning	- .767	7.56
III	Word Meaning	+1.733	4.65
IV	Dictation	+1.164	4.96
IV	Language Usage	+1.379	7.92
V	Literature	+2.676	9.96
V	History-Civics	+ .50	6.88
VI	Geography	+ .166	6.54
VI	Physiology-Hygiene	+2.885	7.14
VII	Arithmetic Reasoning	+ .052	7.12
VII	Arithmetic Computation	-2.53	8.10
	Stanford Achievement Test, Forms V and W Ninth Grade: 49 cases		
VIII	Paragraph Meaning	+2.544	5.16
VIII	Word Meaning	+2.684	3.84
IX	Dictation	+ .940	3.66
IX	Language Usage	- .140	6.51
X	Literature	+1.385	6.75
X	History-Civics	+2.859	6.02
XI	Geography	+ .910	5.76
XI	Physiology-Hygiene	-2.680	8.90
XII	Arithmetic Reasoning	- .245	4.95
XII	Arithmetic Computation	-4.146	8.19

(1) These standard deviations are not larger than the means as the scores on which the means are based extend in both directions from zero.

Chapter IV

Summary

Does the summer vacation take a heavy toll from the knowledge acquired by pupils during the preceding school year or years? This question can be answered safely in the negative, as out of the twenty-two tests tabulated, only eight showed a mean change that is not a gain. Of these eight tests which showed a loss of knowledge, only four losses were sufficiently large to cause any concern at all. To offset those four which showed some noticeable loss, there were five tests which showed an equal gain and nine more which showed enough change on the positive side to prove clearly that the summer vacation does not cause a heavy loss in the knowledge attained during the preceding year or years.

The findings of this experiment indicate that there is no special need for strenuous review drills at the beginning of the school year except, possibly, in the fundamentals of arithmetic. Even here there is reason to cause one to hesitate before launching a campaign of strenuous review. If the facts involved in the computation processes function so little in the lives of boys and girls that, during the period of school inactivity, many of these facts slip away, the fault may be with the arithmetic program rather than with the summer vacation. The results need to be analyzed further to ascertain whether there is justifiable reason for this forgetting. Perhaps greater economy of time and effort

would result if certain computation facts that are now included in the study of arithmetic for the eighth grade were taught at a later period when they would fill a greater need in the lives of the pupils. Skill in any performance is desirable only in-so-far as it functions in the interests of the individual at the time he is acquiring it or as a preparation for later activities in which its absence would be a distinct and assured handicap. As a pupil's interest wanes, his skill of performance wanes. When he does not see that a subject or a degree of skill will be of use to him, he will not work at it as hard or as advantageously as he would if he saw its benefits to him. In the same way, it is very difficult to secure the same degree of interest from young pupils, especially, in a repetition of a situation of practice or of testing unless a new urge can be created in each individual. This is practically impossible in a performance that functions as little as would speed in addition and division in the lives of boys and girls from a Children's Aid Society which could hardly be cited as a normal group or one in a normal situation.

The indications are that the pupils who are more mature mentally not only retain more of previously acquired knowledge but are more active in gaining new facts when left to their own voluntary efforts than are the more inferior pupils. In general, the more mature child comes back to school better equipped with facts and relationships than he was when he left it for the vacation period. This is not true with the less mature group,

however. These pupils retain less of what they have previously learned, and they acquire less voluntarily so that, at the reopening of school, they must begin lower down the educational ladder than the level to which they had climbed or had been driven at the beginning of the vacation period. These indications persist through all the tests except those in arithmetic computation and in geography. In computation, the lower groups in mental age lost less than the upper group over the summer although both groups suffered noticeable losses. In geography, the findings are not so consistently in favor of the lower mental-age group, yet there are indications that geography facts challenge the interest of the lower group fully as much as they do the upper group. In both computation and geography, the ability to recall facts enters in largely. In this form of mental work, the more inferior pupil is not handicapped as much as he is in tests in which abstract thinking is involved. Since this is the work that he can do well, the recalling process may have greater interest for him than for the more mature pupil who finds greater challenge in thought.

Do the so-called drill subjects suffer greater loss than do the content subjects? Here, again the answer can only indicate trends. In subjects, such as history and literature, in which reading during vacation tends to bring back to the attentions of the pupils facts previously learned, forgetting is less likely to occur. At the same time, new material is gained which may color the results of a test of retention. Reading ability, both in

word analysis and in paragraph meaning, is not hurt by the vacation period. Though reading is a skill, it differs from the skill in manipulating numbers in that it is a skill used more frequently by the junior high school boy and girl throughout the summer vacation; consequently, he loses less of his reading skill than of his skill in computing figures. Skill to spell words seems to remain constant through the long vacation. There seems to be little urge on the part of the pupil to learn to spell on his own initiative. Spelling of words has little challenge for the pupils of junior high school age.

A summary of the trends indicated by this study as to the effects of the long vacation on the previously acquired knowledge of pupils of junior high school age follows:

- (1) Pupils of the junior-high-school age do not forget to any appreciable amount in summer vacation the facts they have learned earlier.
- (2) The new learning that results from maturation, from assimilation, and from free reading more than offsets the loss through forgetting.
- (3) The pupils in the upper rank in mental age not only forget less, but they acquire more through new learning than do those of lower rank.
- (4) The greatest loss of knowledge which has been gained earlier occurs in arithmetic computation; and the least new learning takes place there.

- (5) As a group, pupils of junior high school age read better on their return to school in the fall than they did before the vacation began.
- (6) In the content subjects, there are greater gains than losses resulting from the vacation period.
- (7) Ability to reason in arithmetic is not lost appreciably in the long vacation.
- (8) Pupils in the lower rank in mental age retain number facts slightly better than do those of higher rank but in reasoning ability the upper group has the advantage.
- (9) Facts that are learned largely through memory seem to have more interest for the pupils in the lower rank in mental age for they show better retention of them. Especially is this true when the period of retention is more than a year in length.

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