

A CONTROLLED EXPERIMENT IN VISUAL
EDUCATION IN GENERAL SCIENCE

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Contributions of the Graduate School
Indiana State Teachers College
Number 335

Submitted in Partial Fulfillment
of the Requirements for the
Master of Science Degree
in Education

1938

The thesis of Max C. McCowen ,
Contribution of the Graduate School, Indiana State
Teachers College, Number 335, under the title
A Controlled Experiment in Visual Education
in General Science

is hereby approved as counting toward the completion
of the Master's degree in the amount of 8 hour's
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CHAPTER I

INTRODUCTION

The first few years of the present century may be taken as marking roughly a turning point in the mode in which changes are brought about in American Education. The feature of the new era which sets it off from those which precede it is the application of scientific methods to the investigation of educational problems. Before 1900 new subjects of study, new forms of organization, and new methods of teaching were introduced on the ground of opinion. They were opposed on the same ground. Now proposed innovations, and established practices as well, must meet the challenge of the science of educational measurement, which stands ready to appraise them, not on the ground of opinion, but on the ground of objectively ascertained fact. The real hope for consistent progress in education lies in the application to it of careful, painstaking methods of research.

The need of scientific scrutiny of the group of new methods or devices which go by the name of visual education is apparent on every hand. Visual education is relatively expensive, particularly in the form of motion pictures. Extreme and extravagant claims are made for visual education. We are told that it will speed up education tenfold, that it will in whole

or in part displace the teacher or textbook, that it will make education absorbingly interesting and thoroughly permanent.

Visual education is promoted by advertising campaigns which set forth the most grotesque arguments for adoption such as: "What goes in one ear goes out the other, but what goes in through the eye sticks, as there is no hole in the back of the head."¹

This study was undertaken in the belief that school administrators have sufficient confidence in scientific methods to be hospitable to a serious attempt to weigh the educational possibilities of visual education.

The writer of this experiment disclaims any pretension of having finally and completely determined what the possibilities are.

What is Visual Education? This is a question asked by some and should be answered before the writer continues. Visual education represents a grouping of educational materials or devices and an organized department of instruction which is based, not upon subject matter but upon the method of presentation.² This method has as its essential feature the fact that it belongs to one of the senses. Such a situation is without parallel. We do not have departments of auditory education, or olfactory education.

¹ Frank N. Freeman, Visual Education: A Comparative Study of Motion Pictures and Other Methods of Instruction. (Chicago: The University of Chicago Press, 1924). p. 4.

² Ibid.

The term visual education as it is used in this study will refer to the use of motion picture films and lantern slides as aids to classroom instruction.

I. THE PROBLEM

Statement of problem. It was the purpose of this study to evaluate two groups of students, one group being taught by the traditional method and visual aids while the second group was taught wholly by the traditional method or without motion picture films and lantern slides.

II. SIMILAR STUDIES

Trends since 1915 in instructional motion picture research.³ Experimental study of the motion picture in classroom instruction began shortly after 1915. Among the first experiments reported was that of David Sumstine, published in School and Society, in 1918. Whatever limitations this investigation may reveal in the light of more recent teaching technique and experimental methods, it was, nevertheless, a beginning of experimental study of the role of the motion picture in instruction.

Within six years following the publication of Sumstine's study and culminating in the publication of the University of Chicago study in visual education in 1924, research developed

³ Edgar Dale, Fannie W. Dunn, Charles F. Hoban Jr., Etta Schneider, Motion Pictures in Education. (New York: H. W. Wilson Company, 1937. pp. 307-312.

rapidly. The general problem attacked was the instructional function of the motion picture in relation to (a) other visual aids such as slides, demonstrations, maps, and the like, and (b) the traditional classroom procedures utilizing purely verbal instruction, by means of textbooks, supplementary reading and so on.

Among the pioneers in this phase of experimentation were the late Joseph J. Weber, F. Dean McClusky, and Frank H. Freeman. Weber devoted himself largely to the attempt to discover the relative values of the motion picture, the slide, and the diagram accompanied by verbal instruction, in the development of informational learning.

McClusky's⁴ investigation was more extensive in pupil population, range of subject matter, and increased variation of the technique of motion picture use. While his general problem was much the same as Weber's, McClusky introduced a broadened conception of motion picture technique, varying the number of projections and the kind and amount of verbal accompaniment.

Freeman's early contribution was directive, experimental, and editorial. He directed the research undertaken at the University of Chicago under a grant of \$18,000 from the Commonwealth Fund, conducted some of the experimental studies, and edited the published report of the investigation. Thirteen studies were reported dealing with the comparison of various

⁴ Ibid., p. 307.

modes of presentation of motion pictures with other visual and non-visual methods of instruction in a wide variety of subjects of the curriculum.

The University of Chicago studies were intended to define in broad general terms the function of the motion picture in instruction. Its superiority over other visual aids was determined to be the depiction of motion, and its place in the instructional procedure in those learning situations in which "it is essential to grasp the nature of the movement."⁵ Freeman also postulated a second function, less clearly evident at that time from experimental data, as the arousal of interest and the sustenance of attention. He pointed out the need for further experimentation to establish this function.

With the function of the motion picture in education thus broadly defined, experimentation from 1924 to 1930 was extended to the problem of the contribution of the motion picture in arousing various types of pupil reactions, particularly in the social studies. Wood and Freeman⁶ undertook an extensive investigation under a grant from the Eastman Kodak Company to determine the contribution of the motion picture, when used as an integral part of classroom teaching procedure, in (a) motivating greater pupil activity in relation to the subject studied, (b) increased factual learning, (c) improving descriptive processes, and (d) promoting understanding of causes, effects and relationships.

⁵ Freeman, op. cit., p. 74.

⁶ Dale, Dunn, Hoban Jr., Schneider, op. cit., p. 308.

At approximately the same time, Knowlton and Tilton⁷ were investigating the functions of the Yale Chronicles of America photoplays in (a) motivating greater pupil activity and classroom participation, (b) increasing knowledge of historical chronology, historical geography, historical personages, and interaction of events, causal relationships, and interrelationships other than time, and (c) increasing permanency of learning in these various aspects. Whereas the Wood and Freeman investigation was extensive, the Knowlton and Tilton investigation was intensive, and whereas Wood and Freeman secured their measures of motivating influence of films from reports of cooperating teachers, Knowlton and Tilton devised methods of securing quantitative data on this problem. Regardless of the measures employed, the results of the two investigations on the problem of motivation were in essential agreement.

In England during this same period Consitt⁸ was at work. Abandoning as too limited in its possibilities the objective method of measuring results of instruction, she secured reports from a large number of teachers and pupils throughout England on (a) the values accruing to the use of the motion pictures in instruction, (b) its adaptability to various age and grade levels, (c) the nature of the pupil response, and (d) the technical imperfections of available motion pictures.

⁷ Ibid., p. 309.

⁸ Ibid., p. 309.

The experimental studies of the 1924-1930 period differed from those reported prior to 1925 in that: (a) the motion pictures which were used for experimental evaluation were specifically constructed for instructional purposes, while those previously used were in many cases films produced by industrial concerns for indirect advertising purposes, (b) the instructional periods were of sufficient length to permit organized use of several films and the accumulation of reliable results, (c) the motion pictures were used as an integral part of the instructional procedure in addition to the traditional media and procedures of instruction, (d) wider sampling was made of pupil population, teachers, age-grade, and mental-ability levels, (e) learning outcomes were more finely differentiated and more accurately measured, (f) indirect outcomes, such as greater classroom participation, increased voluntary reading, etc., were studied, (g) permanent as well as immediate results of motion pictures instruction were investigated, (h) comparative effectiveness of motion-picture instruction with various age-grade and mental-ability levels was measured, (i) objective measures were supplemented by reports of teachers and pupils on their experiences with instructional motion pictures.

Up to 1930, however, research was limited to the use of silent films. Meanwhile, sound accompaniment has been added to motion pictures. During the past six years the general trend of experimental research has been in the direction of (a) the effectiveness of sound motion pictures in informational learning and the development of thinking in various subject-matter areas,

(b) the relative effectiveness of various methods of verbal accompaniment to motion pictures with large and small classes. Arnspiger and Rulon investigated the effectiveness of sound pictures produced for and used with definite units of instruction.

Clark, Westfall, and Einbecker⁹ evaluated the effectiveness of various methods of verbal accompaniment to films. The problem of the effectiveness of motion picture with large and small groups of pupils was investigated by Stoddard,¹⁰ who compared sound motion pictures in auditorium showings with traditional non-visual methods in the classroom, and by Knowlton and Tilton,¹¹ who compared the auditorium and classroom use of silent films.

Characteristic research developments of this most recent experimental investigation are: (a) extended investigation of problems previously isolated, (b) use of sound motion pictures in experimental classes, (c) greater correlation and integration of motion pictures with the curriculum, (d) more intensive study of smaller and better controlled experimental groups.

During this same period a series of studies on the social influences of the motion pictures, including a study of learning in the theatrical situation, was carried on under the direction

⁹ Ibid., p. 310.

¹⁰ Ibid., p. 311.

¹¹ Ibid., p. 311.

of W. W. Charters¹² of Ohio State University. Because they deal with the theatrical film apart from the purely "instructional" film, treatment of these studies is omitted from this discussion. By their implication these studies are, however, of great instructional significance, and in a broad sense of the word treat directly the "educational" influence of the motion picture.

In this review of trends since 1915 in instructional motion-picture research, reference has been made only to the major published studies, most of which were subsidized by some agency interested in the use of films in education. During the entire period many smaller and more restricted investigations were carried on independently, generally by a graduate student in partial fulfillment of requirements for advanced degrees. The result of this independent research has been, in general, the extension of data on problems already investigated.

Since the writer's study is not as large in scope as the studies previously reported, a similar study related to the writer's experiment will be reviewed in addition to one of the larger studies made.

III. RELATED STUDIES

Halsey¹³ reports in a study in which three classes are selected in which all were doing the same work in geography.

¹² Ibid., p. 311.

¹³ James H. Halsey, "An Experiment in Geography Teaching." The Educational Screen. 15:137-141, May, 1936.

Two-thirds of all participating in the experiment were members of the 9-A class, and the remainder had a 10-B classification. In two of the classes there were twenty-nine and in the third class twenty-two.

The first of these classes, in which there were twenty-nine pupils, served as the control group. The instruction was carried on in the usual method of daily assignment, class recitation and discussion, and supervised class study. No motion pictures or lantern slides were used.

The second of these classes, which also had twenty-nine pupils, served as experimental group I. The instruction of this group was similar to that of the control group with the exception that motion pictures and lantern slides were shown.

The third class, in which there were only twenty-two pupils, served as experimental group II. The instruction of this group was radically different from the instruction of the other two. Experimental group II was given no outside or homework assignments, the class was conducted entirely in the informal lecture-discussion method, and the motion pictures and lantern slides, instead of the textbook, were the basis of instruction.

A comparison of general ability of the three groups was made by the use of medians of the intelligence scores, standardized tests in United States geography and of the pre-test.

From the median scores the control group had the highest general ability, the experimental group I the second highest, and the experimental group II the lowest general ability.

To accurately measure the increase in knowledge of these three classes the same test was used before and after the experiment.

The results of the experiment as indicated by the scores on the end-test are in exactly opposite order to the results that might be expected considering the general abilities of the three groups. These results show an advantage for the use of motion pictures and lantern slides, as well as a decided advantage for a modified teaching technique and class plan in the use of visual aids. Experimental group II, having the modified teaching technique and class plan, in which the instruction was based on visual aids, made the highest scores. Experimental group I, which also saw the films and slides, but which depended mostly on the text and the conventional teaching methods, made the second highest scores. The control group which saw no films or slides made the lowest scores.

Freeman¹⁴ reports in a study in which films were used to test the effectiveness of the instruction of groups of pupils who saw films with the effectiveness of other groups who studied the same topic but did not see the films. The comparison was made in twelve cities scattered throughout the different parts of the country. In all, nearly 10,000 children took part in the experiment. These were about equally divided between the experimental groups who saw the films and the control group who

¹⁴ Frank N. Freeman, "Experimental Evaluation of Classroom Films." School Executive. December, 1929. p. 170.

did not. About two-thirds of the children were in the geography classes in the elementary schools and one-third in the general science classes in the junior high schools. Care was taken to select classes in the experimental and control groups which should be as nearly as possible the same general social background or type of neighborhood, in age, grade, and intelligence. In order that the groups might be compared in intelligence and information, scores on intelligence tests were obtained for all groups. In addition, a test on the subject matter which was to be covered by the lessons was given at the outset of the experiment.

In order that progress and achievement of the two groups might be compared it was necessary that they covered approximately the same ground in their study. In order to do this, a study guide was prepared to cover each lesson. At the end of the experiment another set of questions was administered.

Both the intelligence test scores which were obtained from the various school systems and the subject-matter which was given at the beginning of the experiment show that the pupils in general science were not exactly matched. Taking all of the cities together, the pupils in the experimental group who saw the films were somewhat lower in intelligence and had somewhat less information on the subject to be studied than the pupils in the control groups. In geography the groups were about evenly balanced.

The general results of the experiment, both in geography and in general science, came out quite clearly in favor of the

films. That the pupils who saw the films acquired a significantly larger amount of information than did the pupils who did not see them appeared proven beyond question.

CHAPTER II

THE PROCEDURE

I. FIRST PROCEDURE

Source of data. The data for this study were collected from two 7-A general science classes in the Laboratory School of Indiana State Teachers College.

The study was conducted over a period of about thirteen weeks. (February 7, 1938 to May 9, 1938). The classes were equated upon the basis of the student's I. Q. rankings.¹ There was a very close I. Q. correlation between the two groups. The 7-A² group showed a very slight advantage over the 7-A¹ group in their I. Q.'s. Table I shows the I. Q. ranking of the two groups. The median for both groups was 102.5. Figure 1 illustrates the correlation of the I. Q.'s. The group hereafter to be known as the experimental group will be spoken of as the X group and the control group will be spoken of as the C group. The X group was composed of 21 students and the C group consisted of 20 students. Both groups will first be discussed in relation to the first unit which will be known as Unit A. This unit was entitled "Life on the Earth." Each group was given the same pre-test of the work to be covered during the duration of the unit. The work assigned to each class was the same

¹ Otis Self-Administering Tests of Mental Ability: Intermediate Examination.

TABLE I

I. Q. RANKINGS OF STUDENTS IN
GROUPS 7A¹ AND 7A²

Student number	Group 7A ¹	Group 7A ²
1	125	126
2	122	120
3	119	118
4	116	114
5	114	113
6	112	111
7	111	109
8	109	108
9	106	105
10	105	104
11	101	101
12	98	99
13	98	98
14	97	97
15	96	96
16	94	92
17	91	91
18	91	85
19	90	81
20	79	70
21	67	
Median	102.5	102.5

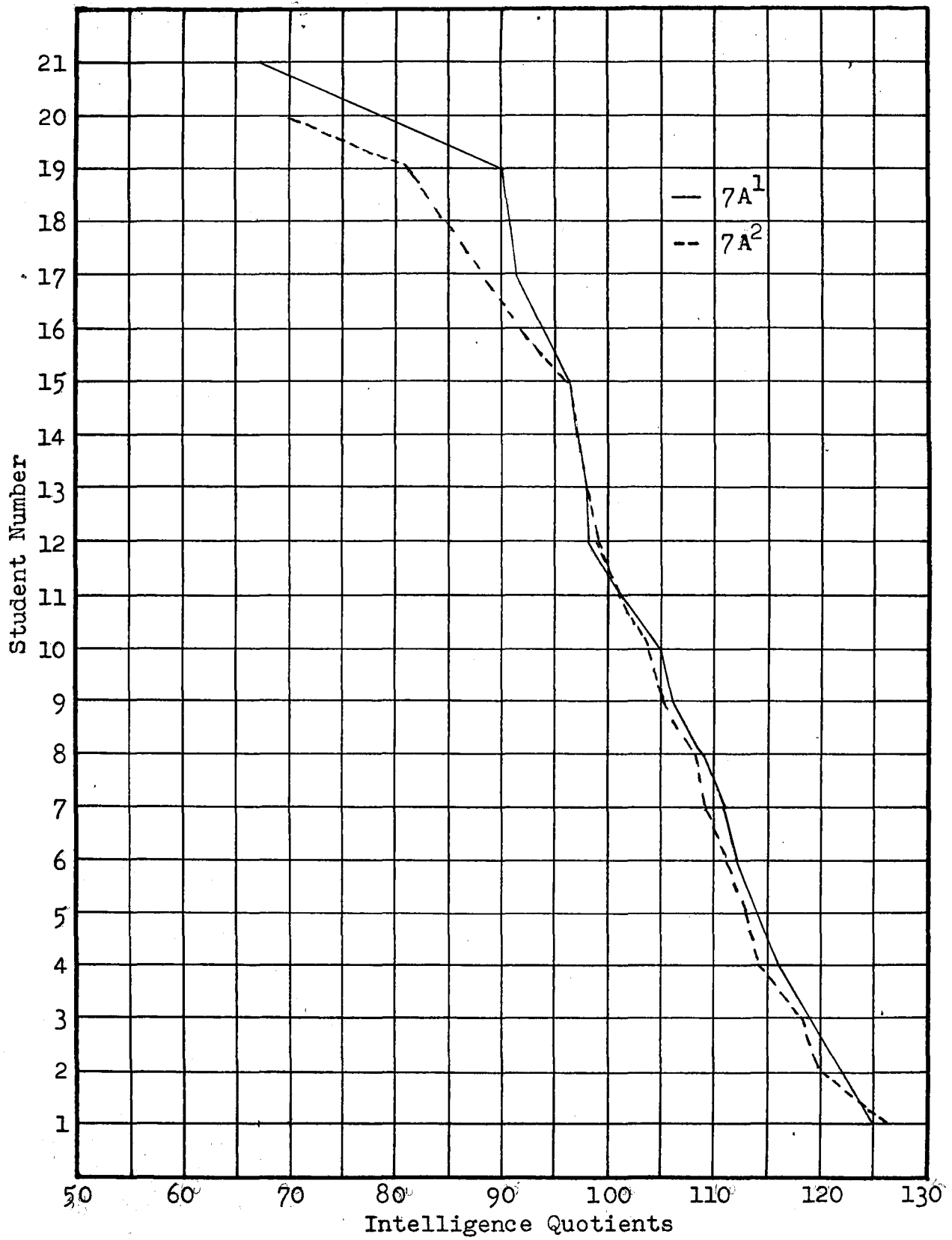


FIGURE I
I. Q. Distributions

except the X group was allowed to see motion pictures (16 mm.) and lantern slides related to their general science lessons.² The writer discussed the films and slides as they were shown to the class so as not to leave any misunderstandings in the minds of the students. Each class was given laboratory work as was needed to explain a science concept. In order that the X and the C group might cover the same material in Unit A, a study guide³ was prepared to cover each topic in the unit. After the work of Unit A was completed the same pre-test was given as a post-test.⁴ The same length of time was allotted for the unit in both groups with the exception of the class study periods of the X group which were reduced to show the motion picture films and lantern slides. Lantern slides were shown to review the topics that were discussed in the unit.

II. SECOND PROCEDURE

A second unit which shall be known as Unit B was taught in which the previous control group became the new experimental group and the previous experimental group became the new control group. These new groups will be spoken of as X and C groups in relation to Unit B. This unit was entitled "The Relation of the Water Supply to the Welfare of the Community." The X group

² Mr. Ford Lemler, director of the Visual Education Bureau of Indiana University cooperated in securing the proper motion picture films and slides from his department to be used as teacher aids. The Keystone View Company, Meadville, Pennsylvania furnished the necessary lantern slides for this experiment.

³ See Appendix.

⁴ See Appendix.

was composed of 19 students and the C group consisted of 20 students. The same techniques that were used in the first procedure were used in the second procedure. This second procedure will be used to serve as a check upon the first.

III. LIMITATIONS

Since the films and lantern slides were secured through the services of the Visual Bureau of Indiana University, which serves the schools of the Middle West, the films and lantern slides had to be scheduled when they could be secured from the visual education bureau. Because of these difficulties the films and slides were usually shown to present the work of the ensuing class study. It was somewhat difficult to correlate the use of the motion pictures and lantern slides with the class discussions because the visual education bureau will permit the use of their slides only for a short period. It was likewise difficult for their use since the class met only on Monday, Wednesday and Friday of each week. The motion picture films and slides for Unit B were not as plentiful as for Unit A, which was probably due to the fact that not many instructional films and slides have been prepared for this unit.

CHAPTER III

RESULTS FROM THE FIRST PROCEDURE

The unit tests were scored by the writer marking only the correct items on the tests. The scores of the unit tests were condensed into the following tables (Table II and Table III) to show the comparison of the X and C groups in the pre-test and post-test for Unit A. The highest possible score was 75.

The post-test means of the X and C groups were as follows:

X Group	47.28
C Group	<u>41.95</u>
	5.33

The means of the gains of the X and C groups were as follows:

X Group	25.95
C Group	<u>19.20</u>
	6.75

In order to measure the reliability of the unit tests given, it was necessary to find the standard error of the mean for each group, both for the post-test and the difference between the pre-test and the post-test. The following formulas were used:

$$E_m = \frac{\sigma}{\sqrt{N}} \quad \sigma = \left[\sqrt{\frac{\sum t^2}{N} - \left(\frac{\sum t}{N}\right)^2} \right] \times I$$

TABLE II

COMPARISON OF THE PRE-TEST AND POST-TEST SCORES
FOR THE EXPERIMENTAL GROUP, UNIT A

Student number	Pre-test	Post-test	Difference
1	33	51	18
2	38	62	24
3	29	62	33
4	15	46	31
5	23	46	23
6	20	43	23
7	25	46	21
8	28	66	38
9	14	45	31
10	15	46	31
11	17	53	36
12	20	46	26
13	29	50	21
14	12	36	24
15	23	55	32
16	19	45	26
17	15	49	34
18	26	47	21
19	6	32	26
20	26	34	8
21	15	33	18
Means		47.28	25.95
Standard deviations		10.6	7.2
Standard errors		3.26	2.3

TABLE III

COMPARISON OF THE PRE-TEST AND POST-TEST SCORES
FOR THE CONTROLLED GROUP, UNIT A

Student number	Pre-test	Post-test	Difference
1	38	62	24
2	17	42	25
3	21	49	28
4	22	44	22
5	29	55	26
6	28	42	14
7	19	54	35
8	23	43	20
9	18	32	14
10	30	55	25
11	18	37	19
12	20	29	9
13	38	57	19
14	27	37	10
15	20	37	17
16	6	22	16
17	11	37	26
18	26	40	14
19	21	31	10
20	23	34	11
Means		41.95	19.20
Standard deviations		10.25	7.5
Standard errors		3.26	2.3

X Group	E_m post-test = 2.31
C Group	E_m post-test = 2.3
X Group	E_m differences = 1.57
C Group	E_m differences = 1.68

From the standard error of the means of the post-test for the X and C groups the standard error of the difference of the post-test means was found.

$$E_D \text{ (Group X\&C post-test, Unit A) } = 3.26$$

The critical ratio for the post-tests, (Unit A) equals 1.63. This figure of 1.63 is to be interpreted as follows: 94.52¹ times out of 100 the X group will exceed the C group if the unit tests were repeatedly given.

From the Standard error of the means of the gains of the X and C groups the standard error of the difference of the gains was found.

$$E_D \text{ (Group X\&C gains, Unit A) } = 2.3$$

The critical ratio for the gains, (Unit A) equals 2.93. The latter figure is to be interpreted as follows: 99.81² times out of 100 the X group will exceed the C group if the tests were repeatedly given.

¹ Ernest W. Teigs, and Claude C. Crawford, Statistics for Teachers, (Boston: Houghton Mifflin Company, 1930). p. 137.

² Ibid., p. 137.

CHAPTER IV

RESULTS FROM THE SECOND PROCEDURE

The tests for Unit B were scored in the same way as for Unit A, marking only the correct items on the tests. The scores for the unit tests were condensed into the following tables (Table IV and Table V) to show the comparison of the X and C groups in the pre-test and the post-test for Unit B. The highest possible score was 50.

The post-test means of the X and C groups were as follows:

X Group	32.15
C Group	<u>30.05</u>
	2.10

The mean of the gains of the X and C groups were as follows:

X Group	16.42
C Group	<u>14.00</u>
	2.42

In order to measure the reliability of the unit tests given, it was necessary to find the standard error of the mean for each group, both for the post-test and the difference between the pre-test and post-test.

TABLE IV

COMPARISON OF THE PRE-TEST AND POST-TEST SCORES
FOR THE EXPERIMENTAL GROUP, UNIT B

Student number	Pre-test	Post-test	Difference
1	18	42	24
2	19	35	16
3	17	40	23
4	17	36	19
5	24	39	15
6	22	37	15
7	13	39	26
8	8	37	29
9	8	19	11
10	20	31	11
11	15	32	17
12	12	19	7
13	21	37	16
14	18	35	17
15	4	17	13
16	12	31	19
17	13	34	21
18	13	24	11
19	25	27	2
Means		32.15	16.42
Standard deviations		7.75	1.63
Standard errors		2.47	1.82

TABLE V .

COMPARISON OF THE PRE-TEST AND POST-TEST SCORES
FOR THE CONTROLLED GROUP, UNIT B

Student number	Pre-test	Post-test	Difference
1	22	38	16
2	24	27	3
3	19	40	21
4	15	33	18
5	13	44	31
6	14	40	26
7	21	27	6
8	22	43	21
9	11	23	12
10	21	25	4
11	17	32	15
12	17	23	6
13	20	35	15
14	13	21	8
15	11	22	11
16	13	28	15
17	13	29	16
18	6	26	20
19	13	19	6
20	16	26	10
Means		30.05	14.00
Standard deviations		7.65	7.65
Standard errors		2.47	1.82

X Group E_m post-test = 1.78

C Group E_m post-test = 1.71

X Group E_m difference = 1.45

C Group E_m difference = 1.11

From the standard error of the means of the post-test for the X and C groups the standard error of the difference of the post-test means was found.

E_D (X&C group post-test, Unit B) = 2.47

The critical ratio for the post-test, (Unit B) equals .85. The latter figure of .85 is to be interpreted as follows: 80.23¹ time out of 100 the X group will exceed the C group if the unit tests were repeatedly given.

From the standard error of the means of the gains of the X and C groups the standard error of the difference of the gains was found.

E_D (X&C groups gains, Unit B) = 1.82

The critical ratio for the gains, (Unit B) equals 1.33. This figure of 1.33 is to be interpreted as follows: 91.15¹ times out of 100 the X group will exceed the C group in gains if the tests were repeatedly given.

¹ E. W. Teigs, and C. C. Crawford, op. cit., p. 137.

² Ibid., p. 137.

TABLE VI
 DIFFERENCE BETWEEN THE X GROUPS
 FOR UNIT A AND UNIT B

Unit A	Critical ratio	Chances out of 100 that the X group will be superior
Post-test	1.63	94.52
Gain	2.93	99.81
Unit B	Critical ratio	Chances out of 100 that the X group will be superior
Post-test	.85	80.23
Gain	1.33	91.15

CHAPTER V

SUMMARY AND CONCLUSIONS

Summary. The X groups for both Unit A and Unit B show definite improvement over the C groups. The X group for Unit A shows a much greater improvement over the C group than the X group of Unit B shows over the C group. This difference is probably due to the fact that more visual aids were available for Unit A than for Unit B yet what visual aids were shown enhanced the pupils knowledge for the unit.

Conclusions:

1. Visual aids are effective in instruction to the degree that they approach reality of experience.
2. The pupils who saw the visual aids acquired a significantly larger amount of information than did the pupils who did not see them.
3. Visual aids when used to present the topics to be studied serve as motivation for the students.
4. The purpose of educational films and slides is to give the student clearness and perception of objects which are beyond his immediate experience and which are necessary to extend his knowledge of the physical world. Educational films and slides are not designed to displace the teacher nor to take the place of oral discussion or reading. They are designed rather to give the basic experience which may then be elaborated by means of language. This experiment shows convincingly that they are effective means of giving the basic experience. When

they are deliberately planned and consciously used to serve this purpose they should make the student better acquainted with the world in which he lives, and stimulate him to better thinking.

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- Sumstine, David R., "A Comparative Study of Visual Instruction in the High School," School and Society, 7:235-238, February, 1918.
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- Wise, Harold E., "Visual Aids in Science Teaching," The School Executive, 56:346-348, May, 1937.
- Wood, Ben D., "What is the Potential Value of the Teaching Film?" The Nation's Schools, 3:54-60, March, 1929.

ANNOTATED BIBLIOGRAPHY

ANNOTATED BIBLIOGRAPHY

A. FILMS

Tuberculosis and How It May Be Avoided. By scenes and animations, tubercle bacilli are shown growing in the laboratory and in the lung tissue of the human body. A tuberculin test is given, a positive reaction is obtained, and the daily routine at a preventorium is pictured.

Diphtheria. A diphtheritic throat is compared with a normal one--the complete preparation and use of antitoxin are demonstrated--methods of modern diphtheria control and of preventing the disease by the administration of toxin-antitoxin are shown.

Life in a drop of water. Samples of pond water are shown in photomicrographic views illustrating the various kinds of life in a drop of water.

Mosquito, Life History of the Yellow Fever. Includes splendid photomicrographic views of mosquito eggs floating in water, hatching, feeding, swimming, breathing of the larva--metamorphosis from larva to pupa, and from pupa to mosquito--adult mosquito biting and feeding.

Potato Enemies. Takes up potato enemies that attack the vines above the ground: flea beetles, Colorado potato beetle, leaf hoppers, and tarnished plant bugs. It shows the damage wrought by them, and demonstrates the spraying

and dusting methods used to combat these pests. Unit II treats the underground insects and diseases that attack potato tubers.

Cotton Growing. Shows various steps in preparing the ground--stages in the growth of cotton plants--methods of fighting the boll weevil--harvesting, ginning, bagging, and transporting cotton.

Wild Flowers. Woodland, meadow and field flowers live out their life cycles on the screen. Through time-lapse photography they are seen as they grow, blossom and wilt--all in an interval of a few minutes.

From Flower to Fruit. Shows how all parts of a flower help in producing seeds. The flowers of roses, lilies and apples mature, anthers produce pollen, insects assist in pollination, pollen tubes grow, fertilization is completed, and the fruit develops. Time-lapse motion photomicrography and animated diagrams are freely used.

Mold and Yeast. Specimens of mold on fruit, leather, clothes and bread--the way in which molds grow, develop, and germinate--and the formation of buds and new plants of mold like yeast.

Planting and Care of Trees. Outlines the life cycles of the apple tree tent caterpillar, the codling moth, and the white marked tussock moth--shows the ravage of insects--the proper planting and care of trees.

Frogs, Toads, and Salamanders. Development of typical amphibians through the stages of eggs, aquatic larvae, and final metamorphosis to the adult form.

New York Water Supply. Gives an insight into a typical sanitary water system for a large city. Scenes and animations picture methods used in bringing water from the Catskills, through the mountains and under the Hudson River, to New York City.

Irrigation. Pictures the distribution of water through modern systems, and the effect upon lands.

Water Power. The relationship of water power to electricity. Water wheels, high and low head developments, hydroelectric generators, the principle of the turbine and transmission and use of electric power.

Drinking Health. Pictures the necessity of having sanitary means for drinking. The evils of the common drinking cup are also shown.

B. SLIDES

The European Corn-Borer. Illustrating the ways and methods of attack on corn and other crops by corn-borers. Methods of combating the corn-borer are also suggested.

The Fly. This set of slides paints vividly the fly as a disease spreader, and it offers numerous plans for combating this menace.

Development of Plant and Animal Life. Many of these slides are made from microscopic views. This set takes up the

following in detail: cell, seeds, roots, leaves, branches, stems, buds, stems structure, leaf structure, flowers and fruits, bacteria, algae, protoza, metazoa, parasitic worms, arthropods, metamorphosis, insects of economic value, insect pests, fish and frogs, birds, mamals, plant fibers, and the laws of heredity.

Living Things. Plants and Animals--Adapted for use in a general science class.

Farm Sanitation. Sewage and sewerage of farm homes.

Health. A general health set dealing with water, food, activity and protection.

APPENDIX

APPENDIX

UNIT A--LIFE ON THE EARTH

Topic 1. Our Smallest Living Things.

- Problem:
1. Understand what bacteria are, and the conditions under which they grow and reproduce.
 2. Know in what ways bacteria aid us.
 3. Know in what ways bacteria are our enemies.
 4. Understand the relationship of bacteria to human diseases.
 5. Know how to guard the human body against invasion by disease producing bacteria.

I. Questions:

1. What are bacteria? How many kinds are there? How large are they?
2. How do bacteria grow and reproduce? Under what conditions do they grow and reproduce best?
3. Are all bacteria harmful? How do bacteria aid men in industry, in food manufacturing, and in maintaining soil fertility?
4. What is the relation of bacteria to disease?
5. How do persons become immune to a disease?
6. How do bacteria enter the human body?
7. What can an individual do to help his body resist disease?

II. Words you will need to know.

environment	toxin
bacteriology	spore
disinfectant	immune
antitoxin	vaccination
antiseptic	epidemic

III. Laboratory Study--One-celled Plants and Animals

1. Bring to class a small bottle of stagnant water and leave it for us to study.
2. Prepare a slide from one of the cultures of bacteria and study it through a microscope.
3. Make a drawing of what you see.
4. Prepare a slide from the stagnant water that you brought in a few days ago and study it through the microscope.

5. Make a drawing of what you see. How does this slide differ from the first?

IV. Special report: Louis Pasteur

References:

- Davis and Sharpe, Science.
 Caldwell and Curtis, Science for Today.
 Clement, Collister, and Thurston, Our Surroundings.
 Lake, Harley, and Welton, Exploring the World of Science.
 Pieper and Beauchamp, Everyday Problems in Science.
 Powers, Neuner, and Bruner, This Changing World.
 Powers, Neuner, and Bruner, Man's Control of His Environment.
 Skilling, Tours Through the World of Science.
 Watkins and Bedall, General Science for Today.
 Wood and Carpenter, Our Environment: How We Use and Control It.
 Conn, Bacteria, Yeast, and Molds in the Home.
 Stephenson, The World of Invisible Life.

Topic 2. Other Enemies of Man

- Problem: 1. Reasons why the house fly is our most dangerous household pest.
 2. The life history of the house fly and mosquito.
 3. Methods used to exterminate insect pests.

I. Questions:

1. Why is the house fly a deadly enemy of man?
2. What is the life history of the house fly?
3. How can we protect ourselves from flies?
4. What is the life history of the mosquito?
5. How can we control mosquitos?
6. How are insect pests controlled?

II. Words you will need to know:

maggot wriggler anopheles culex
 crop rotation

III. References:

- Davis and Sharpe, Science. pp. 418-421.
 Caldwell and Curtis, Science for Today. pp. 564-565; 632-633.
 Clement, Collister, and Thurston, Our Surroundings. pp. 541-545.

- Lake, Harley, and Welton, Exploring the World of Science. pp. 671-673.
- Pieper and Beauchamp, Everyday Problems in Science. pp. 284-289.
- Powers, Neuner, and Bruner, This Changing World. pp. 235-241.
- Watkins and Bedell, General Science for Today. pp. 483-485.
- Wood and Carpenter, Our Environment: How We Use and Control It. pp. 636-640.
- Peabody and Hunt, Biology and Human Welfare. pp. 498-511
- Gregg and Rowell, Health Studies. pp. 438-462.

Topic 3. The Origin and Development of Living Things.

- Problem:
1. Have a clear understanding that all living things come from living things.
 2. Have a knowledge of how flowering plants reproduce.
 3. Have an understanding of how higher animals reproduce.

I. Questions:

1. What are living things made of?
2. What is the structure of cells, tissues and organs?
3. Does life always come from life?
4. What is the structure and function of a flower?
5. How are seeds formed?
6. What is pollination? What are some different agencies of pollination?
7. How do higher animals reproduce?

II. Words you will need to know:

egg sperm protoplasm fertilization pollination

III. Laboratory study:

1. Observe the frog eggs and watch for any changes.
2. After you have studied a flower, dissect the structure that we have discussed in class.

IV. References:

- Caldwell and Curtis, Science for Today. pp. 524-536; 581-586.
- Powers, Neuner, and Bruner, This Changing World. Chapter 21.
- Watkins and Bedell, General Science for Today, pp. 427-437; 160-161.

- Wood and Carpenter, Our Environment: How We Use and Control It. pp. 769-776.
 Davis and Sharpe, Science, pp. 347-367.
 Clement, Collister, and Thurston, Our Surroundings.
 pp. 312-317.

Topic 4. Improvement of Living Things.

I. Questions:

1. What do we mean by the term heredity?
2. Why do you resemble your parents?
3. Who was Gregor Mendel and for what is he noted?
4. Have animals been improved by man? How?
5. Have plants been improved by man? How?
6. Who was Luther Burbank and for what is he noted?
7. How can man be improved? Explain.

II. References:

- Caldwell and Curtis, Science for Today, pp. 587-595.
 Watkins and Bedell, General Science for Today.
 pp. 529-551.
 Wood and Carpenter, Our Environment: How We Use and Control It. pp. 686-702, 776-790.
 Davis and Sharpe, Science, pp. 438-453.
 Hunter and Whitman, Problems in General Science, pp.
 609-627.
 Van Buskirk and Smith, Science for Everyday Life,
 pp. 480-487.

UNIT A TEST--LIFE ON THE EARTH

I. Multiple Choice

Directions: Each question will consist of several answers. For each question you are to decide which is the best answer, then write the number corresponding to this answer in the space to the left of the number.

- _____ 1. The method by which diseases are transferred is of (1) no (2) great (3) slight importance in determining the method of prevention.
- _____ 2. The most dangerous period of life is (1) babyhood (2) middle age (3) old age.
- _____ 3. (1) red (2) white corpuscles destroy germs.
- _____ 4. Cells reproduce by (1) expanding (2) contracting (3) dividing (4) increasing.
- _____ 5. Bacteria which are shaped like a sphere are known as (1) cocci (2) spirilla (3) bacilli (4) legumes.
- _____ 6. Bacteria grow best in a place which is (1) dark (2) light (3) cool (4) dry.

- _____ 7. Bacteria in milk converts the sugar into (1) souring (2) tubercle (3) lactic acid (4) hydrocholic acid.
- _____ 8. The science of improving the heredity of future generations is known as (1) genetics (2) logic (3) biology (4) eugenics.
- _____ 9. Laws of heredity were discovered by (1) Edison (2) Burbank (3) Mendel (4) Reed.
- _____ 10. All living matter within a cell is called (1) protoplasm (2) chlorophyll (3) corpuscle (4) nucleus.
- _____ 11. The transfer of pollen from anther to stigma of flowers is called (1) pollination (2) diffusion (3) transpiration (4) fertilization.
- _____ 12. The pollen of the flower is made by the (1) pistil (2) style (3) stamen (4) stigma.
- _____ 13. The statement that "all life comes from life" is (1) false (2) partly true (3) true (4) true only of plants.
- _____ 14. The larva of a fly is called a (1) Cocoon (2) caterpillar (3) maggot (4) wriggler.
- _____ 15. The genus of mosquito that carries malaria germs is called (1) anopheles (2) culex (3) stegomyia (4) wriggler.
- _____ 16. The number of stages in the life history of a fly or mosquito is (1) 2 (2) 4 (3) 5 (4) 3 (5) 6
- _____ 17. The larva of a mosquito is called (1) worm (2) maggot (3) caterpillar (4) wriggler.
- _____ 18. Mosquitoes lay their eggs on (1) grass (2) mud (3) stagnant water (4) garbage (5) manure.
- _____ 19. The best way to get rid of flies is by (1) fly traps (2) destroy breeding places (3) fly paper (4) swatting them (5) poison.
- _____ 20. The best way to get rid of mosquitoes is by (1) citronella (2) poison (3) swatting them (4) pour oil on breeding place.
- _____ 21. Disease bacteria in the human body give off a poison called (1) antitoxin (2) toxin (3) insulin (4) enzymes.
- _____ 22. The agent used in treatment of diphtheria is (1) vaccine (2) toxin (3) insulin (4) antitoxin.
- _____ 23. A person who does not contract a disease when exposed to the disease germs is said to be (1) vaccinated (2) inoculated (3) immune (4) insulated.
- _____ 24. The process of introducing antitoxin into the blood of people is called (1) vaccination (2) metabolism (3) germination (4) assimilation.
- _____ 25. Bacteria are (1) animals (2) plants (3) insects (4) larvae.
- _____ 26. The passing on from generation to generation of similar traits in living things is called (1) variation (2) evolution (3) heredity (4) pollination.
- _____ 27. A disease carried by drinking water is (1) measles (2) mumps (3) diphtheria (4) typhoid fever.

- _____ 28. Living organisms in water may be killed by (1) filtering (2) freezing (3) boiling (4) shaking.
- _____ 29. All living matter must contain (1) bones (2) seeds (3) wood (4) protoplasm.

II. True and False

Directions: Write the letter T or F on the line before the number to indicate whether the statement is true or false.

- _____ 1. In order to prevent the spread of contagious diseases, persons with dangerous diseases are placed under quarantine.
- _____ 2. Louis Pasteur sacrificed his life to discover the cause of yellow fever.
- _____ 3. All bacteria are harmful.
- _____ 4. Diphtheria antitoxin is obtained from the blood of a horse.
- _____ 5. An animal or plant which lives in or on the body of a living thing from which it takes its food is known as a parasite.
- _____ 6. Colds are not harmful to people.
- _____ 7. When a disease spreads rapidly among a large group of people it is known as an epidemic.
- _____ 8. The pollen of flowers is made by the pistil.
- _____ 9. "All life comes from life."
- _____ 10. A person can protect himself during an epidemic of typhoid fever by boiling his drinking water.
- _____ 11. A fuzzy-like growth on old exposed foods is mold.
- _____ 12. Scarlet fever is caused by sore throat.
- _____ 13. Germs live in clean places.
- _____ 14. Molds destroy food easily in dry atmosphere.
- _____ 15. Bacteria are animals.
- _____ 16. To live and to grow, animals must have sunlight.
- _____ 17. Common disease germs may have the form of a pyramid.

III. Completion

Directions: Write in the space the correct word or words that will make the statement true.

1. When a frog reproduces, a cell called the _____ unites with a cell called the _____. The process is called _____.

2. One-celled animals are called _____.
3. Yeast plants reproduce by sending out small outgrowths called _____.
4. With what part of its body does the fly carry germs?
_____.
5. When germs enter the body or get into a cut, they are immediately attacked by the _____.
6. Germs which get into the body reproduce by _____.
7. Most of the damage done by germs is due to the formation of poisons called _____.
8. The disease commonly caused by contaminated milk and water is _____.
9. When a person can ward off an attack of a disease, the person is said to be _____.
10. What chemical may be placed in garbage cans or open toilets to kill larvae of flies _____.
11. Single-celled plants germs are called _____.
12. Pnuemonia is a disease of the _____.
13. The disease most often contracted from contaminated water is _____.
14. Heating milk to kill bacteria is known as _____.

IV. Matching

Directions: The following terms are to be matched. You are to write in the space at the left of Column A the number of the item in Column B that describes the item in Column A.

- | -A- | -B- |
|--------------------------------|---------------------------------------|
| _____ 1. pollen | 1. maggot |
| _____ 2. contaminated water | 2. bacteria |
| _____ 3. sour milk | 3. similar group of tissue
(cells) |
| _____ 4. Fuzzy-like growth | 4. yeast |
| _____ 5. sperm | 5. tuberculosis germs |
| _____ 6. mosquito, larvae | 6. fertilization |
| _____ 7. an organ | 7. wriggler |
| _____ 8. sputum | 8. larva |
| _____ 9. larva, fly | 9. larva |
| _____ 10. union of egg & sperm | 10. mold |
| _____ 11. Pasteurization | 11. typhoid fever |
| _____ 12. heredity | 12. flower |

- | | |
|---------------------------|----------------------------------|
| _____ 13. protoplasm | 13. Pasteur |
| _____ 14. adult, mosquito | 14. living matter |
| _____ 15. good sleep | 15. malaria fever |
| | 16. Mendel |
| | 17. helps to resist dis-
ease |
| | 18. stem |

UNIT B--THE RELATION OF THE WATER SUPPLY TO
THE WELFARE OF THE COMMUNITY

Topic 1. Methods of Purifying Water.

- Problems:
1. A knowledge of what water is made up of.
 2. A knowledge of common methods in use to purify water.
 3. A knowledge of how to purify water in your own home.

I. Questions:

1. What is water?
2. What is the universal solvent?
3. What impurities are commonly found in water?
4. How are chemical impurities removed from water?
5. How is water purified in the home?
6. How is water purified by distillation?
7. How are temporary and permanent hardness removed from water?

II. Words you will need to know:

sterilize bacteria solvent hard water soluble
insoluble

III. Laboratory experiment:

1. What is water made up of?
2. How can water be purified by filtration?

IV. References:

- Caldwell and Curtis, Science for Today, pp. 73-92.
Clement and Collister and Thurston, Our Surroundings, pp. 45-67.
Hunter and Whitman, My Own Science Problems, pp. pp. 79-102.

- Lake, Harley, and Walton, Exploring the World of Science, pp. 69-99.
 Peiper, and Beauchamp, Everyday Problems in Science. pp. 176-215.
 Van Buskirk and Smith, The Science of Everyday Life, pp. 81-104.
 Watkins and Bedell, General Science for Today. pp. 50-68.
 Davis and Sharpe, Science, pp. 117-139.
 Gregg and Powell, Health Studies, pp. 496-510.
 Wood and Carpenter, Our Environment: Its Relation to Us, pp. 8-43.
How We Adapt Ourselves to It, pp. 185-281.
How We Use and Control It, pp. 181-234.

Topic 2. How Communities Obtain Pure Water.

- Problem: 1. A realization of the importance of a pure water supply.
 2. A knowledge of how various types of communities obtain an adequate supply of pure water.
 3. A knowledge of the types of impurities found in water, their sources and dangers and the methods used in removing them from water on a large scale.

I. Questions:

1. How do persons who live in the country or in a small town secure an adequate water supply?
2. How are the inhabitants of large cities supplied with pure water.
3. Of what importance is pure water to the health of the communities?

II. Words you will need to know:

precipitate reservoir aeration aqueduct alum

III. References:

Same as for Topic 1.

Topic 3. Using Water in the Home and Community.

I. Questions:

1. How is water distributed in your home?
2. How does water enable us to get rid of sewage?
3. What are the dangers of improper sewage disposal?
4. What are the modern methods used for sewage disposal
5. How is sewage disposed of in your community?

II. Words you will need to know:

septic tank

antiseptic

III. References:

Same as for Topic 1.

UNIT B TEST--THE RELATION OF THE WATER SUPPLY
TO THE WELFARE OF THE COMMUNITY

I. Matching

Directions: The following terms are to be matched. You are to write in the space at the left of Column A the number of the item in Column B that describes the item in Column A.

-A-	-B-
_____ 1. Contains mineral matter	1. Channel for carrying water
_____ 2. Water	2. Water
_____ 3. Aqueduct	3. Contains bacteria
_____ 4. Sewage	4. Sterilize water
_____ 5. Rivers & lakes	5. Hydrogen & oxygen
_____ 6. More pressure	6. Used to dispose sewage
_____ 7. Septic tank	7. Hard water
_____ 8. Universal solvent	8. Greater the depth of the water
_____ 9. Chlorine	9. Sources of water supply for a city
_____ 10. Reservoir	10. Whirlpools
_____ 11. Deep driven well	11. Less the depth of the water
	12. Storage for water
	13. Source of pure water

II. Completion

Directions: Write in the space the correct word or words that will make the statement true.

1. _____ atom _____ plus _____ atom _____ will combine to make water.
2. Water is a _____.

3. _____ can be used to purify impure water.
4. Soft water is water that does not contain _____.
5. Water for drinking purposes can be safely purified in the home by _____.
6. Hardness of water is due to _____.
7. Spraying water into the air to purify it is known as _____.
8. _____ are added to settle the suspended matter in water.
9. Water is composed of two elements _____ and _____.
10. To distribute water _____ is needed.
11. Borax and washing soda are said to _____ water.
12. For homes without sewage systems, the _____ is the best disposal method.
13. A chemical which may be added to water to make materials settle faster is _____.
14. Cities which obtain their water supply from distant mountain streams and lakes build _____ to carry the water.
15. To prevent the entrance of sewage gases into the house _____ are installed in drainage systems.

III. Multiple Choice

Directions: Each question will consist of several answers. For each question you are to decide which is the best answer, then write the number corresponding to this answer in the space to the left of the number.

- _____ 1. The process of purification when air is mixed with impure water is known as (1) filtration (2) aeration (3) pollution (4) distillation.
- _____ 2. People in the country have as their most common source of water (1) wells (2) creek (3) city-water (4) lake.
- _____ 3. Sterilization of water with (1) salt (2) chlorine (3) copper sulfate is used to kill bacteria.

- _____ 4. Water traps in sinks keep (1) rats (2) mosquitoes (3) bad odor out of the house.
- _____ 5. Most harmful thing found in water is (1) bacteria (2) wood (3) sand.
- _____ 6. Septic tanks are used to (1) store water (2) purify water (3) purify sewage (4) filter water.
- _____ 7. Shallow wells (1) should be located so that all drainage is away from the well (2) furnishes pure water (3) are easier to get water from.
- _____ 8. Well water is (1) hard (2) soft (3) medicinal.
- _____ 9. (1) Filtration (2) distillation (3) pollution will remove all disease germs from water.
- _____ 10. Cities should obtain their water supply (1) up-stream (2) downstream from where they empty their sewage.
- _____ 11. The disease most commonly spread by drinking water is (1) diphtheria (2) smallpox (3) mumps (4) typhoid fever.
- _____ 12. Wells from which water flows without pumping are called (1) cisterns (2) artesian (3) diffused (4) reservoirs.

IV. True and False

Directions: Write the letter T or F on the line before the number to indicate whether the statement is true or false.

- _____ 1. Water can be purified by filtration.
- _____ 2. A chemical combination of hydrogen and oxygen will make water.
- _____ 3. Pure water has no color or odor.
- _____ 4. Hard water contains mineral matter.
- _____ 5. Typhoid fever is not spread by water containing disease germs.
- _____ 6. Sand should not be used for filtering water.
- _____ 7. The location of a city does not determine how the water supply shall be secured.
- _____ 8. It is dangerous to build a cesspool near a well.
- _____ 9. Disposing of sewage is not a problem of inland cities.
- _____ 10. Boiling will kill most disease-producing bacteria present in impure water.
- _____ 11. Drinking water is treated with chlorine to improve the taste.
- _____ 12. Reservoirs in water-supply systems are placed on high hills in order to secure clear atmosphere.

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OTIS SELF-ADMINISTERING TESTS OF MENTAL ABILITY

By ARTHUR S. OTIS, PH.D.

Formerly Development Specialist with Advisory Board, General Staff, United States War Department

INTERMEDIATE EXAMINATION: FORM A

For Grades 4-9

20

Score.....

Read this page. Do what it tells you to do.

Do not open this paper, or turn it over, until you are told to do so. Fill these blanks, giving your name, age, birthday, etc. Write plainly.

Name..... Age last birthday..... years
First name, initial, and last name

Birthday..... Teacher..... Date..... 19....
Month Day

Grade..... School..... City.....

This is a test to see how well you can think. It contains questions of different kinds. Here is a sample question already answered correctly. Notice how the question is answered:

Sample: Which one of the five words below tells what an apple is?

1 flower, 2 tree, 3 vegetable, 4 fruit, 5 animal..... (4)

The right answer, of course, is "fruit"; so the word "fruit" is underlined. And the word "fruit" is No. 4; so a figure 4 is placed in the parentheses at the end of the dotted line. This is the way you are to answer the questions.

Try this sample question yourself. Do not write the answer; just draw a line under it and then put its number in the parentheses:

Sample: Which one of the five things below is round?

1 a book, 2 a brick, 3 a ball, 4 a house, 5 a box.....()

The answer, of course, is "a ball"; so you should have drawn a line under the words "a ball" and put a figure 3 in the parentheses. Try this one:

Sample: A foot is to a man and a paw is to a cat the same as a hoof is to a — what?

1 dog, 2 horse, 3 shoe, 4 blacksmith, 5 saddle.....()

The answer, of course, is "horse"; so you should have drawn a line under the word "horse" and put a figure 2 in the parentheses. Try this one:

Sample: At four cents each, how many cents will 6 pencils cost?.....()

The answer, of course, is 24, and there is nothing to underline; so just put the 24 in the parentheses.

If the answer to any question is a number or a letter, put the number or letter in the parentheses without underlining anything. Make all letters like printed capitals.

The test contains 75 questions. You are not expected to be able to answer all of them, but do the best you can. You will be allowed half an hour after the examiner tells you to begin. Try to get as many right as possible. Be careful not to go so fast that you make mistakes. Do not spend too much time on any one question. No questions about the test will be answered by the examiner after the test begins. Lay your pencil down.

Do not turn this page until you are told to begin.

EXAMINATION BEGINS HERE.

1. Which one of the five things below does not belong with the others?
1 potato, 2 turnip, 3 carrot, 4 stone, 5 onion..... (Do not write on these dotted lines.) ()
2. Which one of the five words below tells best what a saw is?
1 something, 2 tool, 3 furniture, 4 wood, 5 machine..... ()
3. Which one of the five words below means the opposite of west?
1 north, 2 south, 3 east, 4 equator, 5 sunset..... ()
4. A hat is to a head and a glove is to a hand the same as a shoe is to what?
1 leather, 2 a foot, 3 a shoestring, 4 walk, 5 a toe..... ()
5. A child who knows he is guilty of doing wrong should feel (?)
1 bad, 2 sick, 3 better, 4 afraid, 5 ashamed..... ()
6. Which one of the five things below is the smallest?
1 twig, 2 limb, 3 bud, 4 tree, 5 branch..... ()
7. Which one of the five things below is most like these three: cup, plate, saucer?
1 fork, 2 table, 3 eat, 4 bowl, 5 spoon..... ()
8. Which of the five words below means the opposite of strong?
1 man, 2 weak, 3 small, 4 short, 5 thin..... ()
9. A finger is to a hand the same as a toe is to what?
1 foot, 2 toenail, 3 heel, 4 shoe, 5 knee..... ()
10. Which word means the opposite of sorrow?
1 sickness, 2 health, 3 good, 4 joy, 5 pride..... ()
11. Which one of the ten numbers below is the smallest? (Tell by letter.)
A 6084, B 5160, C 4342, D 6521, E 9703, F 4296, G 7475, H 2657, J 8839, K 3918 ()
12. Which word means the opposite of pretty?
1 good, 2 ugly, 3 bad, 4 crooked, 5 nice..... ()
13. Do what this mixed-up sentence tells you to do.
number Write the the in 5 parentheses..... ()
14. If we believe some one has committed a crime, but we are not sure, we have a (?)
1 fear, 2 suspicion, 3 wonder, 4 confidence, 5 doubtful..... ()
15. A book is to an author as a statue is to (?)
1 sculptor, 2 marble, 3 model, 4 magazine, 5 man..... ()
16. Which is the most important reason that words in the dictionary are arranged alphabetically?
1 That is the easiest way to arrange them. 2 It puts the shortest words first. 3 It enables us to find any word quickly. 4 It is merely a custom. 5 It makes the printing easier.. ()
17. Which one of the five things below is most like these three: plum, apricot, apple?
1 tree, 2 seed, 3 peach, 4 juice, 5 ripe..... ()
18. At 4 cents each, how many pencils can be bought for 36 cents?..... ()
19. If a person walking in a quiet place suddenly hears a loud sound, he is likely to be (?)
1 stopped, 2 struck, 3 startled, 4 made deaf, 5 angered..... ()
20. A boy is to a man as a (? is to a sheep.
1 wool, 2 lamb, 3 goat, 4 shepherd, 5 dog..... ()
21. One number is wrong in the following series. What should that number be? (Just write the correct number in the parentheses.)
1 6 2 6 3 6 4 6 5 6 7 6..... ()
22. Which of the five things below is most like these three: horse, pigeon, cricket?
1 stall, 2 saddle, 3 eat, 4 goat, 5 chirp..... ()
23. If the words below were rearranged to make a good sentence, with what letter would the last word of the sentence begin? (Make the letter like a printed capital.)
nuts from squirrels trees the gather..... ()
24. A man who betrays his country is called a (?
1 thief, 2 traitor, 3 enemy, 4 coward, 5 slacker..... ()
25. Food is to the body as (? is to an engine.
1 wheels, 2 fuel, 3 smoke, 4 motion, 5 fire..... ()
26. Which tells best just what a pitcher is?
1 a vessel from which to pour liquid, 2 something to hold milk, 3 It has a handle, 4 It goes on the table, 5 It is easily broken..... ()

Do not stop. Go on with the next page.

27. If George is older than Frank, and Frank is older than James, then George is (?) James.
1 older than, 2 younger than, 3 just as old as, 4 (cannot say which)..... ()
28. Count each 7 below that has a 5 next after it. Tell how many 7's you count.
7 5 3 0 9 7 3 7 8 5 7 4 2 1 7 5 7 3 2 4 7 0 9 3 7 5 5 7 2 3 5 7 7 5 4 7..... ()
29. If the words below were rearranged to make a good sentence, with what letter would the last word of the sentence begin? (Make the letter like a printed capital.)
leather shoes usually made are of..... ()
30. An electric light is to a candle as a motorcycle is to (?)
1 bicycle, 2 automobile, 3 wheels, 4 speed, 5 police..... ()
31. Which one of the words below would come first in the dictionary?
1 march, 2 ocean, 3 horse, 4 paint, 5 elbow, 6 night, 7 flown..... ()
32. The daughter of my mother's brother is my (?)
1 sister, 2 niece, 3 cousin, 4 aunt, 5 granddaughter..... ()
33. One number is wrong in the following series. What should that number be?
3 4 5 4 3 4 5 4 3 5..... ()
34. Which of the five things below is most like these three: boat, horse, train?
1 sail, 2 row, 3 motorcycle, 4 move, 5 track..... ()
35. If Paul is taller than Herbert and Paul is shorter than Robert, then Robert is (?) Herbert.
1 taller than, 2 shorter than, 3 just as tall as, 4 (cannot say which)..... ()
36. What is the most important reason that we use clocks?
1 to wake us up in the morning, 2 to regulate our daily lives, 3 to help us catch trains,
4 so that children will get to school on time, 5 They are ornamental..... ()
37. A coin made by an individual and meant to look like one made by the government is called(?)
1 duplicate, 2 counterfeit, 3 imitation, 4 forgery, 5 libel..... ()
38. A wire is to electricity as (?) is to gas.
1 a flame, 2 a spark, 3 hot, 4 a pipe, 5 a stove..... ()
39. If the following words were arranged in order, with what letter would the middle word begin?
Yard Inch Mile Foot Rod..... ()
40. One number is wrong in the following series. What should that number be?
5 10 15 20 25 29 35 40 45 50..... ()
41. Which word means the opposite of truth?
1 cheat, 2 rob, 3 liar, 4 ignorance, 5 falsehood..... ()
42. Order is to confusion as (?) is to war.
1 guns, 2 peace, 3 powder, 4 thunder, 5 army..... ()
43. In a foreign language, good food = Bano Naab
good water = Heto Naab
The word that means *good* begins with what letter?..... ()
44. The feeling of a man for his children is usually (?)
1 affection, 2 contempt, 3 joy, 4 pity, 5 reverence..... ()
45. Which of the five things below is most like these three: stocking, flag, sail?
1 shoe, 2 ship, 3 staff, 4 towel, 5 wash..... ()
46. A book is to information as (?) is to money.
1 paper, 2 dollars, 3 bank, 4 work, 5 gold..... ()
47. If Harry is taller than William, and William is just as tall as Charles, then Charles is (?) Harry.
1 taller than, 2 shorter than, 3 just as tall as, 4 (cannot say which)..... ()
48. If the following words were arranged in order, with what letter would the middle word begin?
Six Ten Two Eight Four..... ()
49. If the words below were rearranged to make a good sentence, with what letter would the third word of the sentence begin? (Make the letter like a printed capital.)
men high the a wall built stone..... ()
50. If the suffering of another makes us suffer also, we feel (?)
1 worse, 2 harmony, 3 sympathy, 4 love, 5 repelled..... ()
51. In a foreign language, grass = Moki
green grass = Moki Laap
The word that means *green* begins with what letter?..... ()

Do not stop. Go on with the next page.

52. If a man has walked west from his home 9 blocks and then walked east 4 blocks, how many blocks is he from his home?..... ()
53. A pitcher is to milk as (?) is to flowers.
1 stem, 2 leaves, 3 water, 4 vase, 5 roots..... ()
54. Do what this mixed-up sentence tells you to do.
sum three Write two the four and of..... ()
55. There is a saying, "Don't count your chickens before they are hatched." This means (?)
1 Don't hurry. 2 Don't be too sure of the future. 3 Haste makes waste. 4 Don't gamble..... ()
56. Which statement tells best just what a fork is?
1 a thing to carry food to the mouth, 2 It goes with a knife, 3 an instrument with prongs at the end, 4 It goes on the table, 5 It is made of silver..... ()
57. Wood is to a table as (?) is to a knife.
1 cutting, 2 chair, 3 fork, 4 steel, 5 handle..... ()
58. Do what this mixed-up sentence tells you to do.
sentence the letter Write last this in..... ()
59. Which one of the words below would come last in the dictionary?
1 alike, 2 admit, 3 amount, 4 across, 5 after, 6 amuse, 7 adult, 8 affect ()
60. There is a saying, "He that scatters thorns, let him go barefoot." This means (?)
1 Let him who causes others discomforts bear them himself also. 2 Going barefoot toughens the feet. 3 People should pick up what they scatter. 4 Don't scatter things around..... ()
61. If the following words were arranged in order, with what letter would the middle word begin?
Plaster Frame Wallpaper Lath Foundation..... ()
62. In a foreign language,
many boys = Boka Hepo
many girls = Marti Hepo
many boys and girls = Boka Ello Marti Hepo
The word that means *and* begins with what letter?..... ()
63. A statement which expresses just the opposite of that which another statement expresses is said to be a (?)
1 lie, 2 contradiction, 3 falsehood, 4 correction, 5 explanation..... ()
64. There is a saying, "Don't look a gift horse in the mouth." This means (?)
1 It is not safe to look into the mouth of a horse. 2 Although you question the value of a gift, accept it graciously. 3 Don't accept a horse as a gift. 4 You cannot judge the age of a gift horse by his teeth..... ()
65. Which one of the words below would come last in the dictionary?
1 hedge, 2 glory, 3 label, 4 green, 5 linen, 6 knife, 7 honor..... ()
66. Which statement tells best just what a watch is?
1 It ticks, 2 something to tell time, 3 a small, round object with a chain, 4 a vest-pocket-sized time-keeping instrument, 5 something with a face and hands..... ()
67. Ice is to water as water is to what?
1 land, 2 steam, 3 cold, 4 river, 5 thirst..... ()
68. Which statement tells best just what a window is?
1 something to see through, 2 a glass door, 3 a frame with a glass in it, 4 a glass opening in the wall of a house, 5 a piece of glass surrounded by wood..... ()
69. Which of the five words below is most like these three: large, red, good?
1 heavy, 2 size, 3 color, 4 apple, 5 very..... ()
70. Write the letter that follows the letter that comes next after M in the alphabet..... ()
71. One number is wrong in the following series. What should that number be?
1 2 4 8 16 24 64..... ()
72. An uncle is to an aunt as a son is to a (?)
1 brother, 2 daughter, 3 sister, 4 father, 5 girl..... ()
73. If I have a large box with 3 small boxes in it and 4 very small boxes in each of the small boxes, how many boxes are there in all?..... ()
74. One number is wrong in the following series. What should that number be?
1 2 4 5 7 8 10 11 12 14..... ()
75. There is a saying, "Don't ride a free horse to death." This means (?)
1 Don't be cruel. 2 Don't abuse a privilege. 3 Don't accept gifts. 4 Don't be reckless. ()

If you finish before the time is up, go back and make sure that every answer is right.