

UNIVERSITY OF CINCINNATI

June 19 37

I hereby recommend that the thesis prepared under my supervision by Henry Cooke Hamilton

entitled AN EXPERIMENTAL STUDY OF FACTORS

CONDITIONING THE EFFECTIVENESS OF COLLEGE

ORIENTATION COURSES

be accepted as fulfilling this part of the requirements for the degree of Doctor of Education

Approved by:

Gordon Handrickson, Chairman  
Carl V. Good  
L. A. Teichstein



AN EXPERIMENTAL STUDY OF FACTORS CONDITIONING  
THE EFFECTIVENESS OF COLLEGE  
ORIENTATION COURSES

A dissertation submitted to  
The Graduate Faculty of the Teachers College  
of the University of Cincinnati  
in partial fulfillment of the  
requirements for the degree of

DOCTOR OF EDUCATION

1937

OHIO STATE  
UNIVERSITY  
LIBRARY

Henry Cooke Hamilton  
A.B. Atlanta University 1921  
M.A. University of Pittsburgh 1928

UMI Number: DP15800

### INFORMATION TO USERS

The quality of this reproduction is dependent upon the quality of the copy submitted. Broken or indistinct print, colored or poor quality illustrations and photographs, print bleed-through, substandard margins, and improper alignment can adversely affect reproduction.

In the unlikely event that the author did not send a complete manuscript and there are missing pages, these will be noted. Also, if unauthorized copyright material had to be removed, a note will indicate the deletion.

**UMI**®

---

UMI Microform DP15800

Copyright 2009 by ProQuest LLC.

All rights reserved. This microform edition is protected against unauthorized copying under Title 17, United States Code.

ProQuest LLC  
789 E. Eisenhower Parkway  
PO Box 1346  
Ann Arbor, MI 48106-1346

## ACKNOWLEDGMENTS

This study has been made possible through the cooperation of a large number of persons. To all these the investigator is grateful.

The writer is deeply indebted to Dr. Gordon Hendrickson for his patience, valuable suggestions, and constructive criticisms.

Grateful acknowledgment is due for the valuable contributions of the dissertation committee, Dr. Hendrickson, Dean L. A. Pechstein, and Dr. Carter V. Good.

The author wishes to express his thanks to all those persons who participated in the experiment, the faculty and students of LeMoyne College.

To his wife, Grace Towns Hamilton, the author is indebted for sympathetic criticism and encouragement.

## TABLE OF CONTENTS

	Page
LIST OF TABLES .....	v
 Chapter	
I. INTRODUCTION .....	1
The Problem .....	1
The Nature and Development of Orientation Courses .....	1
Origin of This Study .....	4
Review of Related Literature .....	5
Problems on the College Level .....	5
Studies on the High School Level .....	14
Studies on the Elementary School Level .....	15
Studies Involving Student Opinion .....	18
Summary .....	20
Final Statement of the Problem .....	22
 II. PROCEDURE AND COLLECTION OF DATA .....	 24
 III. RESULTS OF THE FINAL TEST, BOTH SEMESTERS COM- BLINED .....	 34
Introduction .....	34
Statistical Techniques Employed .....	36
Summary .....	41
 IV. RESULTS OF THE TESTS GIVEN AT THE END OF EACH SEMESTER .....	 43
Introduction .....	43
Summary .....	46
 V. RESULTS OF TESTS ON THE DIFFERENT UNITS .....	 48
Introduction .....	48
Statistical Technique Employed .....	48
Results .....	50
Summary .....	55
 VI. COMPARISONS OF THE EFFECT OF THE TWO PROCEDURES ON STUDENTS MAKING HIGH AND STUDENTS MAKING LOW SCORES ON THE INTELLIGENCE AND ACHIEVEMENT TESTS	 57
Introduction .....	57

Chapter	Page
VI. (Continued)	
Results Related to Differences in Intelligence .....	58
Results Related to Differences in High School Achievement .....	61
VII. ANALYSIS OF HIGH SCHOOL BACKGROUND .....	65
Introduction .....	65
Summary .....	70
VIII. ANALYSIS OF THE STUDENT QUESTIONNAIRE .....	71
Introduction .....	71
Time Spent in Preparation for Each Assignment .....	72
Student Reactions to the Method of Presentation .....	74
General Reactions of the Students to the Orientation Course .....	79
Student Reactions to the Various Units .....	79
Student Reactions to the Extent to which the Orientation Course Duplicated Work Taken in High School .....	82
Student Reactions to the Amount of Time Spent in Preparation for the Orientation Course as Compared with Their Other College Courses .....	83
Extent of Overlapping Between Courses .....	85
Value of the Orientation Course in Comparison with Other Courses .....	86
Development of Interest as a Result of the Course .....	88
Students' Ranking of Courses for Certain Outcomes .....	92
Student Points of View and Liking for the Tests .....	92
Other Student Reactions .....	94
Summary .....	97
IX. SUMMARY .....	99
The Problem .....	99
Procedure and Collection of Data .....	99
Statistical Technique Employed .....	102
Major Findings .....	102
BIBLIOGRAPHY .....	110
APPENDIX .....	114

## LIST OF TABLES

Table	Page
I. Means and Standard Deviations of Scores on Tests Used for Equating Groups at the Beginning of the Course in September, 1935, and for the Equated Groups on the Pre-test of September, 1935 .....	26
II. Means and Standard Deviations of Scores on Tests Used for Final Selection of Equated Groups in June, 1936, and for the Equated Groups on Pre-test of September, 1935 .....	33
III. Comparative Results on Initial and Final Tests .	39
IV. Gains and Reliability of Gains from the Initial Test to the Final Tests for Each Semester .....	44
V. Results of Tests Given on Each of Twenty-four Units .....	51
VI. Reliability of Differences on Seventeen Tests Favoring Section II .....	52
VII. Reliability of Differences on Seven Tests Favoring Section I .....	53
VIII. Gains from Initial Test to Final Test for Subjects of Higher and Lower Intelligence .....	59
IX. Gains from Initial Test to Final Test for Subjects of Higher and Lower Achievement .....	63
X. Frequencies of Election of High School Subjects by Members of Each Section .....	66
XI. Gains Made from the Initial Test to the Final Test for Students with Three or More Units in High School Science and for Those Having Less Than Three Units in High School Science .....	69
XII. Average Number of Minutes Given by Students as the Amount of Time Spent in Preparation for Each Assignment .....	73
XIII. Student Reactions to Method of Presentation ...	75
XIV. General Reactions of Students to the Orientation Course .....	78
XV. Student Likes and Dislikes for the Various Units	81
XVI. Student Reactions to the Extent to Which the Orientation Course Duplicated Work Taken in High School .....	83

Table	Page
XVII. Average Amount of Time Spent in Preparation for Each Assignment for the Orientation Course and Other Freshman Courses, According to Student Reports .....	84
XVIII. Student Reactions to the Extent to Which There Was Overlapping between the Orientation Course and the Other Courses which They Were Taking ..	86
XIX. Student Reactions to the Orientation Course as Compared with Other Courses Taken .....	87
XX. Rating of the Orientation Course in Comparison with Other Courses .....	89
XXI. Rankings of Various Units with Reference to the Extent to which Their Interest was Developed as a Result of the Course .....	91
XXII. How Students Ranked Their Courses with Reference to the Expenditure of Energy, Cultural Value, Vocational Value, General Information, and Interest .....	93
XXIII. Student Reactions to the Tests on the Various Units .....	95
XXIV. Miscellaneous Student Reactions for Both Sections Combined .....	96

CHAPTER I  
INTRODUCTION

The Problem

The major problem of this study is to determine the relative merits of two general procedures in the teaching of courses in college orientation. These procedures are (a) to unify the courses and the instruction by having the entire instructional program presented by a single individual; (b) to enrich and broaden the courses and instruction by having the major units presented by various specialists. Minor problems are to determine the influence of certain factors on the relative effectiveness of the two methods, and also to ascertain their relationship to the achievement, attitudes, and development of interest in the orientation course by the students.

Factors considered include: (1) general intelligence; (2) the high school background; (a) subjects studied in high school, (b) results of high school achievement tests; (3) initial status as shown by a pre-test; (4) reactions to the different units of the course on the basis of a student questionnaire.

The Nature and Development of Orientation Courses

In recent years a new type of course has appeared as a part of

the offerings of the American liberal arts college. The movement has spread rapidly until the orientation course, as it is usually called, has generally been accepted as an integral part of the general college curriculum.

Knode (26)<sup>1</sup> traced the origins and development of orientation courses. He found the courses took shape in different sections of the country over a considerable period of time, despite the general impression to the contrary. He traced its beginnings as far back as 1888 when, according to Dean Warren, a course was introduced at Boston University, having as its purpose "the orienting of its new students" with relation to the problems of college life and work. According to Knode, the first survey course in the fields of knowledge was given at Amherst in 1914.

Sibley (38:373-7) gives an excellent account of the various interpretations of the meaning of the course.

A dozen years ago, orientation courses were not common and the name carried no definite meaning. In some places it meant the modest attempt to instruct freshmen in the history and traditions of alma mater; to inform them about their relations with administrative officers; to warn them about academic rules and penalties; to introduce them to the college library; to advise them about activities "extra-curriculum," about the local churches, and in a discreetly general way about fraternities; to exhort them to take care of their health - in short, the miscellaneous program now oftener relegated to a freshman week.

In other places the orientation program consisted of talks by representatives of the various departments of instruction who, appearing in series, explained the organization and sequence of their courses and tried to make clear why an intelligent freshman might wish to specialize in each of these inviting fields. Elsewhere the orientation

---

1

Numbers in the parentheses refer to items in the bibliography.

course, labeled, perhaps, "Foundations" or "Fundamentals," was really less of an innovation than the foregoing; to constitute it portions of the Christian Evidences of a generation ago were combined with general advice on morals, health and habits of study, and whatever else a Y. M. C. A. secretary would refer to as the problems of college life.

The orientation courses of today are nearly all essentially "Survey" courses, and are often so called. They attempt to explain according to modern science, how the physical universe came to be what according to modern science it is; they review the cultural history, especially the social history, of man; they propound what seem to be the collective wisdom of those in charge to be the most significant political, social and economic problems of civilization today; they hint plainly at solutions.

Perhaps the most significant contribution to the development of college orientation courses was a book written by H. J. Doerman, published in 1926, entitled "The Orientation of College Freshmen." Doerman (10:97) summarizes the specific objectives of such courses.

The orientation courses for freshmen given at the present time have one or more of the following objectives:

1. To enable the student to understand the college curriculum.
2. To give a survey of the significant fields of knowledge.
3. To enable the student to understand and make better adjustments to college life.
4. To enable the student to understand present day problems.
5. To train the student in thinking.
6. To teach how to study.
7. To orient the student with respect to a career.

Wilkins (46:247-49) indicates certain definite fields of orientation.

The term orientation has been construed to include the whole program of the freshman year, including the early work of several agencies that continue their activities throughout and after the college course, as in Doerman's study. ....

The field of orientation may properly be used to include three things: orientation with respect to the fields of knowledge, orientation with respect to the immediate problems of college life, and orientation with respect to post college life.

## Origin of This Study

The course in "College Orientation" at LeMoyne College originated from a course called "Philosophy I," offered from 1924 to 1928, which was modeled somewhat after the course in "Contemporary Civilization" offered at Columbia University. In 1929, as a result of curriculum changes and the adoption of a course in "Medieval and Modern European History" as a required course for beginning freshmen, the course in philosophy gave way to a course called "Introduction to Science." This, in turn, was modeled after the course given at the University of Chicago called "The Nature of the World and of Man." The course began as a lecture course, was required of all freshmen, and was taught by a single individual.

In its beginnings (1929-1930), the course was primarily a survey of the physical and biological sciences; later (1931-1932), lectures were included on "How to Study," on "How to Take Notes," and on the "Social Sciences." The title of the course was then changed to "College Orientation." Gradually specialists were brought in from the different departments to give the lectures in their respective fields. Finally (1933-1934), the entire course was taught by different specialists, who gave the lectures in their respective fields. A controversy arose within the faculty as to which of the two basic procedures that had been followed produced the more effective results. These procedures differed in that (1) in the first instance all the lectures were given by a single individual, while (2) in the second instance the various lectures were given by specialists in their

respective fields. The need for a solution to this problem led to the present study.

### Review of Related Literature

In a search of the literature in the field, no studies were found which dealt specifically with the problem at hand, but numerous studies were located which dealt with a comparison of different methods of instruction in colleges, secondary schools, and elementary schools. Since many of these are closely related to the problem and shed some light upon the elements involved, a review of these will be given.

### Problems on the College Level

Stephen M. Corey (8:459-70) made a comparison of "Learning from Lectures versus Learning from Readings." His introduction to the study gives a fair statement of what is to be found in the literature in the field.<sup>1</sup>

Introduction.-- Numerous investigations have been made recently of the comparative value of different teaching methods in institutions of higher learning. The thirty-first yearbook of the National Society for the Study of Education, entitled "Changes and Experiments in Liberal Arts Education" (1932), was encouraging in its reports of the amount of attention being directed towards curricula and instructional problems. Even as early as 1928, Carter V. Good (20:66-95) was able to accumulate some two hundred forty-five references "On College Teaching with Special Emphasis on Methods of Teaching."

Relatively few of these studies, however, have dealt with the lecture, which is one of the unique aspects of collegiate instruction. Most of the experimental investigations of the lecture method of teaching have consisted of attempts to compare it with the demonstration and individual methods of teaching the sciences.

---

1

For this study as well as for the studies which follow, summaries rather than quotations are given.

The Experiment.- The experiment was conducted during part of an orientation course for freshmen in the Teachers College of the University of Nebraska. The general experimental set-up involved the equated groups technique, the difference between the two groups being that one read the materials and the other listened to a mimeographed lecture, identically worded. The groups were equated with respect to vocabulary, reading ability, and general psychological test scores.

The time factor was held constant by allowing the students who read materials as many minutes for their study as were required for the lecture. Immediately after both the lecture and the reading period a test of immediate recall was administered. The same test was given again without warning two weeks later, to measure retention over a longer period. The subjects were permitted to make notes, but they were told that an immediate recall test would be given on the materials involved.

The Problem.- The problem with which the investigator was chiefly concerned was: Do students learn more from listening to a lecture or from reading identically worded materials for the same length of time? Interpretations were based on finding the difference between the mean scores, the sigma of the difference, and the chances in one hundred that the difference was significant.

Conclusions.- (1) Immediate recall is better for materials students have read than for the same materials heard in lecture. (2) The two types of presentation have no very significant effect upon delayed (fourteen days) recall. (3) The scores on tests measuring retention of materials read are more closely related to standardized test results for reading, vocabulary and intelligence than are scores on tests measuring the retention of materials in lectures. (4) There is a tendency for students scoring in the highest psychological test quartile to do relatively better on reading than on lecture tests. (5) When students in the highest psychological test quartile of the reading group are compared with those in the highest quartile of the lecture group with respect to delayed recall, no significant differences appear. The same is true of other psychological test quartiles.

The results of Corey's study seem to indicate that in terms of immediate recall, reading of the material produces somewhat better results, and that in terms of delayed recall or retention, there is no significant difference. If such be true, it would probably be an advantage to have mimeographed copies of the lectures made for outside reading and to spend the time of the lecture period in a discussion of the materials.

Charles L. Bane (3:300-302) made several experiments to determine the relative merits of the lecture and class discussion methods of college teaching.

Bane made a summary of five carefully controlled experiments to determine the relative effectiveness of the lecture and class discussion methods of college teaching. In the case of the lecture, the instructor did all the talking; in the class discussion, both teacher and students participated, discussion being initiated by questions from the teacher. The instructor taught both a lecture and a discussion section of the same class. In each experiment, the following conditions were kept constant in both the lecture and discussion sections: (1) The amount of teaching time, period by period, was exactly the same. (2) The subject matter, both as to specific facts and general principles, was essentially the same, as shown by expert stenographic reports and other objective checks. (3) Identical assignments were made from day to day, whether involving textbooks, reference reading or special problems - all materials being made equally available to both sections. (4) Objective subject matter tests, based upon material known to have been presented to both sections, were administered under similar conditions. (5) Intelligence was measured by the same standardized tests - Forms A and B of Morgan's Mental Test, and the Terman Group Intelligence Tests.

In short, there was in each experiment a strict adherence to the "law of one variable," the technique of instruction being the only changing factor. Comparative group scores on objective subject-matter tests, with intelligence taken into account, were accepted as the criterion of relative effectiveness of the two teaching methods. The tests, in the main, consisted of a series of true-false statements varying in number from 40 to 180 in the different experiments.

Relative group achievement was measured in three ways: (1) By totaling the A.Q.'s for each group. (2) By adding the scores of the two sections made by students paired on the basis of equal intelligence. (3) By summing up the subject-matter scores of all the students in either section without reference to differences in intelligence. While all three methods of measuring point to the same conclusions, the second appeared to be more reliable. "Immediate recall" tests were given at intervals throughout the experiments and "delayed recall" tests were given from one to six months after the completion of the experiment proper.

Conclusions.- In every one of the five experiments, the class-discussion section secured a significantly higher group score on the delayed recall tests. On the immediate recall tests the group score distinctly favored the lecture section in three of the experiments and the class-discussion group on the other two. In the two cases where

the discussion groups were superior on the immediate recall tests, they were relatively even more superior on the delayed recall tests. It would seem clear, then, that the lecture is relatively better suited to the immediate recall of subject-matter and the class-discussion method better adapted to its retention. The conclusions then, are:

(1) The lecture and class-discussion methods of college teaching appear about equally effective in the immediate recall of content material.

(2) The class-discussion method is more effective than the lecture in the delayed recall of subject-matter.

(3) The lecture method is more suitable for the immediate recall of subject-matter than for its retention to a later period, while the reverse is true of the class-discussion method.

V. F. Payne (35:1277-94) made a comparative study of the lecture-demonstration and the individual laboratory methods.

Payne compared the work of six groups of general college chemistry students, introduced to the study by a lecture-demonstration method, with the work of six sections introduced by the individual laboratory method. A total of 299 students in four colleges and taught by five instructors was studied. Standard chemistry aptitude and training tests, the ordinary examinations, and teaching grades were used in comparing the work of the students.

From the six groups, twelve sections of two paired sections each were formed. One section of each group was taught during the first part of the year, generally a semester, by class demonstration with no individual laboratory work during this introductory work, while the paired section was taught throughout the year by the more commonly used individual laboratory method.

Comparisons of the attainments of the groups were made on the bases of percentile ranks; by counting the pairs of students favorable to either method, by sex, by student preferences and opinion and by the differences made between predictive and attainment tests. Both the short formula and the long formula were used for finding the critical ratios from the differences obtained.

Conclusion.- From a study of the literature and his own experimental work, Payne concluded that the better students will succeed as well, and those students of lesser ability will probably succeed better (as success is ordinarily measured) in their entire first year's work in college chemistry, if they have a period of introduction of approximately one half year, through teacher-demonstration, with the exclusion for that period of individual laboratory work.

The results of Payne's study confirm the results of numerous other investigations with reference to the relative merits of these two methods of instruction. The findings in some few instances favor the individual laboratory method but more often the results indicate that the lecture-demonstration method is as effective, or more effective than the individual-laboratory method, for the introductory course in college chemistry.

Victor P. Morris and Harl R. Douglass (13:285-92) made a study of the relative effectiveness of the problem method versus the lecture and reading method at the University of Oregon.

Douglass and Morris made use of two sections of the course in "Principles of Economics," which were available for experimental purposes. The two courses met at nine and ten o'clock respectively. One section had sixty-three and the other sixty-eight students enrolled. Both sections were taught by the same instructor, a man "who, in the opinion of those of his colleagues who knew him best as an instructor, was equally skilled in the two types of class-room procedure." In order to reduce to a minimum the differences between students, only data from paired students were used. The students were paired, in the cases of freshmen and sophomores, on the basis of percentile ranks on the American Council on Education psychological tests, and in the cases of juniors and seniors, on the basis of the average of the university marks received during the preceding term. Thirty pairs were selected to constitute equivalent groups on the basis of the average university mark. The results of instruction were measured by the gains made on an objective test of 344 items, covering two terms of work and given at the beginning and also at the end of the period of time devoted to experimentation.

Results.-- The investigation showed that the mean gain, as measured by the objective test, was greater for the students of the problem section in the case of the students paired on the basis of percentile rank on the American Council on Education psychological tests, but that for the students paired on the basis of average marks, the mean gain was greater for students taught by the lecture and assigned reading method. A statistical analysis of the differences found led the writers to conclude that they were probably real differences, not due to chance, and that probably errors in sampling caused the apparent conflict in the findings for the two groups. The only definite conclusion reached by the investigator was: "The problem

project method is better on the average for students above average, though not at all uniformly to be expected as indicated by the relatively medium amount of correlation,  $r = .317$ , between superior gains or students in the problem section and their intelligence percentile ranks."

Any inferences which might be made as a result of comparing gains made by freshmen and sophomores, paired on the basis of a psychological test, with those of juniors and seniors paired on the basis of average university marks, are subject to question.

In the same series of experiments at the University of Oregon, Harl R. Douglass and Harold Saxe Tuttle (14:293-99) made a study of the relative effectiveness of the lecture method with quiz sections and of the project plan.

The problem was to determine whether the lecture method with quiz sections is more or less effective than the project plan in which no lectures are given and the student is required to work out his own conclusions. Two sections in Educational Psychology, each with an enrollment of sixty-nine students, were compared. In the first section, two lectures and one quiz were held each week; while in the second section, the class met three times a week without separate quiz sections and no lectures, the work being conducted by the project plan. Each student in the second section was provided with a syllabus of the course containing a series of specific problems paralleled by the traditional topic headings to which they referred, and provided with references to standard works on educational psychology. The same set of references was given to both sections. In the project class, students were divided into committees of four. Each committee distributed four successive problems among its members so that each student had to report one-fourth of the total number of problems. Every student, however, was held responsible for the solution of all problems. No other differences entered into the work of the two classes so far as conditions could be controlled. Both sections were given the Otis self-administering test and objective subject-matter tests at the beginning and at the end of the term. The students were also classified as having previously studied psychology or as having had no psychology.

As a means of measuring the relative effectiveness of the two methods, students were paired on the basis of the Otis and Whipple test scores and on their knowledge of psychology at the opening of the term. The difference between the initial and the final subject-matter

test scores for forty-three pairs of students for whom complete data were available was used as a measure of the relative effectiveness of the two methods. Of these forty-three pairs, fifteen had had previous training in general psychology.

Results.- The results of the experiment show no significant differences in the two methods used for the twenty-eight pairs of students who had had no previous training in general psychology, but a notable gain under the project method as compared with the lecture method for those who had had previous training in general psychology. The difference in favor of the project plan, measured in points gained during the term as shown by the scores on the tests given at the beginning and close of the work of the course, represents an advantage of twenty-five per cent over the lecture-quiz method.

With reference to the above study, a question might be raised as to the reliability of the difference found, and as to whether or not the correlation between the paired students was taken into consideration.

Dennis H. Cooke (7:674-678) made two experiments to determine the relative merits of three procedures in the learning of educational statistics.

Cooke experimented to determine whether students obtain most from courses in educational statistics by spending all of their time in working problems, in reading statistical textbooks and literature, or in a combination of both these procedures. He used eighteen graduate students in the first experiment, divided into two groups having equal average intelligence as measured on two group intelligence tests. Each student in the reading group read two hours daily from a carefully prepared reading list, while each student in the problem group spent two hours daily working statistical problems. Each member in the combination group spent one hour daily reading and one hour in working problems. The experiment was conducted along this plan for six weeks, during which time three true-false tests were given. At the end of this period, two objective type achievement tests in educational statistics were given. For the second six weeks of the experiment, the reading and problems group were exchanged, the combination group remaining the same. During this period, two true-false were given, and at the end separate forms of the achievement tests were given.

A tabulation of the results showed that the combination group slightly exceeded the reading group on each of the seven true-false

tests. The combination group scored higher than the problem group in four of the seven tests and equally on one test. The reading group scored higher than the problem group in three of the seven tests, while the problem group exceeded the reading group in four tests. The problems group slightly exceeded the reading group in the average score on the achievement tests. Again, there was a slight tendency for the combination group to exceed both the reading and problem groups.

As a result of the first experiment, it was concluded tentatively that it is probably more profitable to distribute one's time between problem solving and reading statistical literature (combination method).

The Second Experiment.-- In order to secure information regarding the best distribution of the students' time between these two types of study, a second experiment was conducted using thirty graduate students. The differences found were small and indicated that there seems to be no choice between the problem and the reading groups, but again the combination group either equals or exceeds each of the other groups.

Conclusion.-- The author concludes that the results of the experiment suggest that an equal distribution of the student's time between working statistical problems and reading statistical literature is slightly preferable to a larger proportion of his time being given either to reading or to working problems.

Norma V. Scheideman (37:672-4) made a comparison of two methods of college instruction in elementary psychology.

Scheideman undertook to determine the measurable differences in achievement in elementary psychology as a result of two different methods of instruction, the lecture conference method and the individualized method, which were conducted at the State University of Iowa during the academic year 1925-1926. Students were paired on the basis of (1) grade points made during the first collegiate year, (2) comparable percentile rankings attained in the freshman entrance examinations, and (3) combined percentile rankings and grade points when converted into comparable scores.

The results showed that in not any one of the three cases was the reliability of the difference significant. If any differences may have existed in the relative effectiveness of the two methods, they were small and of no significance. The author concluded that these two methods of instruction are of equal effectiveness in teaching elementary psychology.

D. A. Worcester (47:73-79) made an investigation to determine the amount of knowledge which the students possessed at the beginning

of a course in educational psychology.

In two institutions students just beginning the introductory course in educational psychology were given examinations designed as final examinations for the course. In each case it was found: (1) that nearly all of the students knew something of the subject-matter of the course; (2) that a large proportion of the students gave evidence of knowing a good deal - from twenty per cent to forty per cent - of the course; (3) that certain students had in some way or other acquired so much of the matter of the courses that it was very doubtful if they should be allowed to go on with it; (4) that certain topics were already familiar to nearly everybody.

E. B. Greene (21:619-24) made an investigation of certain aspects of the lecture in college teaching.

In the interest of better controls, the experiments were limited to six fifty-minute periods, during which strictly the same topics were presented in various ways. The study made comparisons between three methods of presenting material to college students; lectures, unguided reading, and guided reading, with and without notes. It was found in both immediate tests and tests after from one to four weeks that the results of the guided reading were very superior to either the results of the lectures or the unguided reading. The differences were in all cases large and reliable.

The comparison of lecture and unguided reading procedures showed that the average student did equally well after either presentation, but that the good readers did considerably better after their own reading than they did after the lectures, while the poor readers did better after the lecture than after their own reading.

On immediate and delayed tests, the effect of note-taking was negligible when students were allowed to use their notes for review. When allowed to inspect their notes during the delayed tests, the group averages improved considerably, but not up to the level of averages from the guided reading periods.

Carter V. Good (20:755-70) made an experimental study of the merits of extensive and intensive reading in the social sciences. His conclusions were as follows:

The results of this investigation indicate that the character and the length of reading assignments should vary with the purpose of the reading. If accuracy and a mastery of detailed information are desired, a relatively brief and definite reading assignment should prove effective. If breadth and range of information are the aims,

the basal text should be supplemented by rather extensive reading assignments. Ordinarily, an appropriate combination of limited text assignments and supplementary materials should produce good results in range and accuracy of information.

C. C. Crawford (9:379-86) made a summary of the results of seven experimental studies in college note-taking. Comparisons were made on the basis of the standard deviation of the difference and the experimental coefficient. In each of the seven experiments, an advantage in favor of taking notes in lectures was found.

#### Studies on the High School Level

Nash and Phillips (33:371-79) made a study of the relative value of three methods of teaching high school chemistry.

They made a selection of three groups of students of comparatively equal ability, based on M.A., I.Q., and C. A. Three methods were compared: (1) pupil method - eighteen students allowed to study as they wished; (2) combination method - twenty-two students with whom were used demonstration, lecture, laboratory work and recitation; (3) instructor method - twenty-two students for whom units of work were assigned from the text, and who were never called upon to recite. Under the latter method, the instructor did all the work for the classes, gave the demonstrations, performed the experiments; and worked out the problems before the class.

The investigators conclude that the instructor method was superior to both the pupil and the combination methods.

The results of this study indicate that for high school chemistry, the lecture method is more effective than either the usual method of individual laboratory instruction or a combination of the two methods.

Fred G. Anibel (1:355-65) made a comparative study of the effectiveness of the lecture-demonstration and the individual laboratory method. His conclusions were similar to those of Payne:

The lecture-demonstration procedure produces better results in terms of immediate retention. For delayed retention one method is just as good as the other. The brighter pupils are likely to profit more by lecture-demonstration. Lecture-demonstration requires about two-thirds as much time for the presentation of the experiments. The cost by this method is much less, being only about one-fifteenth the cost of the individual laboratory method.

### Studies on the Elementary School Level

A. W. Stewart (39:205-7) made a comparative study of departmental and grade teaching in the elementary school.

To carry out the experiment, the following items of procedure were necessary: (1) to divide the school from the fifth to the eighth grade into an experimental and a control group, equal in number and in ability to learn; (2) to organize the experimental group on the departmental plan and the control groups on the grade plan; (3) to devise a plan by which the two groups would be given equal teaching ability; (4) to obtain an objective measure of the initial standing of each pupil in each subject for which gains were to be considered; (5) to secure an objective measure of the final standing at the close of the experiment of each pupil in each subject for which gains were to be considered; (6) to compute the gains for each pupil, each grade, and each group in the various subjects considered.

All the pupils were given intelligence tests and each pupil of the experimental group was paired with one in the control group of equal ability as shown by the tests. To stabilize the ability of the teachers, they were divided into two groups, X and Y. During the first semester of the experiment, the X teachers were assigned to the experimental group and the Y teachers were assigned to the control group. At the beginning of the second semester, the teachers of the two groups were exchanged.

Initial tests were given in reading, arithmetic fundamentals and problems, geography, spelling, and English. Different forms of the tests were repeated at the end of the first semester and again at the end of the second semester. Before gains could be computed, it was necessary to express all test scores in a constant unit, that is, a unit that would be the same for different grades and for different subjects. In the transmutation of test scores, distributions for each test were made and translated into T-score tables, such as described by McCall (29:272-306). Individual gains were computed from the T-score by subtracting the initial from the final T-scores. In all there were 887 pairs of scores to be compared. In

forty-two per cent of the pairs, the gain made by the pupil taught departmentally was greater. In fifty-eight per cent of the cases the pupil taught by the grade method exceeded the other member of the pair, who had received departmental instruction.

In the second analysis of results, the gains were averaged by subject and by grades and finally by entire groups. The difference was then found between these average gains. This comparison showed that the grade group had the advantage in each grade, ranging from 16 per cent to 72 per cent of the gains made by the departmental group in each case. In the comparison made by subjects, only in spelling and language did the departmental group make the greater gains and in the latter of these two the advantage was not quite a one per cent advantage. In the totals, the departmental group made a gain of 4.65 T-score points as against 6.66 for the grade group. The resulting advantage for the grade group is 2.01. Since this is 43 per cent of the departmental gain, the pupils taught by the grade method made 43 per cent greater gains than those taught by the departmental method.

As a measure of unreliability, the probable error of the difference was used. For the total advantage 2.01, this measure was .26. Since the advantage was more than seven times the probable error, it was concluded that the advantage was highly reliable, the chances being 285 to 1 that the pupils taught in the grade organization made not less than a 21 per cent greater gain than those taught departmentally.

Continuation of the Experiment.- The experiment was continued for a third semester during which all groups were taught by the departmental plan; the results indicated that the departmental group actually has the advantage over the grade group. The results also indicated that the original group could surpass the pupils of the other group when conditions were similar. This last study gave strong evidence of an adjustment period due to the introduction of the departmental plan. During the first semester, the departmental group made relatively poor progress. During the second semester, they showed improvement, and made approximately as good gains as the grade group; and finally made considerably greater gains in the third semester than the group which had been originally taught by the grade method.

In drawing his conclusions as a result of the findings at the end of the third semester, the author seems to have failed to take in consideration the fact that the apparently greater gains made by the departmental group over the grade group may probably have been due to the fact that during the third semester the same type of adjustment

period was necessary for the introduction of the grade group to the departmental plan. Thus, the same factors which he had accounted for as the cause of the greater gains made by the grade group over the departmental group during the first semester might also serve to account for the greater gains made by the departmental group over the grade group during the third semester.

F. G. Macomber (28:115-22) made a comparative study of the "contract group" and the "discussion group" methods of teaching the social sciences in the seventh grade. He found that the contract plan of individualized instruction was superior to a discussion plan, or the usual method of teaching the social sciences.

V. C. Arnspiger (2) made a study of the relative effectiveness of sound pictures as an aid to teaching.

The Purpose of the Study.- The purpose of the study was two-fold: (1) to determine by experimentation the relative effectiveness (a) of teaching with the aid of certain educational pictures in the fields of natural science and music in grades 5 and 7, respectively, and (b) of the usual methods of classroom instruction; (2) to make an analysis of the composition elements of certain scenes of the talking pictures used in the experiment, this analysis being treated in such a manner as to serve as an introduction to the study of the relative effectiveness of these elements of composition.

The Technique Followed.- The experimental-control technique utilizing the equated-teacher method was followed throughout the experiment. The pupils in the control groups were taught by the ordinary classroom method without the aid of educational talking pictures. The pupils in the experimental groups were presented with three showings of each picture during the regular class periods. Students in the experimental and control groups were equated on the basis of intelligence tests. The initial status of the students was determined by initial tests containing approximately 100 items each. Recall tests were administered fourteen weeks after the initial tests.

Statistical Technique Employed.- In treating the data, the means or averages of the experimental group scores were compared with the means of the control group scores. The reliability of the means

was determined by computing the standard deviations of the means. The critical ratio of the difference between the means of the two groups was computed. The superiority of one group over the other was computed by dividing the difference between the means of the two groups by the mean of the inferior group, and expressing this relation in terms of per cent (per cent superiority). Comparisons were made of the effectiveness of the talking picture in groups of below average and above average intelligence.

Results.— The final test gains over the initial tests indicated that the talking pictures made distinct contributions to learning. The critical ratios of the differences between the averages indicated that the superiority of the experimental group was a true superiority in every instance. The average gains made by the experimental groups in both natural science and music exceeded those made by the control groups by statistically significant amounts in both low and high levels of intelligence. The author concluded that the talking pictures make distinct contributions to the learning of below average and above average intelligence levels.

The conclusions found in the above experiment seem inevitable under the conditions of the set-up of the experiment. The experimental group had the advantage of not only the usual classroom instruction of the control group but the additional incentive of the visualization and the hearing of the sound pictures. It might almost be said that the author set out to prove what he found as a result of the experiment. Taken at its face value, the study offers good propaganda in favor of the inclusion of sound pictures for classroom instruction.

#### Studies Involving Student Opinion

Since a portion of this study involves the use of a student questionnaire in which the opinions of students are ascertained, some of the findings in the literature with reference to student opinion are included in this review of the literature in the field of the investigation.

Harl R. Douglass (11:192-97) in an article on "Rating the Teaching Effectiveness of College Instructors," makes the following observation:

It seems reasonable that it is much more scientific and reliable to collect the opinions of a large and representative number of students. From a series of very interesting experiments in this direction, conducted by Dr. E. R. Guthrie, of the Department of psychology of the University of Washington, he was able to show that the reliability of student opinion was quite high and materially higher than the reliability of fellow members of the faculty.

P. W. Ward (44:15-16) made a study of "Student Opinion Concerning Two Survey Courses,"

Ward made a study of two survey courses in operation at Syracuse University in the freshman year, one in the social sciences and a general survey course under the Department of Philosophy. At the end of the semester (May 23, 1932) the students in one of the courses were asked to rate in order of excellence all the courses they were taking in terms of "interest," of "profit" (increase in enlightenment and understanding), and of "success in presentation."

The statistics seem to indicate that most of the students in the survey courses while they were taking them think that they are profitable, and that the courses probably are useful by way of arousing interest in materials subsequently to be studied intensively. The students were willing to rate the survey courses high in "profit" without scoring them above par as regards "success in presentation."

Unless one is to adopt a wholly authoritarian position in Education, the opinion of the students themselves is worth something in reference to a course or a curriculum.

In another study Ward (44:398-409) obtained the attitudes of average and superior students toward survey courses. His findings were as follows:

No significant divergences in attitude appeared between the A-B (superior) and the C-D (average) groups; in both survey courses these groups, in their percentages of combined first and second rankings given to the courses, closely approximated the percentages derived from the unsegregated total groups. Such minor statistical divergences as appeared suggested differences between the two survey courses rather than generic differences between the survey course

and other types of courses. The mass effect of the figures was to indicate that the two survey courses are equally well adapted to the needs of both A-B and C-D groups.

M. Tallmadge and H. R. Douglass (41:349-52) made a study of what college students believe they think about examinations.

This study indicated that students in the College of Education at the University of Minnesota:

1. Overwhelmingly prefer objective to subjective examinations in all types of classes except those of the motor-skill type.

2. Prefer examinations which they may write outside of the classroom.

3. Prefer weekly examinations within all types of courses except those of the motor-skill type for which they prefer semi-quarterly tests.

4. Believe that a marking system consisting of only two marks - Satisfactory and Unsatisfactory - would be desirable, though only a minority believe that it would lead to raising standards for satisfactory work.

#### Summary

This review of the literature has endeavored to give a sampling of the different types of experimental investigations evaluating various methods of teaching on the different levels of instruction and in different types of subject-matter, and has also included some studies relative to student opinion. The findings in this review may be summarized as indicating the following:

(1) The technique in general use for evaluating the effectiveness of different methods of instruction involves: (a) the formation of experimental and control groups equated on the basis of intelligence test scores in conjunction with some other factor such as achievement test scores, semester grades, quality points earned, etc.; (b) the control of all factors and the application of a single variable; (c) finding the differences in gains made between initial and final test

scores; (d) determination of the reliability of the difference found; (e) conclusions based on an evaluation of these results in terms of the critical ratio, experimental coefficient, chances in one hundred, per cent superiority, odds, or some combination of these.

(2) Typical conclusions based upon the use of such procedures of investigation are as follows:

(a) Immediate recall is better for materials students have read than for the same materials heard in lecture. In terms of retention or delayed recall, there is no significant difference between these two procedures.

(b) The lecture method is more suitable for the immediate recall of subject-matter than for its retention to a later period, while the reverse is true of the class-discussion method.

(c) The lecture-demonstration method is as effective as, or more effective than, the individual-laboratory method, for introductory courses in chemistry.

(d) There is no significant difference between the "lecture" and "project" methods of teaching the first course in general psychology.

(e) It is advantageous to take notes in lectures.

(f) The distribution of one's time equally between solving problems and reading statistical literature is more profitable in the learning of educational statistics than spending relatively larger proportions of time in either activity.

(g) The character and length of reading assignments should vary with the purpose of the reading; in general, an appropriate com-

ination of limited text assignments and supplementary materials should produce good results in range and accuracy of information.

(h) Other things being equal, the departmental plan is more effective than the grade plan of teaching in the upper grades of the elementary school.

(i) The use of sound pictures is a definite aid to teaching.

(j) The contract plan of individualized instruction is superior to a discussion plan, or the usual method of teaching the social sciences in the seventh grade.

(3) In general, it might be said that the evaluation of different methods of teaching gives relatively inconclusive and sometimes even contradictory results. Perhaps a statement made by Monroe (31:41) is significant relative to the findings:

It appears reasonable that the effectiveness of a method may be conditioned to such an extent by a teacher's confidence in it, and the zeal and skill with which she applies it, that the method itself is a minor factor in teaching success.

(4) Student opinion is a significant aid to an evaluation of the results and effectiveness of teaching.

#### Final Statement of the Problem

The problem of this study is to determine the relative effectiveness of two general procedures in the teaching of college orientation. The nature of the course is a brief survey of the physical, biological, and social sciences. The course was designed to give to the college freshman a preliminary view of each of these rich intellectual fields, and to aid them in the selection of fields for further study.

Major Problem.- The major problem is to determine the relative merits of two general procedures, namely, (1) to unify the course and the instruction by having the entire instructional program presented by a single individual; (2) to enrich and broaden the course and instruction by having the major units presented by various specialists.

Minor Problems.- Minor problems are to determine the influence of certain factors on the relative effectiveness of the two methods, and also to ascertain their relationship to the achievement, attitudes, and development of interests in the orientation course by the students. Factors considered include: (1) general intelligence; (2) the high school background: (a) subjects studied in high school, (b) results of high school achievement tests; (3) initial status as shown by a pre-test; (4) reactions to the different units of the course on the basis of a student questionnaire.

## CHAPTER II

### PROCEDURE AND COLLECTION OF DATA

Purpose of the Chapter.-- The purpose of this chapter is to show the experimental set-up for the general procedure to be followed, the selection and equating of the two groups, and the collection of data.

LeMoyne College.-- LeMoyne College is located within the city limits of Memphis, Tennessee. It is a small liberal arts college for Negroes, supported by appropriations from the American Missionary Association, and by a relatively small rate of tuition. Its faculty is bi-racial in character, fifty per cent of whom are colored and fifty per cent of whom are white. The college has an enrollment of between three hundred fifty and four hundred students, a large per cent of whom come from Shelby County in which the city of Memphis is located. Most of the other students come from the tri-state area of Arkansas, Tennessee, and Mississippi, as well as a number of students from the other states in the union. LeMoyne is rated as a standard college by the State of Tennessee, and by the Southern Association of Colleges and Secondary Schools.

Selection of Subjects.-- For the purpose of this study, a large group of freshmen was selected from those entering LeMoyne College in

September, 1935. The group consisted of a total of one hundred and sixty students. During Freshman Week these students were required to take both an intelligence test and a high school achievement test. For the intelligence test, "The Otis Self-Administering Test of Mental Ability, Higher Examination, Form B," was used. For the achievement test, "The Iowa High School Content Examination" was used. (Copies of these tests are found in Appendix G and Appendix H.)

Pairing of Subjects.- On the basis of a combination of the results from these tests, this freshman group was divided into sections with a student in each group paired with one in the other of equal intelligence and achievement. A correlation chart of the test scores for intelligence and achievement was constructed. The position of each student was shown by a single dot on the chart. The pairs were selected by locating dots which were closest together. An illustration of the use of this technique is to be found in the report of an experiment by Butterweck (5:116). By this method students of equivalent intelligence and achievement in high school as shown by the test were placed in each section, such that the two groups were as near equal as possible (Table I). The mean of the scores of Section I in intelligence exceeded the mean of Section II by .2 of a point, while the mean of Section II on high school achievement exceeded the mean of Section I by .3 of a point.

Pre-test.- At the beginning of the course both sections were given a pre-test which had previously been compiled by the specialists in the different fields in conjunction with the individual lecturer. This test was designed to secure a cross-section of the information

already possessed by the entering freshmen in the respective fields of the course. It gave a sampling of the major fields of the course. On the pre-test the mean of the scores for Section I exceeded the mean of Section II by only .27 of a point. The means and standard deviations of the scores on the tests used for equating the groups at the beginning of the course, and also for the pre-test are shown in Table I.

TABLE I

MEANS AND STANDARD DEVIATIONS OF SCORES ON TESTS USED FOR EQUATING GROUPS AT THE BEGINNING OF THE COURSE IN SEPTEMBER, 1935, AND FOR THE EQUATED GROUPS ON THE PRE-TEST OF SEPTEMBER, 1935

	Section I	Section II
Number of Cases	80	80
Otis Intelligence Test		
Mean .....	26.55	26.35
Sigma .....	8.91	9.93
Iowa High School Achievement Test		
Mean .....	84.00	84.30
Sigma .....	30.70	35.50
Pre-test in Orientation		
Mean .....	22.91	22.64
Sigma .....	8.07	9.13

Content of Course.— The Orientation Course briefly surveys the following fields: (1) Astronomy, (2) Geology and Physiography, (3) Physics, (4) Chemistry, (5) Biology, (6) Bacteriology, (7) Evolution,

(8) Anthropology, (9) Sociology, (10) Economics, (11) Political Science, (12) Heredity, (13) Embryology, (14) Physiology, (15) Psychology, and (16) Hygiene and Sanitation. In addition to these major units, the course included lectures on "How to Study," "How to Take Notes," and the "Use of the Library," as well as some of the fundamental operations in mathematics. An outline of the lectures is shown in Appendix A.

Method and Materials.- Section I was taught by specialists from each of the above departments. Section II was taught by a single lecturer (the writer), who gave all the lectures in the different fields. Both sections were lectured to on the same days at different hours, but upon the same basic materials. In order to keep the content of these lectures as much the same as possible, the lectures were based upon the same basic text, "The Nature of the World and of Man," By H. H. Newman and others (34), of the University of Chicago. For the social sciences not covered by this text, syllabi were provided by the social science departments as a basis for the lectures in their respective fields. Prior to the lectures, conferences were held between the specialists and the individual lecturer relative to the material to be covered, and together they worked out the tests to be given at the end of each series of lectures.

Tests.- At the completion of each division or unit of the course, both sections were given the same test covering the materials of the series of lectures on that unit. These tests on each unit were compiled by the specialists in collaboration with the individual lecturer. Each test consisted of one hundred items and usually

included true-false, sentence completion, multiple choice, and matching questions. Samples of these tests are given in Appendix B. All tests were of the objective type and did not include any essay questions. Keys for scoring the tests were made prior to the giving of the tests, care being taken that the questions be such as to permit only one answer, in order to prevent differences in scoring. All tests were scored by two advanced students in the college who had previously taken the course and who in the opinion of the lecturers were well qualified for the scoring. The scoring was then checked by the specialists and also by the individual lecturer to insure accuracy in scoring.

The Instructors.- For each unit, three lectures were given, followed by a test on the materials covered in the lectures on the unit. All of the specialists as well as the individual lecturer were familiar with the specific contents of the course. Each of the specialists had lectured in the course on his specific unit for the two years previous to the experiment (1933-1934 and 1934-1935). The individual lecturer had presented all the lectures in the course during one of the preceding years (1931-1932).

Each of the specialists had at least a Master's degree from some reputable college or university, with a major in the particular field in which he was lecturing. The average amount of training was two years of graduate study. The above facts indicate an equivalence of preparation and experience for participation as lecturers in the experiment. Furthermore, all were enthusiastic participants. Since LeMoyne College is a relatively small college with an enrollment of

between three and four hundred students, with a limited faculty, there is much rivalry between the different departments to secure majors in their respective fields. Consequently, the lecturers in the orientation course felt that the course afforded an opportunity so to present the materials in their lectures as to attract the freshmen into their respective departments, either for specialization, or to take additional courses.

Due to faculty limitations, it was necessary for the individual lecturer also to serve as specialist for several of the units. These units were the basis for tests 3, 4, 13, 18, and 24.

Variance in Procedure for the Two Semesters.- The individual lecturer used a different procedure in each of the two semesters. During the first semester, the individual lecturer endeavored to duplicate as nearly as possible the lectures given by the specialists. He sat in on each of the lectures given by the specialists, and took detailed notes on the lectures. The attempt was made to make the lectures as near identical as possible for the two sections, in order that the only difference between the two sections might be the giving of lectures by different specialists on each unit for Section I, and the giving of all lectures by a single lecturer for Section II.

An analysis of stenographic reports of parallel lectures, together with observations made by specialists who sat in on the parallel lectures given by the individual lecturer revealed the following with reference to the degree of identity between the lectures:

(1) The subject-matter content of the parallel lectures was essentially the same.

(2) There was a tendency on the part of the specialists to use more technical terms in their lectures.

(3) The specialists tended to give more detailed discussions of the minor details of the content of their lectures than did the individual lecturer.

(4) The individual lecturer tended to stress more the important and significant facts of the content.

(5) The individual lecturer tended to stress more the inter-relation between the various units than did the specialists.

(6) In the opinion of the specialists and of the individual lecturer, these tendencies, although present, were not considered sufficiently large to constitute significant differences.

During the second semester this procedure was fundamentally modified. Instead of attempting to make the lectures identical with those of the specialists, the individual lecturer covered the same materials in his own way. He especially emphasized the essential unity of all sciences and endeavored to picture the various units as a continuous development of the nature of the world and of man. As much as possible the technical terminology characteristic of each unit was eliminated. Care was taken to see to it that the items covered in the tests were sufficiently covered by both lecturers. This latter procedure appealed to the writer as being more nearly comparable to actual classroom situations as such courses would actually be handled under other than experimental conditions.

Post-test.- At the end of each semester, that portion of the

pre-test was again given which contained the items relating to the divisions or units covered during that semester. Together these items constituted the post-test or final test which served as a device for an evaluation of the extent of improvement in knowledge retained as a result of the instruction.

Analysis of High School Transcripts.- An analysis was made of the high school records of these freshmen to determine what subjects they had studied in high school from which they might have secured a background of information in the fields covered by the course. Such subjects as physics, chemistry, biology, zoology, botany, physiology, general science, civics, and economics, which might have been taken in high school, were tabulated. The scores made by these pupils in the orientation course in related fields were studied to determine the effectiveness of this supposed background in attaining success in these fields.

Student Reactions.- An elaborate questionnaire was devised and used at the end of the course to ascertain student attitudes and reactions:  
\*

- (1) Towards the methods of presentation;
- (2) Towards the various units presented;
- (3) As compared with other courses taken;
- (4) The extent to which interest in various fields had been developed as a result of the course;
- (5) Their points of view and liking for the tests given at

---

\*  
Appendix C

the end of each unit.

Final Selection of Subjects in Each Group.- A number of eliminations and withdrawals occurred during the year. For the final statistical analysis of results, it was desired to consider only those individuals in each section who had remained in the course for the entire year and whose initial status was such that individuals of corresponding initial status could be found in the other section. This final selection of subjects was based upon a method of pairing described by Garrett (19:277-8). The distribution of raw scores on each of the separate tests (intelligence and achievement) was reduced to percentiles. These separate percentile ranks were then combined into a final percentile ranking for each individual. Students in the two sections with equivalent composite scores were paired for the purpose of a statistical analysis of the results. (See Appendix D.)

This procedure left for the final study a total of one hundred and eighteen students, or fifty-nine students in each section. After this final selection, the mean of Section I exceeded the mean of Section II by .16 of a point in intelligence, and by .17 of a point in high school achievement. The means and standard deviations of these test scores are shown in Table II.

A comparison of Table II with Table I shows the groups as finally selected to be more evenly balanced as to general intelligence and high school achievement than were the larger groups forming the two sections at the beginning of the year. In terms of pre-test scores, the groups finally chosen differ slightly more in terms of

TABLE II  
 MEANS AND STANDARD DEVIATIONS OF SCORES ON TESTS  
 USED FOR FINAL SELECTION OF EQUATED GROUPS IN  
 JUNE, 1936, AND FOR THE EQUATED GROUPS ON  
 PRE-TEST OF SEPTEMBER, 1935

	Section I	Section II
Number of Cases	59	59
Otis Intelligence Test		
Mean .....	28.15	27.99
Sigma .....	9.08	9.14
Iowa Achievement Test		
Mean .....	90.08	89.91
Sigma .....	29.78	32.40
Pre-test in Orientation		
Mean .....	24.13	22.96
Sigma .....	7.80	7.92

means than the complete sections as originally selected. On all three tests, however, variability (shown as sigma) is almost identical for the final groups, whereas initially variability was greater for Section II.

## CHAPTER III

### RESULTS OF THE FINAL TEST, BOTH SEMESTERS COMBINED

#### Introduction

Purpose of the Chapter.-- In this chapter a comparison is made of Section I and Section II results for the year as a whole, in terms of initial and final tests, without regard to the variation in procedure between the first and second semesters. The results may be interpreted as suggestive of general findings only.

The Final Test.-- At the end of each semester, that portion of the pre-test was given which contained the items relating to the divisions or units covered in the lectures during that semester. Together these items constituted the post-test or final test, which served as a device for an evaluation of the extent of improvement in knowledge retained as a result of the instruction. The items of which the test consisted were compiled by the various instructors who participated in the experiment. The test consisted of a total of one hundred items, of which twenty were true-false; forty-eight were sentence-completion; and thirty-two were multiple-choice. A copy of the test will be found in Appendix E. The items in the test had previously been tried out on the freshman class of the previous

year as their final examination, and revised on the basis of the results.

Objective of Initial and Final Tests.- The objective of the initial test was to ascertain the knowledge already possessed by the entering freshmen with reference to the materials of the course. By using the same questions in the final test, a fair indication is secured of the gain in knowledge as a result of the instruction in the course. This gain could be indicated by finding the difference between the number of correct responses made on the initial and final tests.

Reliability of the Test.- The reliability of the complete test was found to be .86. This coefficient of reliability was found by the method suggested by Garrett (19:271). He says:

If a test has no duplicate and cannot well be repeated, we may measure the reliability of half of the test and then by Spearman's formula find the reliability of the whole test. The procedure is as follows: First, we make up two independent sets of scores by combining, say, alternate exercises in the test. For example, one set of scores may be the performance on the odd exercises, e.g., 1, 3, 5, etc., the other set the performance on the even exercises, e.g., 2, 4, 6, etc.; or some other plan may be used. These two sets of scores are now correlated to find the reliability of the half test. If the self-correlation of the half test is called  $r_h$ , substituting  $N = 2$  in Spearman's formula, we can calculate the reliability of the whole test by the formula,

$$r_x = \frac{2 r_h}{1 + r_h}$$

In using this formula we make the assumption that the halves of the test as we have made them up are approximately equivalent in difficulty and content.

In the above formula,  $r_x$  equals the reliability coefficient for the whole test;  $r_h$  equals the  $r$  for the half test.

Data for the application of this procedure were secured from the pre-test records of one hundred and sixty students. The correlation

of the test halves produced a coefficient of .76, and the application of Spearman's prophecy formula produced a reliability coefficient of .86.

The differences between the scores made by the students on the initial test and the final test indicate the amount of measurable information gained by those students as a result of the course.

#### Statistical Technique Employed

The General Plan.- The general plan for handling the experimental data follows the method suggested by Monroe and Englehart (32: 1-75). The notation and formulae presented by these writers will be reviewed briefly, as a basis for a presentation of the results, the application being made to the data of this study.

The Notation Used.- For the initial test at the beginning of the course,

Let  $e$  represent the individual scores made by the students in Section I on the initial test.

Let  $c$  represent the individual scores made in Section II.

Let  $E_1$  represent the mean of the scores for Section I.

Let  $C_1$  represent the mean of the scores for Section II.

For the final test at the end of the course,

Let  $e'$  = raw scores made in Section I on the final test.

Let  $c'$  = raw scores made in Section II on the final test.

Let  $E_2$  = mean of scores for Section I on the final test.

Let  $C_2$  = mean of scores for Section II on the final test.

Then for the initial test

For Section I -  $e_1, e_2, e_3, \dots, e_n$  whose mean is  $E_1$

For Section II -  $c_1, c_2, c_3, \dots, c_n$  whose mean is  $C_1$

And for the final test

For Section I -  $e'_1, e'_2, e'_3, \dots, e'_n$  whose mean is  $E_2$

For Section II -  $c'_1, c'_2, c'_3, \dots, c'_n$  whose mean is  $C_2$

(See Appendix F for these raw scores.)

The mean gain in achievement made by Section I is  $E_2 - E_1$  and is designated by the symbol, "Gain E." (This may also be attained by calculating the individual gains and averaging them.)

The mean gain in achievement made by Section II is  $C_2 - C_1$  and is labeled, "Gain C."

The difference in gains, D, is equal to Gain E - Gain C.

Let  $r_{12}$  = coefficient of reliability.

$r_{E E_{12}}$  = correlation between initial and final test scores of Section I.

$r_{C C_{12}}$  - correlation between initial and final test scores of Section II.

According to Monroe and Englehart (32:64-5):

To determine the standard error of measurement of the difference in Gains D, one should insert the values of the standard errors of measurement of the Gains E and C in the formula below.

$$\sigma_{\text{meas}_D} = \sqrt{\sigma_{\text{meas}_{\text{Gain}_E}}^2 + \sigma_{\text{meas}_{\text{Gain}_C}}^2}$$

Computation.- The calculation follows:

$$r_{12} = .86 \quad E_1 = 24.13 \quad \sigma_{\text{dist}_e} = 7.8$$

$$r_{E_1 E_2} = .39 \quad E_2 = 65.46 \quad \sigma_{\text{dist}_{e_1}} = 10.59$$

$$r_{C_1 C_2} = .35 \quad C_1 = 22.96 \quad \sigma_{\text{dist}_c} = 7.92$$

$$N = 59 \quad C_2 = 63.34 \quad \sigma_{\text{dist}_{c_1}} = 11.16$$

$$\text{Gain E} = E_2 - E_1 = 65.46 - 24.13 = 41.33$$

$$\text{Gain C} = C_2 - C_1 = 63.34 - 22.93 = 40.41$$

$$D = \text{Gain E} - \text{Gain C} = 41.33 - 40.41 = .92$$

$$\sigma_{\text{meas}} = \frac{\sigma_{\text{dist}} \sqrt{1 - r_{12}}}{\sqrt{N}}$$

$$\sigma_{\text{meas}_{E_1}} = \frac{7.8 \sqrt{1 - .86}}{\sqrt{59}} = .38 \quad \sigma_{\text{meas}_{E_2}} = \frac{10.59 \sqrt{1 - .86}}{\sqrt{59}} = .51$$

$$\sigma_{\text{meas}_{C_1}} = \frac{7.92 \sqrt{1 - .86}}{\sqrt{59}} = .39 \quad \sigma_{\text{meas}_{C_2}} = \frac{11.16 \sqrt{1 - .86}}{\sqrt{59}} = .54$$

These values should be inserted in the following formulae:

$$\sigma_{\text{meas}_{\text{Gain E}}} = \sqrt{\sigma_{\text{meas}_{E_1}}^2 + \sigma_{\text{meas}_{E_2}}^2 - 2r_{E_1 E_2} \cdot \sigma_{\text{meas}_{E_1}} \cdot \sigma_{\text{meas}_{E_2}}}$$

$$\sigma_{\text{meas}_{\text{Gain C}}} = \sqrt{\sigma_{\text{meas}_{C_1}}^2 + \sigma_{\text{meas}_{C_2}}^2 - 2r_{C_1 C_2} \cdot \sigma_{\text{meas}_{C_1}} \cdot \sigma_{\text{meas}_{C_2}}}$$

$$\sigma_{\text{meas}_{\text{Gain}_F}} = \sqrt{(.38)^2 + (.51)^2 - 2 \times .39 \times .38 \times .51} = .5$$

$$\sigma_{\text{meas}_{\text{Gain}_C}} = \sqrt{(.39)^2 + (.54)^2 - 2 \times .35 \times .39 \times .54} = .54$$

$$\sigma_{\text{meas}_D} = \sqrt{(.5)^2 + (.54)^2} = .73$$

Difference in gains = .92

$$\text{Critical ratio} = \frac{.92}{.72} = 1.26$$

A critical ratio of 1.26 = 3962 / 5000 = 8962 cases in 10,000 or 90 chances in 100 that the true difference is greater than zero.

Results.— These results are summarized in Table III which shows the comparative gains of Section I and Section II from the initial test to the final test.

TABLE III

COMPARATIVE RESULTS ON INITIAL AND FINAL TESTS

	Section I	Section II
Number of Cases	59	59
Initial Test		
Mean .....	24.13	22.96
Sigma (dist.) .....	7.80	7.92
Final Test		
Mean .....	65.46	63.36
Sigma (dist.) .....	10.59	11.16
Correlation .....	.39	.35
Gain .....	41.33	40.41
Coefficient of Reliability ..		.86
Difference in Gains .....		.92
Sigma (diff.) .....		.73
Critical Ratio .....		1.26
Chances in 100 .....		90

The difference of .92 in the gain of Section I over Section II is not a statistically reliable difference, as shown by the critical ratio of 1.26. A critical ratio of three or more is accepted as indicating practical certainty that a true difference in the same direction exists. Monroe and Englehart (32:66) give the following formula for the chances of the statistical significance of a difference:

$$E. C.* = \frac{\text{Diff.}}{2.78 \times \sigma_{\text{diff.}}}$$

A critical ratio which is less than three is not generally accepted by statisticians as a reliable difference. According to Garrett (19:133), a  $\frac{D}{\sigma_{\text{diff.}}}$  of 1.26 is  $\frac{1.26}{3}$  - or about 42 per cent of what it should be in order to insure a difference always greater than zero.

Garrett says (19:133):

It is usually customary to take a  $\frac{D}{\sigma_{\text{diff.}}}$  - of 3 as indicative of complete reliability, since  $-3\sigma$  includes practically all of the cases in the distribution of differences below the mean. A  $\frac{D}{\sigma_{\text{diff.}}}$  greater than 3 is to be taken as indicating just so much added reliability.

McCall (29:404-5), uses the formula:

$$E. C. = \frac{\text{Difference}}{2.78 \times \sigma_{\text{diff.}}}$$

When the expression is equal to 1.0, the chances that the true difference has the same sign are in the ratio of 369 to 1. This is the critical point below which differences should not be recognized as significant. E. C. = 1 equals just exactly practical certainty.

According to Monroe and Englehart (32:75):

---

\* E. C. = Experimental Coefficient

A discussion of the significance of a difference in gains should make it clear that caution must be exercised in interpreting a small difference and that the interpretation cannot be accomplished by the application of any formula or group of formulae. In general it is necessary to inquire carefully and critically into the conditions of the experiment; then the best that can be done is to estimate the allowance that should be made for imperfections in the data. Since an estimate must be considered only an approximation, it follows that the interpretation of a relatively small difference in gains must be somewhat uncertain. When the difference is relatively large, definite conclusions may be justified, but even in this case they must be restricted to the conditions of the experiment.

Since the difference found was relatively small and unreliable, it follows that the differences in achievement attained under the two procedures are not significant.

#### Summary

The results presented in this chapter indicate that there is no significant difference in the achievement attained in the two different sections as judged by the difference in gains from the initial test to the final test. What differences do occur are in favor of lectures by specialists. The chances are 90 in 100 that the superior achievement by the students in Section I who had lectures by specialists as compared with the students in Section II who had lectures by a single individual is not due to chance. The odds are nine to one or only 42 per cent of what they should be to insure a difference in achievement always greater than zero.

The failure to find significant differences between the results for Section I and Section II for the year as a whole indicates the necessity for breaking down the general results and analyzing the data in terms of such detailed factors as may appear when the evidence is

considered semester by semester, and unit by unit. Chapters IV and V present such a detailed analysis.

## CHAPTER IV

### RESULTS OF THE TESTS GIVEN AT THE END OF EACH SEMESTER

#### Introduction

Purpose of the Chapter.-- In Chapter III comparisons were made of the equated groups with reference to the gains made in achievement from the initial test to the final test as a result of the instruction for both semesters combined. In this chapter comparisons will be made of the gains made in achievement from the initial test to the tests given at the end of each semester.

Procedure.-- During the first semester the individual lecturer endeavored to duplicate as nearly as possible the lectures given by the specialists. The extent to which this was accomplished has been indicated in Chapter II. During the second semester the procedure was varied to the extent that, instead of attempting to make the lectures identical with those of the specialists, the individual lecturer covered the same materials in his own way.

At the end of each semester, that portion of the pre-test was given again which contained the items relating to the division or units covered by the lecturer during that semester. From the results of these tests were obtained the gains made from the initial test to

the semester tests.

First Semester Results.— Table IV shows a comparison of the gains and the reliability of the gains made from the initial test to the semester tests for the paired groups. For the first semester, the difference in mean gains was found to be only .10 with a critical ratio of .07 or 53 chances in 100 that the mean gain of Section I would exceed

TABLE IV

GAINS AND RELIABILITY OF GAINS FROM THE INITIAL TEST  
TO THE FINAL TESTS FOR EACH SEMESTER

	Section I	Section II
<b>First Semester</b>		
Mean(gains) .....	16.30	16.20
Sigma(dist.) .....	6.33	8.79
Sigma(mean) .....	.82	1.14
Difference .....	.10	
Sigma(diff.) .....	1.40	
Critical Ratio ....	.07	
Chances in 100 ....	53	
<b>Second Semester</b>		
Mean(gains) .....	25.55	24.63
Sigma(dist.) .....	8.60	8.74
Sigma(mean) .....	1.02	1.03
Difference .....	.92	
Sigma(diff.) .....	1.45	
Critical Ratio ....	.63	
Chances in 100 ....	74	
Number of Cases	59	59

the mean gain of Section II. This indicates that there was practically no difference in the achievement of the paired groups during the first semester under either method. The odds are only 53 to 47 in favor of Section I, or practically no difference at all. These results are just what might be expected if the lectures for Section I and Section II really duplicated each other.

Second Semester Results.- For the second semester the difference in the means of the gains was found to be .92 in favor of the method used for Section I. The critical ratio was .63 or 74 chances in 100 that the mean of Section I would exceed the mean of Section II, the odds being approximately 3 to 1. The difference is small and unreliable. Here a difference appears, but it is not marked. So far as it is to be trusted, it indicates better preparation for the final examination by the specialists.

Comparisons.- Comparing the results in gains for the two semesters, it was found that both Sections I and II made higher gains during the second semester than during the first semester. For Section I the difference in gains for the two semesters was 9.25 in favor of the second semester. The standard error of this difference is 1.35. The difference in gains divided by the standard error of the difference gives a critical ratio of 6.85. For Section II the difference in gains for the two semesters was 8.43 in favor of the second semester. The standard error of this difference is 1.54 and the critical ratio is 5.50. Both of these differences are large and statistically significant.

Causes of Differences.- These large differences in the gains for both sections in the second semester over the first semester can probably be accounted for when the causes which may have produced them are considered. An analysis of the scores made on the initial test shows that the students scored successfully on comparatively few of the questions relating to the social sciences. The units on the social sciences were lectured upon during the second semester; as a result the students made the greatest gains on the subject-matter on which they knew least at the beginning of the course. An analysis of the students' high school transcripts shows that most of them took two or more courses in physical and biological science in high school. (The distribution of the subjects taken in high school is shown in Table X on page 66.) The majority of the lectures on these sciences occurred during the first semester. The students made least gain on those items about which they knew most at the beginning of the course, as shown by the scores on the initial and final tests. Thus they made least gain during the first semester and most gain during the second semester. Finally, the freshmen had become better adjusted to college life and to the lecture method of instruction, and had settled down to more effective work by the beginning of the second semester.

#### Summary

The results of this chapter indicate that there is very little difference in the achievement attained by the paired groups under either procedure, as judged by the differences in gains from the

initial test to the tests given at the end of each semester. What small differences do occur are in favor of the method of lectures by specialists.

During the second semester the differences in the gains of Section I over Section II are slightly higher than for the first semester. The difference, however, is small and unreliable and would seem to indicate that the variance in the procedure for the second semester did not produce a significant difference.

The students in both sections made significantly higher gains in achievement during the second semester than they made during the first semester. Apparently under either procedure or method of instruction, students would accomplish more during the second semester than during the first semester.

## CHAPTER V

### RESULTS OF TESTS ON THE DIFFERENT UNITS

#### Introduction

Purpose of the Chapter.- In Chapter III comparisons were made of the results of the course as indicated by the gains made in achievement from the initial test to the final test. Chapter IV compared the results of the tests given at the end of each semester. In this chapter, comparisons will be made of the differences attained by the two sections as indicated by the tests which were given at the completion of the series of lectures on each unit. The content and method of scoring these tests have been indicated in Chapter II.

#### Statistical Technique Employed

In treating the data, the means, or averages, of the scores made by Section I were compared with the means of the scores made by Section II on the tests. The standard deviations of the distributions of the scores were computed for the paired groups.

The reliability of the means was determined by computing the standard deviations of the means. Differences between means may be statistically significant or may be due to chance. In order to

determine whether these differences are statistically significant, the critical ratio of the difference between the means of Section I and Section II was computed (the difference between the means divided by the standard deviation of the difference between the means). A critical ratio of three or more indicates practical certainty that a true difference in the same direction exists.

In Chapter III, in comparing the gains made by the equated groups, the long formula was used in determining the reliability of the difference.

According to Walker (43:54):

If an investigator, arguing from the abbreviated formula, has decided that a particular difference is so small in relation to its standard error that it cannot be considered significant, it is quite possible that the use of the longer formula would cause him to revise his conclusions. This would not be true if there were a negative correlation between the variates contributing to the difference, but such cases are rare in educational research.

(a) Difference between the performance of the same individual on two occasions.

$r$  = coefficient of correlation between the two sets of scores made by the same person.

(b) Difference between the performance of equated individuals.

$r$  = correlation between score made by child in group 1 with his pair in group 2.

The coefficient of correlation was computed between the gains made from the initial test to the final test for the equated groups and found to be  $-.20$ . Since the correlation was found to be negative and very low, the short formula was used to compute the reliability of the differences of the test scores in this chapter. Furthermore, the number of subjects taking each test varied, seldom being at the maximum of fifty-nine in each group. At the same time it seemed desirable to keep each group as large as possible. Use of the short

formula does not misrepresent the facts, except in so far as it fails to show reliability quite so high as it might be were the long formula used.

## Results

Comparison of Means for the Twenty-four Tests.— In Table V are shown the comparative results of the tests given at the end of each series of lectures. An analysis of Table V shows that in seventeen of the twenty-four tests, the means of Section II exceed the means of Section I. In seven of the twenty-four tests the means of Section I exceed the means of Section II. In six of the seventeen tests in which the means of Section II exceed the means of Section I, the differences are statistically significant. The critical ratios of these six tests are 3.62 for test 4, 5.19 for test 5, 3.81 for test 6, 5.07 for test 9, 4.79 for test 10, and 5.32 for test 18. These differences are large and reliable and indicate practical certainty that on these six units the means of Section II would always exceed the means of Section I.

In no one of the seven tests on which the means of Section I exceed the means of Section II is the difference a statistically significant one.

The reliability of the differences on the seventeen tests favoring Section II are shown in Table VI, and for the seven tests favoring Section I in Table VII.

TABLE V  
RESULTS OF TESTS GIVEN ON EACH  
OF TWENTY-FOUR UNITS

Test	Section I			Section II			Differences Favoring Section I	Differences Favoring Section II	Critical Ratio
	Means	Sigma (dist.)	Number Cases	Means	Sigma (dist.)	Number Cases			
1	63.75	14.24	48	63.84	15.25	52		.09	.03
2	78.18	8.16	59	73.69	8.70	59	4.49		2.36
3	76.72	11.15	58	69.13	15.80	58	7.59		2.40
4	55.81	16.50	56	65.22	10.56	55		9.41	3.62
5	59.95	14.50	57	72.93	12.50	58		12.98	5.19
6	68.63	10.50	58	76.25	11.25	52		7.62	3.81
7	56.01	15.60	57	61.40	13.85	55		5.39	1.71
8	52.24	17.95	57	57.86	17.05	56		5.62	1.73
9	57.41	14.35	56	69.57	11.20	58		12.16	5.07
10	65.22	12.00	57	75.61	11.65	58		10.39	4.79
11	65.86	13.00	58	63.88	14.00	58	1.98		0.76
12	83.10	10.45	58	87.50	8.80	59		4.40	2.48
13	79.91	9.95	58	84.13	8.20	55		4.22	2.48
14	60.06	13.30	57	64.82	15.30	54		4.76	1.54
15	63.29	11.80	57	65.42	15.30	53		2.13	0.83
16	71.79	16.65	56	73.50	16.65	55		1.71	0.55
17	67.92	14.00	59	73.62	10.40	58		5.70	2.52
18	65.89	15.10	59	81.31	16.25	59		15.42	5.32
19	69.68	10.75	55	69.59	13.80	55	.09		0.04
20	78.03	9.75	57	82.16	13.05	59		4.13	1.79
21	60.87	10.65	58	63.49	10.95	56		2.62	1.13
22	68.54	12.50	48	65.97	15.05	52	2.57		0.83
23	64.91	11.75	56	62.23	12.50	56	2.68		1.19
24	66.14	11.50	55	62.00	11.65	59	4.14		1.94

TABLE VI  
 RELIABILITY OF DIFFERENCES ON SEVENTEEN  
 TESTS FAVORING SECTION II

No. of Test	Critical Ratio	Chances in 10,000 *	Approximate Odds
1	.03	5120	1 to 1
4	3.62	9998.41	Certainty
5	5.19	9999.9975	Certainty
6	3.81	9999.297	Certainty
7	1.71	9564	19 to 1
8	1.73	9482	19 to 1
9	5.07	9999.9973	Certainty
10	4.79	9999.9899	Certainty
12	2.48	9934	150 to 1
13	2.48	9934	150 to 1
14	1.54	9383	15 to 1
15	.83	7967	4 to 1
16	.55	7088	2 to 1
17	2.52	9941	160 to 1
18	5.32	9999.9988	Certainty
20	1.79	9633	26 to 1
21	1.13	8708	9 to 1

\*From Garrett (19:91, Table X).

TABLE VII  
RELIABILITY OF DIFFERENCES ON SEVEN  
TESTS FAVORING SECTION I

No. of Test	Critical Ratio	Chances in 10,000	Approximate Odds
2	2.36	9909	108 to 1
3	2.40	9918	120 to 1
11	.76	7764	3 to 1
19	.04	5160	1 to 1
22	.83	7967	4 to 1
23	1.19	8830	7 to 1
24	1.94	9738	37 to 1

According to McCall (29:404-5):

The odds of 369 to 1 constitute the critical point below which differences should not be recognized as significant.

Results for Units in which the Lectures were the Same for Both Sections.— For the five units in which the individual lecturer presented the lectures for both sections, the differences are in favor of Section I on tests 3 and 24, the odds being 120 to 1, and 37 to 1, respectively. The differences are in favor of Section II on the other three tests, 4, 13, and 18. On test 13 the odds are 150 to 1 in favor of Section II. On test 4 the odds are 680 to 1 in favor of Section II, and on test 18 the odds are indeterminately high in favor of Section II. Both of these last two differences are large and statistically significant, the odds being considerably more than the critical point

of 369 to 1.

The fact that these odds in some instances favor Section I and in others Section II when both sections are taught by the same instructor would seem to indicate that the lecturer makes relatively little difference in the determination of achievement when the materials are equally well presented.

The results of the tests are in favor of lectures by a single individual in seventeen out of the twenty-four or seventy per cent of the tests. In six or twenty-five per cent of the tests the differences are significant and reliable. In one of these cases, however, test 18, in which the odds are greatest in favor of Section II, there is reason to believe that the large difference may be due to the transfer of information from the students in Section I to the students in Section II during the interval between the tests, in spite of the precautions taken to prevent such an occurrence.

Comparison of the Data for the Two Semesters.— The first twelve of the twenty-four tests were presented during the first semester and covered the lectures on the physical and biological sciences. The last twelve of the twenty-four tests were presented during the second semester and covered the lectures on the social sciences. For the first semester the means of Section II exceeded the means of Section I on nine of the twelve tests, including five of those where the differences are statistically significant. For the second semester the means of Section II exceeded the means of Section I on eight of the twelve tests, including one of those where the difference is

statistically significant.

An analysis of the data reveals no significant difference in achievement attained as a result of the variance in procedure for the two semesters or for the different subject matter fields. What differences do occur tend to favor Section II for immediate recall on the physical and biological sciences.

Comparisons with Results for General Tests.- A comparison was made of the results found in Chapter III as portrayed in Table III where the differences favor Section I, and the results shown in Table V where the differences favor Section II. An analysis of these results seems to indicate that, in terms of immediate response as shown by the tests given at the completion of the lectures on each unit, the scores made by the students favor the method where all the lectures were presented by a single lecturer; in terms of delayed response, as indicated by the final test at the end of the course, student scores favor the method where each separate unit is presented by a specialist.

#### Summary

The results presented in this chapter indicate that there is no consistent and significant difference in the achievement attained by the paired groups as judged by the differences in the means of the scores made on the tests given at the completion of each series of lectures. What differences do occur favor the method where all the lectures are given by a single lecturer. In sixteen of the twenty-

four tests the differences favor this method. In six of the tests the differences favor the method where the lectures on the various units are presented by specialists. For the remaining two tests there is practically no difference in the achievement attained.

In contrast to the results in Chapter III where the differences favor the method of presentation by specialists, the combined results indicate the following:

(1) In terms of immediate recall as judged by the tests given at the end of each series of lectures, the results favor lectures by a single individual.

(2) In terms of delayed response, or retention, as judged by the final test, the results favor lectures by specialists.

## CHAPTER VI

### COMPARISONS OF THE EFFECT OF THE TWO PROCEDURES ON STUDENTS MAKING HIGH AND STUDENTS MAKING LOW SCORES ON THE INTELLIGENCE AND ACHIEVEMENT TESTS

#### Introduction

Purpose of the Chapter.- Chapter V made comparisons of the results of the tests given at the completion of the lectures on each unit. The differences between the means of the scores for the two sections were found and tested for reliability. This chapter deals with the differences which obtain between the equated groups for those subjects making high scores and those making low scores on the intelligence and high school achievement tests. The results of the tests and the reliability of these results are treated in two sections, one for results related to intelligence and one for those related to school achievement.

These comparisons were made to ascertain the relative effect of the two procedures on the general attainment of the students in the orientation course as related to their scores made on the intelligence and the high school achievement tests. Brighter students might possibly be better prepared to assimilate the varied viewpoints of a number of lecturers; while those with better academic preparation

might perhaps be more ready for the synthetic treatment a single lecturer would tend to give.

### Results Related to Differences in Intelligence

Due to the limited number of cases dealt with in this experiment, it was believed desirable, in making comparisons between groups of high and low intelligence, to select as the group of high intelligence the upper fifty per cent of the cases, and as the group of low intelligence the lower fifty per cent of the cases.

In order to use measures of reliability it is necessary to have the number of cases at least twenty-five or more.

Garrett states (19:142):

In interpreting standard errors we always make the assumption that measures obtained from successive samples are distributed according to the normal probability curve. This assumption is only true, however, when the number of cases is large; it is not valid when the sample is small. Hence the significance of a measure of probability is conditioned upon having a sufficiently large number of cases. If  $N$  is less than 25, there is little sense or justification in using reliability measures.

Comparisons.-- The raw scores made on the "Otis Self-Administering Test of Mental Ability - Higher Examination," were used as the basis for the comparison. The twenty-nine students in Section I who made the highest scores on the intelligence test were compared with the twenty-nine students in Section II making the highest scores on the test. In a similar manner, the twenty-nine students in Section I who made the lowest scores on the intelligence test were compared with the twenty-nine students in Section II who made the lowest scores on the test. The comparisons were made on the basis of the gains made by

these two groups from the initial test to the final test, the data for the two semesters being thrown together.

Table VIII shows the results of the comparisons of the gains made from the initial test to the final test for the students in the two sections making the upper and lower fifty per cent of the scores on the intelligence test.

TABLE VIII  
GAINS FROM INITIAL TEST TO FINAL TEST FOR  
SUBJECTS OF HIGHER AND LOWER INTELLIGENCE

	Section I	Section II
<b>High Intelligence</b>		
Number of Cases ....	29	29
Mean(gains) .....	44.12	43.09
Sigma (dist.) .....	9.48	9.20
Sigma (mean) .....	1.75	1.70
Difference .....	1.03	
Sigma (diff.) .....	2.44	
Critical Ratio ....	.41	
Chances in 100 .....	66	
<b>Low Intelligence</b>		
Number of Cases ....	29	29
Mean(gains) .....	40.40	37.81
Sigma (dist.) .....	10.61	12.90
Sigma (mean) .....	1.96	2.39
Difference .....	2.59	
Sigma (diff.) .....	3.09	
Critical Ratio ....	.84	
Chances in 100 .....	80	

For the students making the highest scores in the two sections on the intelligence test, the difference in the means of the gains from the initial test to the final test was found to be 1.03 in favor of Section I. The standard error of this difference was 2.44. The critical ratio of .41 indicates that the difference was not statistically significant, the chances being only 66 in 100, or odds of 2 to 1 that the mean of Section I would exceed the mean of Section II.

For the students making the lowest scores in the two sections on the intelligence test, the difference in the means of the gains was 2.59 in favor of Section I. The standard error of this difference was 3.09. The critical ratio of .84 does not indicate a statistically significant difference, the chances being 80 in 100, or odds of 4 to 1 that the mean of Section I would exceed the mean of Section II.

A further analysis of Table VIII gives the following results: For Section I the mean of the gains for those making the high intelligence scores exceeds the mean of those making the low intelligence scores by 3.72. The standard error of this difference is 3.15 and the critical ratio 1.18. The chances are 88 in 100 or odds of approximately 7 to 1 that the students making the high intelligence scores in Section I will improve more than those making the low intelligence scores.

For Section II this difference in the means is 5.28 in favor of the students making the high intelligence scores. The standard error of this difference is 2.93 and the critical ratio 1.77. The chances

are 96 in 100 or odds of 24 to 1. As has been previously stated, a critical ratio which is less than three, or odds of less than 369 to 1 do not indicate a statistically significant difference.

Summary.- Apparently there is little difference in the effect of the two procedures on the general achievement of students making high and those making low scores on the intelligence test. The differences which do occur favor for both high and low groups the method in which the lectures are given by specialists.

The differences in amount of improvement from initial to final tests between students of high intelligence and students of low intelligence for both sections are not statistically significant. However, the probabilities are that students of high intelligence would attain more under either procedure than would students of relatively low intelligence.

#### Results Related to Differences in High School Achievement

Comparisons.- Comparisons were made on the basis of achievement in high school as measured by the scores made on the "Iowa High School Content Examination." The twenty-nine students in Section I who made the highest scores on this test were compared with the twenty-nine students in Section II making the highest scores on the test (Table IX). The difference in the means of the gains made by these two groups of students from the initial test to the final test was found to be 2.90. The sigma of the difference was 2.90, the critical ratio 1, the chances in 100, 84 or odds of approximately

5 to 1 in favor of Section I.

In a similar manner, the twenty-nine students in Section I who made the lowest scores on the high school achievement test were compared with the twenty-nine students in Section II making the lowest scores on the test.

These results are shown in Table IX. The difference in the average of the gains made from the initial test to the final test was found to be 1.23 in favor of Section I. The critical ratio of .43 indicates that the chances are 67 in 100 or odds of 2 to 1 in favor of Section I.

Comparing the students in both sections making the high achievement scores on the test with those making the low achievement scores gives the results which follow: For Section I, the difference between the means of the gains for the students making the high scores and those making the low scores was 1.35 in favor of the students making the high scores. The sigma of this difference was 2.65 and the critical ratio .51; the chances are 69 in 100 or odds of approximately 2 to 1 that the students with higher achievement in the high school test will gain more in the orientation course than those with lower achievement.

For Section II this difference between the means was .32, the sigma of the difference 3.08 and the critical ratio .10, or practically no difference.

Summary.— The results of these comparisons indicate that the achievement made in high school as judged by the scores made on the

TABLE IX  
GAINS FROM INITIAL TEST TO FINAL TEST FOR  
SUBJECTS OF HIGHER AND LOWER ACHIEVEMENT

	Section I	Section II
<b>High Achievement</b>		
Number of cases .....	29	29
Mean (gains) .....	42.88	39.98
Sigma (dist.) .....	12.30	9.75
Sigma (mean) .....	2.28	1.80
<hr/>		
Difference .....	2.90	
Sigma (diff.) .....	2.90	
Critical Ratio .....	1.00	
Chances in 100 .....	84	
<hr/>		
<b>Low Achievement</b>		
Number of Cases .....	29	29
Means (gains) .....	41.53	40.30
Sigma (dist.) .....	7.47	13.50
Sigma (mean) .....	1.38	2.50
<hr/>		
Difference .....	1.23	
Sigma (diff.) .....	2.84	
Critical Ratio .....	.43	
Chances in 100 .....	67	

high school achievement test seems to have no significant effect on the attainment made in the orientation course under either of the two general procedures. The odds are 5 to 1 that the students making the high scores on the tests would gain more when the lectures are given by specialists. The odds are 2 to 1 that the students making

the low scores on the achievement test will gain more when the lectures are given by specialists. These differences are small and unreliable.

The odds are 2 to 1 that the students making the high scores on the achievement test would make more gains under lectures by specialists than would the students making the low scores. There is practically no difference in the attainment made by the students making high scores and those making low scores in achievement in the section where all the lectures are given by a single individual.

CHAPTER VII  
ANALYSIS OF HIGH SCHOOL BACKGROUND

Introduction

Purpose of the Chapter.- Chapter VI made comparisons of the effect of the two procedures on students of relatively high and low intelligence. This chapter deals with an analysis of the high school records of the students to ascertain what subjects they studied in high school from which they might have secured a background of information in the fields covered by the orientation course. Such subjects as physical geography, chemistry, physics, biology, zoology, botany, general science, civics, and economics, which were found as taken in high school were tabulated. The scores made by these pupils on the various tests given were studied to determine the effectiveness of this supposed background in attaining success in the course.

Distribution of Subjects Taken in High School.- Table X shows the distribution of the subjects taken in high school, and the number of students in each section whose high school transcript indicated that they had received credit for these subjects in high school.

The average number of courses taken in high school in the

TABLE X  
 FREQUENCIES OF ELECTION OF HIGH SCHOOL  
 SUBJECTS BY MEMBERS OF EACH SECTION

Subjects Taken in High School	Frequencies of Election	
	Section I	Section II
Physical Geography .....	8	7
Chemistry .....	42	48
Physics .....	35	39
Biology .....	28	23
Zoology .....	0	1
Botany .....	1	2
Physiology .....	2	0
General Science .....	26	22
Civics .....	34	33
Economics .....	10	10
None .....	10	5

fields surveyed by the orientation course was 3.15 for Section I and 3.16 for Section II. There were ten students in Section I and five students in Section II who had no high school background for the course in terms of high school units of credit.

Analysis.- A majority of the students in both sections had credit for high school chemistry. Forty-two or 71 per cent of the students in Section I and forty-eight or 81 per cent of the students in Section II took chemistry in high school. In Table V, test

number seven is the test on the chemistry unit. The means of 56.01 for Section I and 61.4 for Section II are very low in comparison with most of the twenty-four tests, ranking twenty-second and twenty-third respectively. Either the test in chemistry was relatively much more difficult than the other tests, or the high school work in chemistry was not effective in the attainment of success in the unit on chemistry, as judged by the scores made on the test. The same comment applies to biology, which was the field of test eight in Table V. The mean for this test ranked twenty-fourth or lowest for both sections, in spite of the fact that biology was taken by twenty-eight or 50 per cent of the students in Section I, and by twenty-three or 39 per cent of the students in Section II.

The comparisons are somewhat different for physics which was taken by thirty-five or 59 per cent of the students in Section I and by thirty-nine or 66 per cent of the students in Section II. Physics, the field of test six in Table V, ranks eighth for Section I and fifth for Section II. Either the test on the unit in physics was comparatively less difficult or the high school background in physics was more effective in the attainment of success in the unit on physics, as judged by the scores made on the test.

Civics was taken by thirty-four or 58 per cent of the students in Section I, and by 33 per cent of the students in Section II. The means for test seventeen, in political science, rank tenth for Section I and eighth for Section II, as shown in Table V.

The lectures on the units in astronomy, geology, physiography,

physics, chemistry, and biology were all given during the first semester. Since the majority of the units in science were presented during the first semester, the gains made from the initial test to the test given at the end of the first semester can be used as a basis for certain comparisons based on these units.

Table XI shows a comparison of the gains made from the initial test to the final test given at the end of the first semester for the students who had taken three or more units in high school science, and those who had taken two or less than two units in high school science.

An analysis of Table XI reveals that for both sections, the students with three or more units in high school science failed to gain as much as those students with fewer units of high school science. The students in Section I made slightly higher gains than did the students in Section II in both instances. The gains made by the students with an average of less than two units in high school science exceed the average gains for the whole group in both sections.

A comparison of the scores made by the students in both sections who had fewer than three high school units in science revealed that on the initial test these students made relatively lower scores than were made by those with three or more high school units. This greater amount of information already attained by these students with three or more units as shown by the relatively higher scores made by them on the initial test, probably accounts for the smaller gains which they made from the initial test to the test given at the end of the semester.

TABLE XI

GAINS MADE FROM THE INITIAL TEST TO THE FINAL  
TEST FOR STUDENTS WITH THREE OR MORE UNITS  
IN HIGH SCHOOL SCIENCE AND FOR THOSE  
HAVING LESS THAN THREE UNITS IN  
HIGH SCHOOL SCIENCE

	Section I	Section II
Number with three or more high school units	34	27
Average number of units .....	3.4	3.26
Average gain, first semester .....	15.4	12.7
Number with less than three high school units .....	25	32
Average number of units .....	1	1.6
Average gain, first semester .....	17	16.6
Number with no high school units .....	10	5
Average gain, first semester .....	17	13.8
Average gain, second semester .....	26.5	21
Average gain, whole group, first semester .	16.3	16.2
Average gain, whole group, second semester	25.55	24.62

Although the students average only .73 of a unit of high school work in the social subjects for Section I and .75 of a unit for Section II, the gains made during the second semester, during which the lectures on the social subjects were presented, far exceed the gains made during the first semester.

The ten students in Section I who had no high school units in

the fields covered by the orientation course made average gains which exceed those made by the entire group.

Summary.— The results of the comparisons made in this chapter seem to indicate the following:

- (1) The achievement made in the orientation course is not determined by the specific units of subject-matter taken in high school.
- (2) Students with little or no high school background in the field covered by the orientation course tend to gain as much or more than those with some high school background, in terms of high school units.
- (3) Students tend to make most gains in those fields in which they know least at the beginning of the course.
- (4) Novelty seems to be an incentive to learning.

## CHAPTER VIII

### ANALYSIS OF THE STUDENT QUESTIONNAIRE

#### Introduction

In previous chapters, analyses and comparisons have been made which were based on the results of various types of tests. In this chapter an analysis will be made based on the reactions obtained from the student questionnaire.

The student questionnaire was used at the end of the course to ascertain student attitudes and reactions:

- (1) Towards the method of presentation;
- (2) Towards the various units presented;
- (3) As compared with other courses taken;
- (4) To the extent to which interest in various fields had been developed as a result of the course;
- (5) Their points of view and liking for the tests given at the completion of each unit.

The questionnaire was filled out by the students during regular scheduled meetings of the sections, two of the final meetings of the classes being allowed for this purpose. They were filled out under the direction of the investigator, the students being permitted to ask for clarification or interpretation of the questions.

The necessity for making certain uses and comparisons which the investigator desired to ascertain from the results of the questionnaire, prevented the giving of the questionnaire, anonymously. The students in both sections were acquainted with the general nature of the experiment and they had developed a keen and genuine interest in the outcome. This interest was appealed to in motivating their sincerity in the checking of the questionnaire.

The analysis will be made in the order in which the questions appeared on the questionnaire. (A duplicate of the questionnaire appears in Appendix C).

#### Time Spent in Preparation for Each Assignment.

The answer to the first question in the questionnaire merely indicated the section in which the student belonged.

The second question asked: Approximately how many minutes did you spend on the average in preparation for each assignment in this course?

The average number of minutes given by the students as the amount of time spent in preparation for each assignment is shown in Table XII. The responses indicate that the students in Section I spent on the average approximately fifteen more minutes in the preparation for each assignment than did the students in Section II. The critical ratio of this difference is 4.03, a fact that indicates that the difference in time spent is statistically significant.

TABLE XII  
 AVERAGE NUMBER OF MINUTES GIVEN BY STUDENTS  
 AS THE AMOUNT OF TIME SPENT IN PREPARATION  
 FOR EACH ASSIGNMENT

	Frequencies of the Indicated Response	
	Section I	Section II
<b>Average Number of Minutes</b>		
100 - 109 .....	2	--
90 - 99 .....	6	--
80 - 89 .....	1	--
70 - 79 .....	1	1
60 - 69 .....	10	7
50 - 59 .....	1	2
40 - 49 .....	15	9
30 - 39 .....	16	21
20 - 29 .....	4	9
10 - 19 .....	3	10
<b>Mean</b> .....	51.27	36.52
<b>Sigma (dist.)</b> .....	23.40	15.60
<b>Sigma (mean)</b> .....	3.05	2.03
<b>Difference</b> .....	14.75	
<b>Sigma (diff.)</b> .....	3.66	
<b>Critical Ratio</b> .....	4.03	

Judging from this evidence, students spend more time in the preparation of each assignment when these assignments are made by different instructors at constantly recurring intervals, than they spend in preparation for assignments which are constantly being made by the same instructor. It is logical to assume that the necessity for adapting themselves to a different lecturer at constantly recurring intervals may necessitate this larger expenditure of time.

#### Student Reactions to the Method of Presentation

The response to question three indicated the students' reactions to the method of presentation of the Orientation Course. For this question as well as for the questions which follow, significant types of reactions were given on the questionnaire and the students were instructed to check in the blank spaces provided for that purpose, those statements which best indicated their own individual reactions.

Table XIII shows the number of times the students of each section checked the different reactions. As indicated by their responses, the majority of the students in each section naturally preferred the method of procedure which was used for the section in which they belonged. All of the students, however, knew of the difference in the procedure which was being used for the two different sections, and a number of them, in each section, indicated a preference for the procedure being used for the section to which they did not belong.

About the same number or approximately sixty-three per cent of the students in each section were of the opinion that the units were well connected. An even larger number, 43 or 73 per cent in Section I,

TABLE XIII  
STUDENT REACTIONS TO METHOD OF PRESENTATION

	Frequencies for Indicated Response	
	Section I	Section II
(a) Preference a specialist for each division .....	47	15
(b) Preference a single lecturer for entire course .....	12	44
(c) The units were well connected .....	37	38
(d) The units were taught as separate divisions with little connection .....	10	12
(e) The whole course seemed a continuous development of the "Nature of the World and of Man." .....	43	51
(f) The lecturers used too many technical terms .....	9	10
(g) Some of the lecturers gave information beyond my comprehension .....	27	22
(h) Other lectures were easily comprehended .....	44	49
(i) The lecturers over-emphasized their special fields .....	8	3
(j) The instruction was equally good in all fields .....	26	34

and 51 or 86 per cent in Section II considered the whole course as a continuous development of the "Nature of the World and of Man." Since there was a difference here of 13 per cent in the number of responses, the standard error of this difference was found; the chances were 96 in 100 or odds of 24 to 1 in favor of Section II.

Edgerton and Paterson (16:378-391), give a method for determining the standard error of the difference between two percentages. The formula used is given by Mule (46:269):

$$\sigma_{(\text{diff.})} = \sqrt{\sigma_{p_1}^2 + \sigma_{p_2}^2}$$

The computation was as follows:

Let  $p_1$  = per cent of responses by Section I.

Let  $p_2$  = per cent of responses by Section II.

$$\begin{array}{lll} p_1 = 73\% & \sigma_{p_1} = .058 & \sigma_{p_1}^2 = .003364 \\ p_2 = 86\% & \sigma_{p_2} = .045 & \sigma_{p_2}^2 = .002025 \end{array}$$

$$\sigma_{(\text{diff.})} = 13\% \text{ or } .13$$

Substituting these values in the formula:

$$\begin{aligned} \sigma_{(\text{diff.})} &= \sqrt{.003364 + .002025} = \sqrt{.005389} \\ \sigma_{(\text{diff.})} &= .073 \end{aligned}$$

$$\text{critical ratio} = \frac{.13}{.073} = 1.78$$

chances in 100 = 96 or odds of 24 to 1

This means that if the experiment were repeated under similar conditions, the odds are 24 to 1 that more of the students would consider the course a continuous development of the "Nature of the World and of Man" in the section in which the lectures are all given

by a single lecturer, than in the section in which the lectures are given by a number of different specialists.

Approximately the same number of students in each group, 15 per cent of those in Section I and 17 per cent of those in Section II, considered the lecturers to have used too many technical terms.

A larger number, 46 per cent of those in Section I and 37 per cent of those in Section II, reacted that some of the lectures gave information beyond their comprehension. The difference is not significant. Space was provided in the questionnaire for the naming of the fields where this situation occurred. For Section I, the highest frequencies were for Bacteriology and Biology, with 9 each, and Physics, with 8. For Section II, the highest frequencies were Embryology, with 13, Physiology, with 12, Anthropology, with 9, and Biology, Bacteriology, Physics, and Chemistry, with 8 each. The social sciences were least frequently named in both sections. The indications are, that the materials in the lectures on the biological and physical sciences should be simplified and made easier and more comprehensible to meet the needs of less capable students.

By far the greater per cent of the students in both sections considered most of the lectures as easily comprehended. An analysis of the fields named revealed that the students considered heredity and the social sciences (sociology, economics, and political science) as the units most easily comprehended by both sections. These responses to items "g" and "h" are significant when it is considered that a majority of the students had some background of information

in the physical and biological sciences which they obtained in high school, and which they did not have in the social sciences.

Twenty-six or 44 per cent of the students in Section I, and thirty-four or 58 per cent of the students in Section II, considered the instruction as equally good in all fields. The standard error of this difference of 14 per cent was found; the critical ratio was 1.54, indicating 93 chances in 100 in favor of Section II. The odds were thus 13 to 1 that the lectures by the individual lecturer were more likely to be regarded as equally good in all fields.

TABLE XIV  
GENERAL REACTIONS OF STUDENTS TO THE ORIENTATION  
COURSE

Reactions	Frequency for Indicated Response	
	Section I	Section II
(a) There were so many things presented, I am confused .....	2	2
(b) In most or all fields, I have gained knowledge .....	50	41
(c) In some fields I have gained knowledge and insight .....	16	25
(d) In some other fields I have become confused .....	12	10
(e) Too many facts were presented .....	4	5
(f) About the right number of facts to make the material clear .....	47	41
(g) Too few facts were presented to make the material clear .....	2	7
(h) The units have all been related....	36	49
(i) The units were just so many distinct divisions .....	9	6

## General Reactions of the Students to the Orientation Course

Question four aimed to obtain certain general reactions of the students to the course. These reactions are shown in Table XIV. In general the responses as indicated tell the story. Only two in each section felt that the mass of information presented in so many different fields was confusing; a few however felt that the material was confusing in certain specific fields.

An analysis of the students who named some one or more fields in which they were confused, revealed that in every instance with the exception of bacteriology, embryology and physiology, they were students whose scores on intelligence and achievement were exceptionally low, and who had spent least time in preparation for the assignments, according to their own checking of these items.

A relatively large percentage of the students in both sections felt that "About the right number of facts were presented to make the material clear."

For item "h" - the units have all been related, the numbers checking the item were 36 or 61 per cent in Section I, and 49 or 83 per cent in Section II. The standard error of this difference of 22 per cent was found. The critical ratio was 2.27 or 98 chances in 100 that the lectures by the individual lecturer were regarded as correlated better than those by the specialists, as judged by the student questionnaire.

## Student Reactions to the Various Units

Question five was designed to ascertain the reactions of the

students towards the various units in terms of the development of likes and dislikes for the course. The questions provided for a five-point reaction as follows:

- (a) a definite liking for,      (b) a mild interest in,
- (c) no effect,      (d) a mild distaste for, and
- (e) a definite dislike for.

A tabulation of the students likes and dislikes for the various units is shown in Table XV. An analysis of Table XV reveals a striking correlation between the two sections in terms of their checking of their likes and dislikes for the various units. Ranking the reactions in column (a) a definite liking for, in both sections and finding the coefficient of correlation between these ranks, by the Spearman "Footrule" or method of gains (19:192-3), the correlation obtained is  $R = .65$  or  $r = .87$ . By the same method, the correlation between the two sections for their reactions to column (e) a definite dislike for;  $r = .55$ . If columns (a) a definite liking for, and (b) a mild interest in, are combined for each section, the correlation between the order of merit for these reactions is  $.87$ . Similarly a combination of columns (d), a mild distaste for, and (e), a definite dislike for, yields a correlation of  $.78$  between the reactions of the two sections.

These relatively high correlations would seem to indicate that there is little difference in the effectiveness of the two procedures in the development of a liking for or a distaste for the materials of the lectures, as judged by the student questionnaire.

TABLE XV  
STUDENT LIKES AND DISLIKES FOR THE VARIOUS UNITS

	Section I					Section II				
	A. Definite liking for	B. Mild interest in	C. No effect	D. Mild distaste	E. Definite dislike	A. Definite liking for	B. Mild interest in	C. No effect	D. Mild distaste	E. Definite dislike
<u>First Semester</u>										
Astronomy .....	26	23	7	1	2	21	32	4	1	1
Geology and Physiography ...	12	23	13	6	5	6	25	14	8	6
Physics .....	11	23	11	10	4	10	24	7	9	9
Chemistry .....	21	20	7	8	3	16	23	7	6	7
Biology .....	22	23	6	7	1	15	23	8	6	7
Bacteriology .....	16	16	9	12	6	14	24	11	4	6
Hygiene and Sanitation .....	28	22	4	3	2	34	19	5	0	1
<u>Second Semester</u>										
Heredity .....	35	16	3	3	2	42	15	2	0	0
Anthropology .....	18	17	13	10	2	21	19	12	3	4
Sociology .....	31	20	4	4	0	33	24	1	1	0
Economics .....	23	18	7	7	4	23	25	9	3	0
Political Science ..	26	17	5	7	4	22	24	8	5	0
Physiology .....	11	18	14	6	10	13	15	14	3	14
Embryology .....	18	18	10	5	8	11	18	12	8	10
Evolution .....	23	25	6	4	1	27	18	4	6	4
Psychology .....	24	18	8	5	3	39	11	4	3	2
Total .....	345	317	127	98	57	347	339	121	66	71
Per Cent .....	37	33	14	10	6	37	36	13	7	7

Combining the totals of columns (a) and (b) in both sections, and also combining the totals of columns (d) and (e) for both sections, in order to obtain the total distribution of likes and dislikes, the following results are obtained: 71.5 per cent of the total number of responses of the students in both sections indicate that they have developed a definite liking for or a mild interest in the various units; 13.5 per cent of the responses indicate no effect, and 15 per cent of the responses indicate a definite dislike or mild distaste for various units.

Judging by the students' responses to the questionnaire, the orientation course as a whole was highly successful in developing student liking for, and interest in, the various units upon which the lectures were based.

Student Reactions to the Extent to Which the  
Orientation Course Duplicated Work  
Taken in High School

Question six was designed to ascertain the extent to which the lecturers, in their lectures, tended to duplicate the work which the students had already taken in high school. These reactions are shown in Table XVI.

As judged by the students responses, for 10 or 17 per cent of the pupils in Section I, and for 15 or 25 per cent of the students in Section II, the material was practically all new. For 44 or 75 per cent of the students in Section I, and 32 or 54 per cent of those in Section II, a relatively large amount of the materials of the lectures was considered new.

TABLE XVI  
STUDENT REACTIONS TO THE EXTENT TO WHICH THE  
ORIENTATION COURSE DUPLICATED WORK TAKEN  
IN HIGH SCHOOL

	Frequencies of Indicated Response	
	Section I	Section II
(a) Materially practically all new .....	10	15
(b) A small amount of new material given .....	5	12
(c) A large amount of new material given .....	44	32
(d) Most of the material was a duplication of work taken in High School .....	0	0

None of the pupils in either section considered most of the material as a duplication of work taken in high school.

Student Reactions to the Amount of Time Spent  
in Preparation for the Orientation Course  
As Compared with Their Other College  
Courses

Question seven was designed to determine the amount of preparation required for the orientation course as compared with other required freshman courses and electives. The students' reactions to this question are shown in Table XVII.

Required Courses.- Judging by the students responses, the students in both sections spent more time in preparation of their assignments for the other two required freshman courses than they spent in preparation for the orientation course. In the

TABLE XVII  
 AVERAGE AMOUNT OF TIME SPENT IN PREPARATION FOR  
 EACH ASSIGNMENT FOR THE ORIENTATION COURSE  
 AND OTHER FRESHMAN COURSES, ACCORDING  
 TO STUDENT REPORTS

Freshman Courses	Section I		Section II	
	Number Taking	Aver. No. Min.	Number Taking	Aver. No. Min.
Required Courses				
College Orientation .....	59	45	59	35
European History .....	59	85	59	50
English Composition and Rhetoric .....	59	120	59	80
Electives				
Social Sciences .....	31	60	47	40
Biology and Zoology .....	4	120	8	60
College Algebra .....	8	80	8	40
Inorganic Chemistry .....	16	80	8	60
Foreign Languages .....	16	45	31	50
Education and Psychology ...	28	50	36	40

case of European History, this difference may partly be accounted for by the large amount of required outside readings and special reports assigned to them. In the case of English Composition and Rhetoric, the students were required to write a theme each week on various topics assigned to them. Judging by their responses, however, the students in Section I spent a much larger amount of time in the preparation of their assignments in each of their required courses than

did the students of Section II. This difference will again be referred to in a later paragraph.

Electives.- Judging by their responses, the students in both sections spent as much or more time in the preparation of the assignments for their elective courses, than they spent in the preparation of the assignments for the orientation course. In every instance with the exception of foreign languages, the students in Section I spent more time than did the students in Section II.

In the judgment of the investigator, the wide discrepancy between the amounts of time given by the students in the two sections is subject to question. The differences of thirty-five minutes for history, forty minutes for English and algebra, and sixty minutes for biology, are entirely too large to be reliable. It is hardly possible that the majority of the more studious subjects could be in the same section under the conditions by which the two groups were paired. A probable explanation might be that, in the interval between the periods during which the students in the two different sections filled out the questionnaire; the students of Section II as a result of discussing the time given by the members of Section I, decided to indicate smaller amounts of time.

#### Extent of Overlapping Between Courses

Question eight was designed to ascertain the extent to which, in the opinion of the students, the materials of the various units in the course tended to duplicate the materials of other courses they were taking in college.

The reactions to this question are shown in Table XVIII. An analysis of these data is difficult. It is difficult for freshmen to discriminate between materials which are different, closely related, or identically the same. The two sections, however, give reactions to this question. It would seem that for the most part, the amount of overlapping, as indicated by their responses, is not more than would normally be essential for the proper correlation of the materials. For all their courses, a total of only six students felt that there was too much overlapping.

Value of the Orientation Course in  
Comparison with Other Courses

Question nine was designed to ascertain how the students valued the orientation course in comparison with their other college

TABLE XVIII

STUDENT REACTIONS TO THE EXTENT TO WHICH THERE  
WAS OVERLAPPING BETWEEN THE ORIENTATION  
COURSE AND THE OTHER COURSES  
WHICH THEY WERE TAKING

	Section I				Section II			
	Number Taking	Practically no Overlapping	Occasional Overlapping	Too much Overlapping	Number Taking	Practically no Overlapping	Occasional Overlapping	Too Much Overlapping
Inorganic Chemistry ....	16	4	11	1	8	4	4	0
Sociology .....	16	6	10	0	24	9	11	4
Biology & Zoology .....	4	2	2	0	8	4	4	0
Psychology & Education..	28	10	18	0	36	13	22	1
Economics .....	9	6	3	0	12	4	8	0
Political Science .....	6	4	2	0	11	4	7	0

courses in general. The students' reactions are shown in Table XIX.

Approximately fifty per cent of the students in both sections felt that they had gained more valuable information from the orientation course than from any other single course requiring a similar amount of time. Another twenty-five per cent of these students felt

TABLE XIX

STUDENT REACTIONS TO THE ORIENTATION COURSE  
AS COMPARED WITH OTHER COURSES TAKEN

Reactions	Frequencies of Indicated Response	
	Sect. I.	Sect. II
(a) On the whole, would have preferred covering the material in regular courses .....	2	5
(b) Would have preferred giving the full time of the orientation course to one or more specialized courses.,,	10	8
(c) Gained more valuable information from the orientation course than from any other single course requiring a similar amount of time .....	27	29
(d) Gained less information of value from the orientation course than from any other single course requiring a similar amount of time .....	4	2
(e) Gained approximately an equal amount of valuable information from the orientation course as from the average course .....	16	15

that they had gained approximately the same amount of valuable information from the orientation course as from the average course. Only four of the students in Section I, and two students in Section II, felt that they had gained less information of value from the

orientation course than from any other single course requiring a similar amount of time.

Question ten approaches this problem by securing a five-point rating. The question as stated was: Comparing the Orientation Course with your other courses, check the one of the following statements which best gives your opinion of its value.

- (a) A great deal more valuable ..... \_\_\_\_\_
- (b) Slightly more valuable ..... \_\_\_\_\_
- (c) About the same value ..... \_\_\_\_\_
- (d) Slightly less valuable ..... \_\_\_\_\_
- (e) Decidedly less valuable ..... \_\_\_\_\_

The reactions to this question are shown in Table XX.

The results seem to indicate that the two procedures were about equally effective in giving to the students information which they felt was valuable to them. In each group the weight of student opinion is that the course is of greater rather than less value, in comparison with other courses. From this point of view, the course as a whole was highly successful, and more than justifies its existence as a part of the curriculum.

#### Development of Interest as a Result of the Course

For question eleven, the students were given a list of the sixteen basic units of the course and directed to rank them from one to sixteen in the order of their preference, with reference to the extent that their interest had been developed as a result of the course.

TABLE XX  
 RATING OF THE ORIENTATION COURSE  
 IN COMPARISON WITH OTHER  
 COURSES

Reactions	Frequencies of Indicated Response	
	Sec. I.	Sec. II
(a) A great deal more valuable .....	15	16
(b) Slightly more valuable .....	11	8
(c) About the same value .....	27	23
(d) Slightly less valuable .....	4	7
(e) Decidedly less valuable .....	2	5

Since for each section the different units were ranked by fifty-nine different students, it was necessary to find a method for combining these ranks into comparable units and then to reduce these units to a final order of merit. Hull (24:387-491), gives a method whereby this can be accomplished by means of a formula and the use of tables. By use of the formula the per cent position is found. By referring to the tables the corresponding scale score is then found. This scale score can then be multiplied by the number of times the item has received the rank for that position, a procedure which gives a composite score. The total of the composite scores divided by the number of persons ranking the items provides a comparable unit for finding the actual order of merit for the group. E.g.:

$$\text{Formula: } \% \text{ position} = \frac{100 (R - .5)}{N}$$

If  $R = 1$  and  $N = 16$

$$\% \text{ position} = \frac{100(1 - .5)}{16} = 3.13$$

Referring to the table  $\% \text{ position } 3.13 = \text{scale score } 8.6$

If the item was ranked first by four students  $4 \times 8.6 = 34.4$  etc.

Following through the method used by Hull, Table XXI shows how the students in the paired groups ranked the various units with reference to the extent to which their interest was developed as a result of the course.

Using the rank-difference method of finding correlation as presented by Garrett (19:191), the correlation between the ranks of Section I and Section II was found to be  $\rho = .86$  and P.E. = .05.

The results indicate that there is high correlation between the effectiveness of the two procedures in the development of the interest of the students in the various units, as judged by this procedure.

Heredity, the social sciences, and evolution were ranked by both sections as developing the most interest. In order to determine whether or not the students were influenced in their ranking, by the grades which they made on the various units, the correlation was found between the ranks on the various units and the average scores made on the tests for the respective units. For Section I, this  $r = .36$  and P.E. = .15. For Section II,  $r = .35$  and P.E. = .15. Evidently the grades made on the various units had only a slight

TABLE XXI

RANKINGS OF VARIOUS UNITS WITH REFERENCE TO  
THE EXTENT TO WHICH THEIR INTEREST WAS  
DEVELOPED AS A RESULT OF THE  
COURSE

Units	Section I	Section II
	Rank	Rank
Heredity .....	1	1
Sociology .....	2	2
Economics .....	6	3
Evolution .....	4	4
Astronomy .....	9	5
Political Science .....	5	6
Psychology .....	8	7
Sanitation & Hygiene .....	12	8
Biology .....	3	9
Chemistry .....	7	10
Anthropology .....	10	11
Bacteriology .....	14	12
Physics .....	11	13
Geology & Physiography .....	15	14
Embryology .....	13	15
Physiology .....	16	16

relationship to the rankings given the units by the students with reference to the development of interest.

#### Students' Ranking of Courses for Certain Outcomes

For question twelve, the students of both sections were directed to rank the different courses which they had pursued during the year, with reference to: (A) most energy, (B) most cultural value, (C) most value vocationally, (D) most valuable for general information, and (E) most interesting.

Table XXII shows how the students ranked their courses with respect to these values. The orientation course was ranked highest for general information, and relatively high for interest and cultural value. It was ranked relatively low for its vocational value and for the expenditure of energy. In general there was a relatively high correlation between the rankings of the two sections for these outcomes of the course.

#### Student Points of View and Liking for the Tests

For question thirteen, the students were requested to check the statements which best represented their reactions to the tests. These reactions to the test are shown in Table XXIII. These reactions may be summarized as follows:

- (1) The students almost unanimously preferred tests after the completion of each unit.
- (2) They did not feel that too many tests were given.

TABLE XXII

HOW STUDENTS RANKED THEIR COURSES WITH REFERENCE  
TO THE EXPENDITURE OF ENERGY, CULTURAL VALUE,  
VOCATIONAL VALUE, GENERAL INFORMATION,  
AND INTEREST

	Most Energy		Cultural Value		Vocational Value		General Information		Most Interesting	
	A		B		C		D		E	
	Section I	Section II	Section I	Section II	Section I	Section II	Section I	Section II	Section I	Section II
<b>Freshman Courses</b>										
<b>Required Courses</b>										
College Orientation ..	5	7	3	3	5	7	1	1	3	3
English Comp. & Rhetoric ...	1	1	1	1	4	2	4	6	2	4
European History .....	3	2	2	6	6	6	2	3	5	6
<b>Electives</b>										
Social Subjects .....	6	5	4	2	2	3	3	2	4	2
Science .....	2	3	5	7	1	1	5	4	1	1
Languages .....	4	4	7	4	7	5	7	7	6	5
Education & Psychology ...	7	6	6	5	3	4	6	5	7	7
<b>rho .....</b>	<b>.84</b>		<b>.40</b>		<b>.74</b>		<b>.84</b>		<b>.84</b>	

- (3) The students indicated a marked preference for the sentence-completion type of question. There seemed to be little choice between true-false, matching, and multiple-choice questions.
- (4) The students did not feel that the failure to make use of essay questions prevented them from indicating the knowledge they had gained.
- (5) A comparatively large per cent of the students in Section I would have preferred the inclusion of some essay questions.
- (6) The students almost unanimously would not have preferred having all essay questions.
- (7) Approximately thirty-six per cent of the students in Section I, and twenty-five per cent of those in Section II felt that the tests required too much memory.
- (8) Approximately eleven per cent of the students in Section I and twenty-five per cent of those in Section II felt that the tests required too many detailed facts.
- (9) Forty per cent of the students in Section I and twenty-two per cent of those in Section II felt that the tests required a knowledge of too many technical terms.
- (10) The students did not feel that the tests were too difficult.
- (11) The students as a whole felt that the tests afforded a fair opportunity for them to indicate the knowledge which they had gained in the course.

#### Other Student Reactions

Question fourteen provided an opportunity for the students to

TABLE XXIII

## STUDENT REACTIONS TO THE TESTS ON THE VARIOUS UNITS

Reactions	Frequencies for Indicated Response	
	Sect. I	Sect. II
(a) It was advantageous to have a test immediately after the completion of each unit .....	55	58
(b) Too many tests were given .....	2	3
(c) The types of questions which gave the student the best opportunity for indicating the knowledge gained were:		
(1) True-false .....	11	9
(2) Sentence Completion .....	28	25
(3) Multiple Choice .....	10	12
(4) Matching .....	10	13
(d) The failure to make use of essay questions did not give me an opportunity to show best what was learned .....	5	5
(e) I would have preferred the inclusion of some essay questions .....	23	7
(f) I would have preferred all essay questions .....	0	1
(g) The tests required too much memory .....	21	15
(h) The tests required too many detailed facts .....	7	15
(i) The tests required a knowledge of too many technical terms .....	24	13
(j) The tests were too difficult .....	0	2
(k) The tests afforded a fair opportunity to indicate the knowledge gained .....	48	51

state any other reactions, likes or dislikes, for or against the orientation course and for the method of presentation, or to make comments or suggestions.

The reactions which were given and the number of times which they occurred are shown in Table XXIV. Many reactions which duplicated those ascertained in other parts of the questionnaire are not included.

TABLE XXIV  
MISCELLANEOUS STUDENT REACTIONS FOR  
BOTH SECTIONS COMBINED

Reactions	Frequency
Too many subjects were involved .....	1
Select a few teachers who can lecture well .....	1
Do not like women as lecturers .....	1
Too much variation from the basic text-book .....	1
Have only one section for all the lectures .....	2
Do not make use of a text-book .....	3
Have more lectures on each unit .....	3
Devote more time to the social sciences .....	2
Devote more time to class discussions of the materials .....	13
Student participation in the class discussions should be taken into consideration in the determination of grades .....	6
The sections should be smaller .....	3
The sections should meet daily instead of only three times per week .....	1
Lecturers should use fewer technical terms .....	7
The course aids in the selection of a field for concentration .....	18
Most practical of all the required courses .....	5
Consider course as most valuable ever taken .....	20
Enabled to become acquainted with different fields in a short time .....	5
Weekly tests keep students alert .....	6
Prevents election of courses which they might not like .....	8
Provides an opportunity to become acquainted with the different college instructors .....	2
Aids in the selection of electives .....	9

### Summary

The findings from the student questionnaire indicated the following:

(1) Students spend more time in the preparation of their assignments when these assignments are made by different instructors at constantly recurring intervals, than they spend when the assignments are constantly being made by the same instructor.

(2) Those students who spent an amount of time which was far below the average amount of time required by the group as a whole made correspondingly low scores in achievement.

(3) Students generally prefer the procedure to which they have become accustomed.

(4) The units were better correlated and seemed a more continuous development of the "Nature of the World and of Man," in the procedure in which all the lectures are given by the same individual.

(5) There is need for simplification of the materials in the biological and physical sciences to meet the needs of the less capable students.

(6) Though the students regard the instruction in general as good, the odds favor more consistently good lectures, when all the lectures are given by the same individual.

(7) Students of relatively low intelligence and poor high school background tend to spend least time in preparation for their preparation for their assignments, and are most likely to become

confused by the materials.

(8) The two methods of procedure were equally effective in producing a liking for and an interest in the various units of the course.

(9) Students spend more time in preparation for courses in which there are definite required readings, reports, themes, and classroom discussions, than they spend in preparation for purely lecture courses.

(10) The two procedures were equally effective in imparting information which the students considered quite valuable. The majority of the students considered the course as of equal value or of greater value than any other of their courses.

(11) The two procedures were equally effective in the development of student interests in the various units.

(12) Students prefer frequent tests at regular intervals.

(13) Of the different types of objective questions, the students indicate a marked preference for the sentence-completion type. They indicate little choice between true-false, matching, and multiple-choice types.

(14) There is need for the use of fewer technical terms in the lectures, especially in the sciences.

## CHAPTER IX

### SUMMARY

#### The Problem

Major Problem.- The purpose of the study which has been described in the preceding chapters was to determine the relative merits of two general procedures for the presentation of a lecture course in college orientation. These were: (1) to unify the course and the instruction by having the entire instructional program presented by a single individual; (2) to enrich and broaden the course and instruction by having the major units presented by various specialists.

Minor Problems.- Minor problems were to determine the influence of certain factors on the relative effectiveness of the two methods, and also to ascertain their relationship to the achievement, attitudes, and development of interests in the orientation course by the students. Factors considered were: (1) general intelligence; (2) the high school background: (a) subjects studied in high school, (b) results of high school achievement tests; (3) initial status as shown by a pre-test; (4) reactions to the different units of the course on the basis of a student questionnaire.

#### Procedure and Collection of Data

The Procedure.- For the purpose of the study the freshmen

at Le Moyne College during the year 1935-6 were grouped into two sections of eighty students each. From these, fifty-nine pairs, equated on the basis of intelligence and high school achievement, scores, were selected for the final study. For the students in Section I, the lectures on the different areas were presented by specialists; for the students in Section II, all of the lectures were presented by the same individual.

The Tests.- At the beginning of the course, the test which was to be used as a final test for the course was given as a pre-test or initial test. At the end of each semester, that portion of the final test was given which contained the items relating to the divisions or units covered by the lectures during that semester. Together these items constituted the post-test or final test, which served as a device for determining the gains made as a result of the instruction.

The Lectures.- The course was a brief survey of the physical, biological and social sciences. Both sections were lectured ~~to~~ on the same day at different hours, but covering the same basic materials. At the completion of each series of lectures, both sections were given the same test covering the materials of the lectures. Each test consisted of one hundred items. Only objective types of questions were used. All tests were scored by previously prepared keys, and the scoring was checked by both the specialist and the individual lecturer. For each unit, three lectures were given, followed by a test. Each of the lecturers had previously had two years of experience in the teaching of his unit.

Variance in the Procedure.- During the first semester the individual lecturer endeavored to duplicate as nearly as possible the lectures given by the specialists, so that the only difference between the two sections would be lectures by different specialists on each unit for Section I, and all lectures by a single lecturer for Section II. During the second semester, this procedure was varied to the extent that instead of duplicating the lectures of the specialists, the individual lecturer presented the same materials in his own way.

High School Background. - An analysis was made of the transcripts of the students to ascertain what subjects they had studied in high school from which they might have secured a background of information in the fields covered by the course. The scores made by these pupils in the various tests were studied to determine the effectiveness of this supposed background in attaining success in these fields.

Student Questionnaire.- An elaborate questionnaire was devised and used at the end of the course to ascertain student attitudes and reactions: (1) towards the methods of presentation, (2) towards the various units presented, (3) towards the course as compared with those towards other courses taken, (4) the extent to which interest in various fields had been developed as a result of the course, and (5) their points of view and liking for the tests given at the completion of each unit.

### Statistical Technique Employed

The reliability of the initial and final test was found by the method of self-correlation and the application of the Spearman prophecy formula. The general procedure for the comparisons of the equated groups involved the calculations of the mean, standard deviation, correlation coefficients, reliability of the mean, standard error of the difference, critical ratio, and the chances in one hundred of a real difference.

### Major Findings

- (1) The results indicate that there is no significant difference in the achievement attained in the two different sections as a result of the two different procedures for the presentation of the lectures.
- (2) In terms of immediate recall as judged by the tests given at the end of each series of lectures, the results favor lectures by a single individual.
- (3) In terms of delayed response or retention, as judged by the final test, the results favor lectures by specialists.
- (4) In terms of general intelligence, the results indicate that there is no significant difference in the achievement attained under either method of instruction.
- (5) Students of relatively high intelligence tend to achieve more under either method of instruction than do students of relatively low intelligence.

(6) The results indicate that the achievement made in high school as judged by the scores on the high school achievement test, has no significant effect on the attainment made in the orientation course under either of the two general procedures.

(7) The results indicate that the high school background, in terms of specific high school units of credit, has no significant effect on the attainment made in the orientation course. The indications are that students gain most in those fields in which they knew least at the beginning of the course.

(8) In general, students who spend an amount of time which is far below the average amount of time required by the group as a whole, tend to make correspondingly low scores in achievement.

(9) The probabilities are that an orientation course will be better correlated and a more continuous development into a unified whole, when all the lectures are presented by a single lecturer, than when the lectures are presented by a number of different specialists.

(10) The probabilities are that the lectures will be more consistently good in orientation courses, when all the lectures are presented by the same lecturer.

(11) Students of relatively low intelligence and poor high school background tend to spend least time in preparation for their assignments, and consequently, are most likely to become confused by the mass of materials presented in an orientation course.

(12) Students tend to spend more time in preparation for courses in which there are definite required outside readings, special reports

to be made, themes to be written, or classroom discussions, than they spend in preparation for purely lecture courses.

(13) The two procedures are equally effective in imparting information which students consider quite valuable.

(14) Students appear willing to rate the orientation course as of equal value or of greater value than any of their other courses.

(15) Students prefer frequent tests at regular intervals.

(16) The students indicated a marked preference for the sentence-completion type of objective question.

(17) Students overwhelmingly prefer the objective type to the essay type of question.

(18) Students rate the orientation course as exceedingly valuable in aiding in the selection of fields for further study, or for concentration.

(19) The two procedures were equally effective in the development of the interest of students in the various fields of the instruction.

#### Suggestions for Further Investigation

Orientation courses, because of their comprehensive nature and many different possibilities of organization, variance in procedure and content, offer a fertile field for research. This study, so far as can be ascertained, has presented the first evidence that has been secured on a number of problems connected with such courses; yet it is limited to one course, in one college, given under one set of circumstances. Further studies are needed, made under different

conditions and applying to different courses. Research is needed to ascertain the type, extent, and content of such courses, the most effective mode of organization, and the superior techniques of instruction to be used. The following are suggestive types of questions which need to be answered:

- (1) To what extent do such courses function as guidance in the selection of advanced courses in specific fields covered in the course?
- (2) What techniques or procedures can be devised to provide for the individual differences between students?
- (3) Should a single orientation course be offered which makes a brief survey of the various fields of knowledge, or should the materials be presented in several courses, such as: (a) orientation in the physical sciences, (b) orientation in the biological sciences, (c) orientation in the social sciences?

The following are some suggestions for further investigation:

- (1) A carefully controlled experiment for the purpose of comparing the merits of the orientation course with the traditional type of introductory course as a preparation for later work, or concentration in a particular field.
- (2) A number of carefully controlled experiments to determine the relative merits of different techniques of instruction in orientation courses, such as:
  - (a) Lecture-quiz versus discussion quiz.
  - (b) Lecture versus assigned readings.
  - (c) Lecture versus class-discussion.
  - (d) Assigned readings versus class-discussion.
  - (e) Assigned readings versus library research.
  - (f) Class-recitation versus class-discussion.

- (3) A study to determine the extent to which achievement in specific fields of the orientation course results in similar achievement in advanced courses in the same field.
- (4) A study to determine the extent to which accomplishment in specific fields of the orientation course results in the selection of those fields for further study or concentration.
- (5) A four year study to compare the relative effectiveness of orientation courses as against the usual type of college introductory courses; (a) where the first two years of work are principally composed of orientation courses in the various fields of knowledge, followed by concentration in specific fields during the junior and senior years; and (b) where the usual types of introductory courses are offered during the first two years of college work, followed by concentration in specific fields during the junior and senior years.

#### General Conclusions

The results of this study do not indicate a predominant superiority of either of the two general procedures. However, certain advantages accrue to each of the two methods. When the major units are presented by various specialists, the indications are that delayed response or retention is better. This method also affords the students an opportunity to become acquainted with many of the members of the faculty under whom they may later desire to select courses. This may often influence them to major in their respective fields.

When the entire instructional program is presented by a

single individual, the indications favor this method for immediate recall; the probabilities are that the course will be better correlated and that there will be a more continuous development into a unified whole, also that the lectures will be more consistently good under this procedure. Furthermore, under this procedure, the students become adjusted more easily to the method of presentation of the single individual, making it unnecessary for them to be constantly readjusting themselves to the differences in presentation by different specialists at constantly recurring intervals.

An evaluation of the advantages which accrue to each of these two procedures, supplemented by consideration of other non-measured factors, leads to a general recommendation in favor of presentation of the entire instructional program by a single individual. This recommendation is based upon the following considerations:

- (1) Since there is no statistically significant difference in the gains from initial to final examinations as a result of the two different procedures, that procedure should be followed which affords the more advantageous outcomes, in terms of other measures.
- (2) The results favor lectures by a single individual in terms of immediate recall as judged by the tests given at the end of each series of lectures. There were twenty-four such tests. In sixteen of these tests the differences favor this method. In five of these the differences are statistically significant. For two additional tests there is practically no difference in the achievement attained. These results are probably more significant, because of the much greater amount of material covered, than are the results obtained from the final test in which the results favor presentation by

specialists.

(3) The probabilities are that an orientation course will be better correlated and a more continuous development into a unified whole, when all the lectures are presented by a single lecturer, than when the lectures are presented by a number of different specialists.

(4) The probabilities are that the lectures will be more consistently good in orientation courses, when all the lectures are presented by the same lecturer.

(5) There is economy of professorial time, in that this method utilizes the time of only one instructor instead of the time of such a large percentage of the faculty.

(6) There is a clearly demonstrated economy of students' time for study. The average amount of time required in preparation for each lecture was 36.52 minutes under this procedure as against an average of 51.27 minutes for the other procedure.

(7) Under this procedure it is unnecessary for the students to be constantly readjusting themselves to the differences in presentation by different specialists at constantly recurring intervals.

(8) There is a marked favorable attitude of the students for this procedure, as witnessed by their expression of interest, development of a liking for, and guidance to other courses, as well as ease of comprehension.

It is further recommended that: (a) The specialists in conjunction with the individual lecturer should formulate a syllabus for the entire course, to be made available to all the students taking the course. This syllabus should definitely correlate the various units, and will enable the individual lecturer to incorporate in his

lectures many of the advantages which would accrue from having the lectures presented by specialists. (b) Definite assignments of outside readings and special reports should be required in order to obtain more extensive readings to supplement the materials of the lectures. (c) The course should meet daily instead of only three times per week; the two additional meetings to be devoted to class-discussion of the materials of the lectures. This procedure should lead to a fuller understanding of the materials of the lectures, provide an opportunity for clarification of difficult concepts, and afford an opportunity to meet the individual needs of the less capable students.

Final Statement.- This study, so far as can be ascertained, has presented the first evidence that has been secured on a number of the problems connected with orientation courses. Since such courses have become an integral part of the general college curriculum, it is hoped that the findings from this study will result in further investigations for the purpose of finally making such courses as educationally effective as possible.

B I B L I O G R A P H Y

## BIBLIOGRAPHY

1. Anibel, Fred G. "Comparative Effectiveness of the Lecture-Demonstration and Individual-Laboratory Method," Journal of Educational Research, XIII (May, 1926), 355-65.
2. Arnsperger, V. C. Measuring the Effectiveness of Sound Pictures as Teaching Aids. Teachers College Contributions to Education, No. 565. New York: Columbia University, 1933.
3. Bane, Charles L. "The Lecture vs. the Class-discussion Method of College Teaching," School and Society, XXI (March, 1925), 300-2.
4. Betts, G.H. "College Students Reactions to Education Courses," School and Society, XXV (April 23, 1927), 494-96.
5. Butterweck, J. S. The Problem of Teaching High School Pupils How to Study. Teachers College Contributions to Education, No. 237. New York: Columbia University, 1926. Pp. 116.
6. Glark, Mildred. "A Comparison of the Results Obtained from the Teaching of Shorthand by the Word Unit Method and the Sentence Unit Method," Journal of Educational Psychology, XXIII (February, 1932), 122-31.
7. Cooke, Dennis H. "Two Experiments in Learning Educational Statistics," Journal of Educational Research, XXVI (May, 1933), 674-78.
8. Corey, S. M. "Learning from Lectures vs. Learning from Readings," Journal of Educational Psychology, XXV (September, 1934), 459-70.
9. Crawford, C. C. "Some Experimental Studies of the Results of College Note-taking," Journal of Educational Research, XII (December, 1925), 379-86.
10. Doerman, H. J. The Orientation of College Freshmen. Baltimore: Williams and Wilkins Co., 1926. Pp. 162.
11. Douglass, Harl R. "Rating the Teaching Effectiveness of College Instructors," School and Society, XXVIII (August 18, 1928), 192-97.
12. Douglass, H. R. The Experimental Comparison of the Relative Effectiveness of Two Sequences in Supervised Study, University of Oregon Publications, Vol. I, No. 4. Eugene, Oregon: University of Oregon, 1927. 173-218.

13. Douglass, H. R., and Others, Controlled Experimentation in the Study of Methods of College Teaching. University of Oregon Publications, Vol. I, No. 7, University of Oregon, 1929. Pp. 285-92.
14. Douglass, H. R., and Others, Controlled Experimentation in the Study of Methods of College Teaching. University of Oregon Publications, Vol. I, No. 7, University of Oregon, 1929. Pp. 293-99.
15. Dynes, J. J. "Comparison of Two Methods of Studying History," Journal of Experimental Education, I (September, 1922), 42-5.
16. Edgerton, H. A., and Paterson, D. G. "Table of Standard Errors and Probable Errors of Percentages for Varying Numbers of Cases." Journal of Applied Psychology, X ( 1924), 378-391.
17. Eikenberry, Amos R. "A Study In Methods of College Teaching." Unpublished Master's thesis, Ohio State University, 1930.
18. Foster, H. H. "Lecturing vs. Class Discussion." School and Society, XXI ( April 23, 1927), 494-96.
19. Garrett, H. E. Statistics in Psychology and Education. New York: Longmans, Green and Co., 1933. Pp. xii / 317.
20. Good, Carter V. "An Experimental Study of the Merits of Extensive and Intensive Reading in the Social Sciences," School Review, XXIII (December, 1925), 755-70.
21. Greene, E. B. "Certain Aspects of Lectures in Teaching." School and Society, XXXIX (May 12, 1934), 619-24.
22. Hatfield, W. W. "Inductive vs. Dogmatic Instruction," Journal of Educational Research, XXVI (March, 1933), 508-9.
23. Heilman, J. D. "Factors Determining Achievement and Grade Location." The Pedagogical Seminary and Journal of Genetic Psychology, XXXVI (September, 1929), 354.
24. Hull, B. I. Aptitude Testing, New York: World Book Co., 1928. Pp. xiv / 535.
25. Hunt, Thelma. "Overlapping in High School and College," Journal of Educational Research, XVIII (March, 1926), 197-207.

26. Knode, J. C. Orienting the Student in College. Teachers College Contributions to Education, No. 415. New York: Columbia University, 1933.
27. Lindquist, E. F., and Foster, R. R. "On the Determination of Reliability in Comparing the Final Mean-scores of Matched Groups." Journal of Educational Psychology, XX (February, 1929), 102-6.
28. Macomber, F. G. "A Study in Social Science Teaching Methods." Journal of Educational Research, XXVII (October, 1933), 115-22.
29. McCall, W. A. How to Measure in Education. New York: The Macmillan Co., 1922. Pp. xii / 416.
30. Meltzer, H., and Bailor, E. M. "Extent and Nature of Students Knowledge of Psychology Before and After the First Course," Journal of Applied Psychology, XV (June, 1931), 279-93.
31. Monroe, W. S. "Controlled Experimentation as a Means of Evaluating Methods of Teaching," Review of Educational Research, IV (February, 1934), 36-42.
32. Monroe, W. S., and Englehart, M. D. Experimental Research in Education. University of Illinois Bulletin, Vol. XXVII, No. 32. Bureau of Educational Research Bulletin, No. 48. Urbana, Illinois: University of Illinois, 1930. Pp. 75.
33. Nash, H. B., and Phillips, M. E. "A Study of the Relative Value of Three Methods of Teaching High School Chemistry," Journal of Educational Research, XV (May, 1927), 371-79.
34. Newman, H. H., and Others. The Nature of the World and of Man. Chicago: The University of Chicago Press, 1933. Pp. xxiv - / - 553.
35. Payne, V. F. "Lecture-demonstration vs. Individual Laboratory Methods Compared," Journal of Chemical Education, IX (May, 1932), 932-39.
36. Piper, R. F. "Freshman Preferences: Studies in College Orientation," School and Society, XLI (March 16, 1935), 374-6.
37. Scheideman, Norma V. "A Comparison of Two Methods of College Instruction," School and Society, XXV (June, 1927), 672-4.

38. Sibley, R. R. "Orientation Courses," School and Society, XL (September 22, 1934), 373-7.
39. Stewart, A. W. "A Comparison of Departmental and Grade Teaching," Educational Research Bulletin, VI (May, 1927), 205-7.
40. Stumpf, N. F. "Listening vs. Reading Method in the True-False Examination," Journal of Applied Psychology, XV (December, 1931), 555-62.
41. Tallmadge, M., and Douglass, H. R. "What College Students Believe They Think About Examinations," School and Society, XXXIX (March 17, 1934), 349-52.
42. Thompson, Robert S. The Effectiveness of Modern Spelling Instruction. Teachers College Contributions to Education, No. 436. New York: Columbia University, 1930.
43. Walker, H. M. "Concerning the Standard Error of a Difference," Journal of Educational Psychology, XX (January, 1929), 53-60.
44. Ward, P. W. "Student Opinion Concerning Two Survey Courses," School and Society, XXXVI (July 2, 1932), 15-16.
45. Ward, P. W. "Attitude of Average and Superior Students towards Survey Courses," School and Society, XL (September, 22, 1934), 398-400.
46. Wilkins, E. H., Problems of College Education. Minneapolis: University of Minnesota Press, 1928. Pp. xi -/- 173.
47. Worcester, D. A. "Twice-Told Tales or Tautologous Teaching in Higher Education," Educational Administration and Supervision, XII (February, 1926), 73-79.
48. Yule, G. U. Introduction to the Theory of Statistics. London: Chas. Griffin and Co., 1912. P. 260.

**A P P E N D I X**

## APPENDIX A

Le Moyne College

## Outline for College Orientation

First Semester 1935-36

<u>Date</u>	<u>Unit</u>	<u>Lecturer</u>
Sept. 17	Pre-test	
1. Sept. 19-21-24 " 26	How To Use the Library Test	A
2. Sept. 1 Oct. 1 Oct. 3-5 " 8	How To Study How To Take Notes Test	B
3. Oct. 10-12-15 Oct. 17	Astronomy Test	C*
4. Oct. 19-22-24 " 26	Origin and Early Stages of Earth Test	C*
5. Oct. 29-31, Nov. 2 Nov. 5	Physiography and Geology Test	D
6. Nov. 7-9-12 " 14	Physics Test	E
7. Nov. 16-19-21 " 23	Chemistry Test	F
8. Nov. 26-28-30 Dec. 3	Nature and Origin of Life Test	G
9. Dec. 5-7-10 " 12	Bacteriology Test	H
10. Dec. 14-17-19 Jan. 2	Sanitation and Hygiene Test	I
11. Jan. 4-7-9 " 11	Evolution of Plant Kingdom Test	G
12. Jan. 14-17-19 Jan. 21 Jan. 25	Interaction of Plants with Their Environment Test Semester Test	I

---

\*Individual Lecturer (The Writer)

Second Semester 1935-36

<u>Date</u>	<u>Unit</u>	<u>Lecturer</u>
13. Jan.30,Febr.1-4 Febr. 6	Evolution of Invertebrates Test	C*
14. Feb. 8-11-13 " 15	Evolution of Vertebrates Test	I
15. Feb. 18-20-22 " 25	Anthropology Test	J
16. Feb.25-27,Mar.1 March 4	Sociology Test	K
17. March 6-8-11 " 13	Political Science Test	L
18. March 15-18-20 " 22	Factors of Organic Evolution Test	C*
19. March 25-27-29 April 1	Heredity Test	I
20. April 3-5-8 " 10	Economics Test	M
21. April 12-15-17 " 19	Embryology Test	I
22. April 22-24-26 " 29	Physiology Test	G
23. May 1-3-6 " 8	Psychology Test	B
24. May 10-13-15 " 17	Fundamental Operations in Mathematics Test	C*
May 20	Semester Test (Final).	
May 21-23	Student Questionnaire	

## Appendix B

## Samples of Questions Used in Unit Tests.

From Unit on Heredity

## Part I. True or False.

1. Ability runs in families.
2. Eugenics is the science of the improvement of Man's social environment.
3. Man's control of the physical world is paralleled by his control of his biological environment.
4. Feeble-mindedness is a dominant characteristic.
5. Our potentialities are determined by our heredity.
6. Man has made most progress in the control of his social environment.
7. Close inbreeding is desirable for the betterment of the human race.
8. The tendency to insanity may be inherited.
9. Persons whose mentality does not exceed that of a fifteen year-old are said to be feeble-minded.
10. A knowledge of birth control is much needed by many poor families.
11. The reduction of larger families among persons of ability is increasing.
12. Identical twins result from the fertilization of a single ovum.
13. Tuberculosis is hereditary.
14. Blue eyes are dominant over brown.
15. Human stock can only be bettered by more selective breeding.
16. Genetics has no practical value.
17. The off-spring produced from the mating of a Negro and a White is a hybrid.
18. The sex chromosomes contain no other factor.
19. All unit characters are determined by a single gene in the germ plasm.
20. The Kalikuks were all illustrious individuals.

## Part II. Matching.

## Group I.

- |   |                  |       |
|---|------------------|-------|
| 1. A double dose of factors.  | Haemophilia      | _____ |
| 2. The appearance of an individual.                                     | Homozygous       | _____ |
| 3. Mendelian nature of most disadvantageous factors.                    | Eugenics         | _____ |
| 4. Method of inheritance of mental traits and skin color are inherited. | Multiple factors | _____ |
| 5. Inherit the same characters.   | Tuberculosis     | _____ |
| 6. The term used for factors carried in the sex chromosomes.            | Phenotype        | _____ |

- |  |                                     |       |
|--|-------------------------------------|-------|
| 7. Improving the character of the genes. |                                     |       |
| 8. Disease inherited.                    | Identical<br>Twins                  | _____ |
| 9. Inherit a resistance to.              | Larger<br>families of<br>good stock | _____ |
| 10. A part of the Eugenic program.       | Recessive                           | _____ |
| 11. A part of the Euthenic program.      | Sex-linked                          | _____ |
| 12. A product of two zygotes.            |                                     | _____ |
- 

#### Group II.

- |                      |  |       |
|----------------------|--|-------|
| 1. Research          | A product of the same fertilized egg.                                      | _____ |
| 2. Feeble-mindedness | A part of the Euthenic program   | _____ |
| 3. Idiot             | A recessive trait.   | _____ |
| 4. Identical Twins   | Determination of the modes of inheritance of dominant and recessive traits | _____ |
| 5. Fraternal Twins   |  | _____ |
| 6. Better Housing    | Mentality does not exceed that of a two year-old.                          | _____ |

#### Part III. Sentence Completion

1. Individuals whose mentality does not exceed that of a two year-old are called \_\_\_\_\_ of a child of seven \_\_\_\_\_ and of a child of twelve \_\_\_\_\_.
2. \_\_\_\_\_ is the science of the improvement of the human stock.
3. \_\_\_\_\_ is the science of the improvement of the human social environment.
4. Environment is more potent in man than in animals due to Man's prolonged period of \_\_\_\_\_.
5. Man inherits genes for resistance to the disease \_\_\_\_\_.
6. The spread of dysgenic classes can be checked by \_\_\_\_\_ and \_\_\_\_\_.

7. The \_\_\_\_\_ generation brings many physical and mental deteriorations.
8. The U. S. is often referred to as the \_\_\_\_\_ of all nations.
9. The four main steps in the Eugenic program are:
- (a) \_\_\_\_\_ (b) \_\_\_\_\_
- (c) \_\_\_\_\_ (c) \_\_\_\_\_

Part IV. Multiple Choice.

1. The percentage of feeble-minded persons in penal institutions.  
 (a) 15% (b) 25% (c) 30% (d) 10% (e) 50% (\_\_\_\_\_)
2. A possibility of the Eugenic program.  
 (a) Breed better type. (b) More brain.  
 (c) Ful-fill potentialities (d) Weed out worst. (\_\_\_\_\_)
3. Capable of changing the nature of the germ plasm.  
 (a) Family histories. (b) Sterilization.  
 (c) Segregation. (d) Selective mating. (\_\_\_\_\_)
4. In order to keep any class of human beings from decreasing, the following number of children per family must be had:  
 (a) 2.5 (b) 1 (c) 4 (d) 3.7 (e) 5 (\_\_\_\_\_)
5. Blue-eyed children can result from the mating of the following:  
 (a) Heterozygous brown and homozygous brown.  
 (b) Homozygous brown and homozygous blue.  
 (c) Heterozygous brown and heterozygous brown. (\_\_\_\_\_)
6. From the following select 3 dominant characteristics. (\_\_\_\_\_)
- and also select 2 recessive characteristics. (\_\_\_\_\_)
- |                                 |                                |
|---------------------------------|--------------------------------|
| (1) Resistance to tuberculosis. | (2) Haemophilia.               |
| (3) Normal vision.              | (4) Feeble-mindedness.         |
| (5) Black hair.                 | (6) Left-handedness            |
| (7) Curly hair                  | (8) Albinism.                  |
| (9) Extra fingers.              | (10) Tendency to tuberculosis. |
| (11) Normal-mindedness.         | (12) Deaf-mutism.              |

From the Unit on Economics

Part I. True or False.

1. Economics is not a science.
2. The word science is derived from the Latin word "scientia."
3. The study of Economics increases your knowledge about its principles.
4. Economics is a natural science.
5. Economics does not concern itself with matters in which any individual person makes a living.
6. Economics takes interest in the welfare of individuals rather than in society in general.
7. A law in Economics is a statute passed by a legislative body.
8. Laws in Economics do not have a compelling force.
9. The right of "Private Property" means a right over a thing or to a service.
10. Rivalry between buyers of a thing is not competition.
11. Rivalry between sellers of a thing is competition.
12. In an autonomous economic order, the individual must be self-sufficient.
13. Individual exchange or free enterprise allows the individual within certain limits to produce and consume whatever he chooses.
14. Private enterprise, or economic freedom, is, in most countries, the chief characteristic of the present economic organization.
15. Man's self-interest will induce him to produce at least cost.
16. Personal liberty is of no importance in the consideration of economics.
17. Under the present system of private enterprise, property rights of individuals are respected above any other personal rights.
18. Individual initiative is stifled under private enterprise.
19. Price plays a part in production, personal distribution, and in consumption.
20. Involuntary cooperation is not found under the present system.
21. Division of labor may be along minute lines or along geographical lines.
22. Competition regulates the economic activity of man.
23. Control of industry by Government is completely unnecessary.
24. With the exception of Government, there is no other controlling force over industry.
25. An economic law is a statement of how things happen.

Part II. Matching.

- |   |                                      |
|---|--------------------------------------|
| 1. Destruction of Utilities.                        | General Over-production ( )          |
| 2. Creating of Utilities                            | Credit ..... ( )                     |
| 3. Self-sufficiency                                 | Economics ..... ( )                  |
| 4. Bankers  | Consumption ..... ( )                |
| 5. Specialization                                   | Production ..... ( )                 |
| 6. Division of Profits                              | Private Property ..... ( )           |
| 7. National Disaster                                | Autonomous Economic<br>Order ... ( ) |
| 8. Exclusive Control                                | Private Enterprise .... ( )          |
| 9. Impossible                                       | Division of Labor ..... ( )          |
| 10. Science of Business                             | Competition ..... ( )                |
| 11. Chief characteristic of the                     |                                      |
| 12. Regulator of the economic<br>activities of men. |                                      |

Part III. Sentence Completion.

1. Economics studies man as he \_\_\_\_\_ for a living.
2. Economics is a \_\_\_\_\_ of business.
3. Business activity is subject to \_\_\_\_\_.
4. Property right means a right over a \_\_\_\_\_ or  
to a \_\_\_\_\_.
5. The various definitions of Economics all emphasize the following  
four ideals:  
(a) \_\_\_\_\_ (b) \_\_\_\_\_ (c) \_\_\_\_\_ (d) \_\_\_\_\_
6. The five departments of Economics are:  
(a) \_\_\_\_\_ (b) \_\_\_\_\_ (c) \_\_\_\_\_  
(d) \_\_\_\_\_ (e) \_\_\_\_\_
7. Four types of control of Industry are:  
(a) \_\_\_\_\_ (b) \_\_\_\_\_  
(c) \_\_\_\_\_ (d) \_\_\_\_\_

8. The five phases of a business cycle are:

- (a) \_\_\_\_\_ (b) \_\_\_\_\_ (c) \_\_\_\_\_  
 (d) \_\_\_\_\_ (e) \_\_\_\_\_.

Part IV. Multiple Choice.

1. Depression is usually followed by: .....(\_\_\_\_\_)  
 (a) Business prosperity. (b) Recovery  
 (d) Financial strain. (e) Industrial crisis
2. General Over-production is: .....(\_\_\_\_\_)  
 (a) Possible (b) Probable (c) Impossible  
 (d) Improbable
3. The sun-spot theory is: .....(\_\_\_\_\_)  
 (a) Fantastic (b) Silly (c) Not proven  
 (d) Undesirable.
4. Machine production relative to consuming power is: .....(\_\_\_\_\_)  
 (a) Is less than (b) Grows slower  
 (c) Tends to increase faster than.
5. The chief characteristic of our present economic order is: .....(\_\_\_\_\_)  
 (a) Autonomous Economic Order (b) Socialism  
 (c) Private Enterprise (d) Communism (e) Anarchism.

## APPENDIX E

PRE-TEST and FINAL TEST

## Part I. True or False

1. There is interdependence and essential unity in all sciences.
2. The Earth is the largest body in our Solar System.
3. Our Earth has been in existence for millions of years.
4. The center of the Earth is a liquid mass.
5. The Moon is larger than the Earth.
6. A light year is a distance of 186,000 miles.
7. The Sun is the source of all energy.
8. Geological eras extend over millions of years.
9. There are no known facts contrary to evolution.
10. Feeble-mindedness is a dominant characteristic.
11. Brain differences in man and animal are purely qualitative.
12. Seas once covered the North American continent.
13. The President of The U.S. is elected by the people directly.
14. The powers of the Federal Gov't. are called reserved powers.
15. Congress can veto the decisions of the Supreme Court.
16. It is impossible to have a pure Democracy in this country.
17. The right of revolution is recognized in the Declaration of Independence.
18. Mass and weight are identical.
19. The different classifications of the divisions of science are man made.
20. In science, theory and experiments must agree, if the theory is to stand.

## Part II. Sentence Completion.

1. The three major divisions of the Earth are:  
 (a) \_\_\_\_\_ (b) \_\_\_\_\_ (c) \_\_\_\_\_
2. Remains or traces of plants or animals preserved in the rocks of the earth are called \_\_\_\_\_.
3. Earthquakes are caused by \_\_\_\_\_.
4. Chemistry has been aptly defined as the fundamental science of the \_\_\_\_\_ of matter.
5. The number of possible elements according to the periodic table is \_\_\_\_\_.
6. The force which holds atoms in molecules is an \_\_\_\_\_ force.
7. All atoms in their ultimate structure are composed of \_\_\_\_\_ and \_\_\_\_\_.
8. The factors of production are:.....(a) \_\_\_\_\_  
 (b) \_\_\_\_\_ (c) \_\_\_\_\_ (d) \_\_\_\_\_
9. The functional unit of the Nervous System is \_\_\_\_\_.

10. The two types of characters which are responsible for Mendall's Laws are: \_\_\_\_\_ and \_\_\_\_\_ characteristics.
11. The spread of venereal disease can be checked by:  
 (a) \_\_\_\_\_ and (b) \_\_\_\_\_.
12. Three general factors upon which success in studying depends are: (a) \_\_\_\_\_  
 (b) \_\_\_\_\_  
 (c) \_\_\_\_\_
13. Psychology is the science that treats of \_\_\_\_\_.
14. Five general topics treated in General Psychology are:  
 (a) \_\_\_\_\_ (b) \_\_\_\_\_ (c) \_\_\_\_\_  
 (d) \_\_\_\_\_ and (e) \_\_\_\_\_
15. Three methods or techniques used in Psychology for collecting data are: (a) \_\_\_\_\_  
 (b) \_\_\_\_\_ (c) \_\_\_\_\_
16. Three difficulties in studying Sociology are:  
 (a). \_\_\_\_\_  
 (b). \_\_\_\_\_  
 (c). \_\_\_\_\_
17. The rites of passage are: (a) \_\_\_\_\_  
 (b) \_\_\_\_\_ (c) \_\_\_\_\_ (d) \_\_\_\_\_
18. The four wishes are: (a) \_\_\_\_\_  
 (b) \_\_\_\_\_ (c) \_\_\_\_\_ (d) \_\_\_\_\_
19. The scientific method of measuring races is by \_\_\_\_\_.
20. Every body in the universe attracts every other body with a force which is directly \_\_\_\_\_ to the \_\_\_\_\_ of their \_\_\_\_\_ and \_\_\_\_\_ proportional to the \_\_\_\_\_ of the distance between them.

## Part III. Multiple Choice

(Fill in the blank with the number of numbers of the correct ans).

1. Some of the substances listed below are elements, mixtures, or compounds; indicate by numbers which they are:

Elements	Mixtures	Compounds
(1) Mud	(2) Trees	(3) Air
(4) Table Salt	(5) Flour	(6) Silica
(7) Water	(8) Sand	(9) Iron.

2. The one known substance which possesses the combination of properties which we call life is: ..... ( )  
 (1) Cytoplasm (2) Protoplasm (3) Chromatin.
3. The attempt to explain these properties without bringing in mystical or supernatural forces gives rise to: ..... ( )  
 (1) The mechanistic view of life.  
 (2) The vitalistic view of life.
4. All living things are composed of: ..... ( )  
 (1) Tissues (2) Cells (3) Organs.
5. How life first began: ..... ( )  
 (1) We know definitely. (2) We do not know definitely.
6. It is thought by present day Biologists that all the organisms now existing have come about thru a process of orderly change which is termed: ..... ( )  
 (1) Evolution. (2) Special Creation.  
 (3) Spontaneous Generation.
7. All many-celled animals usually develop from the fertilized egg by means of division into smaller cells thru process of: ..... ( )  
 (1) Cleavage (2) Blastopore (3) Archenteron.
8. These cells are subsequently differentiated into what three primary germ layers : ..... ( )  
 (1) Epithelium (2) Ectoderm (3) Connective tissue  
 (4) Entoderm (5) Mesoderm (6) Epidermis.
9. Animals are ultimately dependent upon plants for their food, for plants alone are able to manufacture food material from inorganic substances by a process called: ..... ( )  
 (1) Transpiration (2) Chemosynthesis (3) Photosynthesis.
10. Production is the creation of which of the following: ..... ( )  
 (1) Capital (2) Credit (3) Utilities (4) Exchange.
11. The process of dividing the income of Society among its factors of production is called: ..... ( )  
 (1) Barter (2) Transportation (3) Exchange  
 (4) Distribution.
12. The using up of utilities is called: ..... ( )  
 (1) Marginal Utility (2) Consumption (3) Exchange  
 (4) Labor.
13. The Constitution guarantees to the States which of the following forms of Government: ..... ( )  
 (1) Democratic (2) Socialist (3) Communist  
 (4) Republican (5) Monarchist.

14. The Library Card Catalogue contains which of the following: .....( )
- (1) The names of all the books in a specific library.
  - (2) The title of the chapters in each book.
  - (3) See references from one heading to another.
  - (4) The book cards which the students sign and leave at the desk.
15. A "see" reference directs a person: .....( )
- (1) To the subject heading under which he will find books on a given subject.
  - (2) To additional information on a given subject.
16. A reprint is a republication of a book: .....( )
- (1) With changes in the subject matter of the book.
  - (2) Without changes in the subject matter of the book.
17. The cards in the catalog are arranged: .....( )
- (1) Alphabetically by author, subject and title.
  - (2) In numerical order according to call number.
18. You have been given 30 minutes in which to evaluate the information contained in President Hoover's book entitled "The Challenge to Liberty." To do this you would read: .....( )
- (1) The preface (2) Table of Contents (3) Summary paragraphs. (4) Summary chapter. (5) Title page. (6) Dedication (7) Index (8) Appendix.
19. If the strain is proportional to the stress, the strain: .....( )
- (1) Is made twice as great if the stress is doubled.
  - (2) Is made one-half as great if the stress is doubled.
  - (3) Is made four times as great if the stress is doubled.
  - (4) Is made one-fourth as great if the stress is doubled.
20. Other things being equal, the intensity of the illumination is inversely proportional to the square of the distance. When the distance is doubled: .....( )
- (1) The intensity is twice as great.
  - (2) The intensity is one-half as great.
  - (3) The intensity is four times as great.
  - (4) The intensity is one-fourth as great.

## APPENDIX F

RAW SCORES MADE ON INITIAL AND FINAL TESTS  
GAINS MADE FROM INITIAL TO FINAL  
TEST

Student	<u>Section I</u>			Student	<u>Section II</u>		
	Pre-test	Final Test	Gain		Pre-Test	Final Test	Gain
1	33	71	38	2	36	72	36
3	36	88	52	4	20	63	43
5	35	81	46	6	33	84	51
7	32	74	42	8	30	82	52
9	25	84	59	10	40	63	23
11	20	80	60	12	32	70	38
13	15	69	54	14	34	67	33
15	27	70	43	16	21	63	42
17	28	80	52	18	21	69	48
19	15	62	47	20	28	86	58
21	17	59	42	22	26	55	29
23	31	60	29	24	30	65	35
25	28	80	52	26	27	72	45
27	18	62	44	28	17	66	49
29	24	61	37	30	22	59	37
31	32	65	33	32	37	86	49
33	39	77	38	34	29	63	34
35	26	65	39	36	15	54	39
37	32	65	33	38	36	73	37
39	25	66	41	40	23	84	61
41	19	75	56	42	30	72	42
43	30	49	19	44	30	71	41

<u>Section I</u>				<u>Section II</u>			
<u>Student</u>	<u>Pre-Test</u>	<u>Final Test</u>	<u>Gain</u>	<u>Student</u>	<u>Pre-Test</u>	<u>Final Test</u>	<u>Gain</u>
45	25	85	60	46	17	66	49
47	39	62	23	48	26	78	52
49	21	82	61	50	25	66	41
51	21	52	31	52	15	76	61
53	26	72	46	54	29	53	24
55	20	60	40	56	17	67	50
57	30	76	46	58	24	66	42
59	25	53	28	60	26	68	42
61	31	75	44	62	32	75	43
63	49	80	31	64	18	52	34
65	31	61	31	66	25	60	35
67	17	39	22	68	18	68	50
69	15	61	46	70	19	45	26
71	22	80	58	72	17	63	46
73	28	52	24	74	19	70	51
75	21	58	37	76	30	50	20
77	24	71	47	78	13	66	53
79	19	54	35	80	7	51	44
81	22	54	32	82	34	43	9
83	12	73	61	84	25	45	20
85	18	62	44	86	15	66	51
87	17	69	52	88	27	49	22
89	14	44	30	90	12	62	50
91	22	65	43	92	20	49	29

Student	Section I			Student	Section II		
	Pre-Test	Final Test	Gain		Pre-Test	Final Test	Gain
93	15	66	51	94	18	62	44
95	19	71	52	96	11	36	25
97	8	58	50	98	17	36	19
99	22	62	40	100	17	49	32
101	23	60	37	102	15	51	36
103	25	58	33	104	19	60	41
105	21	71	50	106	16	72	56
107	15	49	34	108	17	49	32
109	24	61	37	110	17	31	14
111	14	52	38	112	11	51	40
113	20	55	35	114	12	66	54
115	17	59	42	116	9	67	58
117	13	61	48	118	16	64	48

## APPENDIX C

## STUDENT QUESTIONNAIRE

The questions which follow are asked in an effort to ascertain your reactions with reference to certain factors in the Orientation Course, namely:

1. Your reactions towards the method of presentation.
2. Your reactions towards the various units presented.
3. Your reactions as compared with other courses taken.
4. Your points of view and liking for the various tests.
5. The extent to which you have developed interest in various fields as a result of the course.

- 
1. In which orientation section have you been a member?  
Place a check in the space provided after the proper answer.
- a. Section I. Lectures by specialists.....( )
  - b. Section II. Individual lecturer .....( )
2. Approximately how many minutes did you spend on the average for each assignment in this course? \_\_\_\_\_ minutes.
3. What is your reaction to the method of presentation of the Orientation course?  
Place a check in the blank after each statement which applies.
- a. My preference was a specialist for each division.....( )
  - b. My preference was a single lecturer for the entire course .....( )
  - c. The units were well connected .....( )
  - d. The units were taught as separate divisions with little connection ,.....( )
  - e. The whole course seemed a continuous development of the nature of the world and of man .....( )
  - f. The lecturers used too many technical terms .....( )
  - g. Some of the lecturers gave information beyond my comprehension .....( )
- In what fields? \_\_\_\_\_  
\_\_\_\_\_
- h. Other lectures were easily comprehended .....( )
- In what fields? \_\_\_\_\_  
\_\_\_\_\_

- i. The lecturers over-emphasized their special fields. ....( )
- j. The instruction was equally good in all fields, .....( )
- k. The instruction was good in the following fields:

\_\_\_\_\_

l. The instruction was poor in the following fields:

\_\_\_\_\_

4. What is your general reaction towards the Orientation Course?

Check only the answers which best apply.

- a. There were so many different things presented, I am confused, .....( )
- b. In most or all fields, I have gained knowledge. ....( )
- c. In some fields I have gained knowledge and insight. ....( )

Name them: \_\_\_\_\_

- d. In some other fields I have become confused. ....( )

Name them: \_\_\_\_\_

- e. Too many facts were presented. ....( )
- f. About the right number of facts were presented to make the material clear, .....( )
- g. Too few facts were presented for a clear understanding of the material. ....( )
- h. The units have all been related. ....( )
- i. The units were just so many distinct divisions. ....( )

5. What is your reaction to the various units presented?

Place the letter which best represents your reaction after each field named.

- The course has created:
- (a) A definite liking for.
  - (b) A mild interest in.
  - (c) No effect.
  - (d) A mild distaste for.
  - (e) A definite dislike for.

1. Astronomy	_____	9. Sociology	_____
2. Geology and Physiography	_____	10. Economics	_____
3. Physics	_____	11. Pol. Science	_____
4. Chemistry	_____	12. Physiology	_____
5. Biology	_____	13. Embryology	_____
6. Bacteriology	_____	14. Evolution	_____
7. Heredity	_____	15. Psychology	_____
8. Anthropology	_____	16. Hygiene and Sanitation	_____

6. To what extent have the materials in the course duplicated work taken in high school? Check the answer which applies.
- a. Material practically all new. .... ( )
  - b. A small amount of new material given. .... ( )
  - c. A large amount of new material given. .... ( )
  - d. Most of the material was a duplication of work taken in high school. .... ( )

7. This question is designed to determine the amount of preparation required for the orientation course as compared with other required freshman courses and electives.

What average amount of time did you spend in preparation for each assignment in the following courses?

Eng. Composition and Rhetoric.	Average no. of minutes	_____
European History .....	Average no. of minutes	_____
College Orientation .....	Average no. of minutes	_____
Other Subjects		
_____	Average no. of minutes	_____
_____	Average no. of minutes	_____
_____	Average no. of minutes	_____

8. Has the Orientation Course tended to overlap with other courses you were taking? Put the letter which best applies in the blank after each subject.

- (a) Practically no overlapping.
- (b) Occasional overlapping.
- (c) Too much overlapping with.

General Chemistry	_____	Social Pathology	_____
General Psychology	_____	Prin. of Economics	_____
Biology .....	_____	Other subjects	_____
_____		_____	

9. In general how valuable has the Orientation Course been to you, in comparison with other courses?

- Check the answer which applies.
- a. On the whole, I would have preferred to cover the material in regular courses. .... \_\_\_\_\_
  - b. I would have preferred giving the full time to one or more specialized courses. .... \_\_\_\_\_
  - c. I have received more valuable information from this course than from any other single course requiring a similar amount of time. .... \_\_\_\_\_
  - d. I have gotten less information of value than from other courses consuming the same amount of time. .... \_\_\_\_\_
  - e. I have gained approximately an equal amount of information from the orientation course as from the average course. .... \_\_\_\_\_

10. Comparing the Orientation Course with other courses, check the one of the following statements which best gives your opinion of its value.

- a. A great deal more valuable than ..... \_\_\_\_\_
- b. Slightly more valuable..... \_\_\_\_\_
- c. About the same value ..... \_\_\_\_\_
- d. Slightly less valuable ..... \_\_\_\_\_
- e. Decidedly less valuable ..... \_\_\_\_\_

11. The following is a list of the various units presented. Rank them from 1 to 16 in the order of your preference with reference to the extent to which your interest has been developed as a result of the course.

- |                                |       |                              |       |
|--------------------------------|-------|------------------------------|-------|
| a. Astronomy                   | _____ | i. Anthropology              | _____ |
| b. Geology and<br>Physiography | _____ | j. Sociology                 | _____ |
| c. Physics                     | _____ | k. Economics                 | _____ |
| d. Chemistry                   | _____ | l. Pol. Science              | _____ |
| e. Biology                     | _____ | m. Physiology                | _____ |
| f. Bacteriology                | _____ | n. Psychology                | _____ |
| g. Evolution                   | _____ | o. Embryology                | _____ |
| h. Heredity                    | _____ | p. Hygiene and<br>Sanitation | _____ |

12. List below in the space provided, the courses in which you are now enrolled. Included the orientation course. Now, in column A, put a figure "1" by the course on which you expended most energy, "2" by the next most, and so on for the other courses. Then, in column B, rank your courses in the same way in regard to the most value culturally; in column C, in regard to the most valuable vocationally; in column D, in regard to most valuable for general information. In column E, put the figure "1" by the course you found most interesting, and so on for the other courses.

	Most Energy A	Cultural Value B	Vocational Value C	General Infor- mation D	Most Interest- ing E
<u>Title of Course</u>					
<u>College Orientation</u>					

13. Your point of view and liking for the tests.

Check the statements which best represent your reactions.

- a. It was advantageous to have a test immediately after the completion of each unit. .... ( )
- b. Too many tests were given. .... ( )
- c. The types of questions which gave the student the best opportunity for indicating the knowledge gained were:
- (1) True or false \_\_\_\_\_
- (2) Sentence Completion \_\_\_\_\_
- (3) Multiple Choice \_\_\_\_\_
- (4) Matching \_\_\_\_\_
- d. The failure to make use of essay questions did not give me an opportunity to show best what was learned. .... ( )
- e. I would have preferred the inclusion of some essay questions. .... ( )
- f. I would have preferred all essay questions. .... ( )
- g. The tests required too much memory. .... ( )
- h. The tests required too many detailed facts. .... ( )
- i. The tests required a knowledge of too many technical terms. .... ( )
- j. The tests were too difficult. .... ( )
- k. The tests afforded a fair opportunity to indicate the knowledge gained. .... ( )

14. Optional.

Write a paragraph in which you state any other reactions, likes or dislikes, you may have for or against the Orientation Course, and the method of presentation, or other comments, or suggestions,

## APPENDIX D

FINAL PAIRING FOR SECTIONS I AND II. RAW SCORES  
AND PERCENTILE RANKS FOR INTELLIGENCE AND HIGH  
SCHOOL ACHIEVEMENT TESTS, AND COMPOSITE PER-  
CENTILE RANKS

Section I						Section II							
Student	Raw Score		%	Raw Score		Comp. %	Student	Raw Score		%	Raw Score		Comp. %
	Otis			Lowa				Otis			Lowa		
1	48	96	156	96	96	2	57	100	206	100	100		
3	53	99	135	89	94	4	43	95	146	94	95		
5	37	84	164	99	92	6	45	96	126	86	91		
7	48	96	132	87	92	8	35	77	161	98	88		
9	35	77	156	96	87	10	37	84	140	92	88		
11	38	87	127	84	86	12	38	87	131	87	87		
13	33	71	140	92	82	14	39	88	127	84	86		
15	36	81	122	80	81	16	44	95	105	69	82		
17	42	95	98	64	80	18	35	78	126	85	80		
19	36	81	121	79	80	20	37	96	87	54	75		
21	40	91	98	64	78	22	33	71	116	77	74		
23	35	77	108	71	74	24	33	71	115	76	74		
25	33	71	112	75	73	26	32	68	117	78	73		
27	37	83	93	60	72	28	30	62	120	79	71		
29	29	58	126	84	71	30	29	56	121	79	68		
31	32	68	107	71	70	32	36	81	85	52	67		
33	29	58	121	79	69	34	36	81	85	52	67		
35	30	62	109	73	68	36	32	68	96	63	66		
37	32	68	101	66	67	38	31	66	100	66	66		
39	27	46	131	86	66	40	28	52	119	78	65		

<u>Section I</u>						<u>Section II</u>					
Student	Raw Score Otis	%	Raw Score Iowa	%	Comp. %	Student	Raw Score Otis	%	Raw Score Iowa	%	Comp. %
41	35	77	85	50	64	42	29	58	103	68	63
43	29	58	101	66	62	44	21	28	139	91	60
45	33	71	79	45	58	46	27	46	100	66	56
47	24	38	109	73	56	48	44	95	55	12	54
49	26	42	99	64	54	50	33	71	72	34	53
51	21	28	116	77	53	52	30	59	79	45	52
53	28	52	84	51	52	54	26	42	91	59	51
55	32	68	74	36	52	56	27	46	90	56	51
57	24	38	96	63	51	58	29	58	78	44	51
59	27	46	84	51	49	60	27	46	86	53	50
61	29	58	74	37	48	62	31	66	70	31	49
63	36	81	58	15	48	64	17	15	113	76	46
65	27	46	82	49	48	66	22	30	87	54	42
67	23	33	86	53	43	68	28	52	69	30	41
69	26	42	78	44	43	70	26	42	75	39	41
71	25	20	97	63	42	72	22	30	82	49	40
73	16	13	89	66	40	74	29	58	62	20	39
75	25	40	76	40	40	76	28	52	64	23	38
77	31	66	53	10	38	78	26	43	71	33	38
79	21	28	79	45	37	80	23	32	73	35	34
81	27	46	54	23	35	82	15	8	90	57	33
83	17	15	86	53	32	84	21	28	74	37	33

<u>Section I</u>						<u>Section II</u>					
Student	Raw Score Otis	%	Raw Score Iowa	%	Comp. %	Student	Raw Score Otis	%	Raw Score Iowa	%	Comp. %
85	22	30	70	31	31	86	17	15	82	49	32
87	20	25	72	34	30	88	19	20	77	41	31
89	16	10	83	50	30	90	23	33	67	26	30
91	25	40	57	14	27	92	21	28	69	30	29
93	21	28	63	21	25	94	26	42	59	16	29
95	19	23	62	20	22	96	20	25	70	31	28
97	20	25	57	15	20	98	18	18	69	30	24
99	18	18	61	19	19	100	17	15	63	21	18
101	20	25	54	11	18	102	22	30	46	3	17
103	17	15	61	19	17	104	25	20	55	11	16
105	16	10	62	20	15	106	14	5	62	20	13
107	18	18	53	10	14	108	18	18	40	1	10
109	9	2	63	21	12	110	13	4	58	15	10
111	18	18	46	4	11	112	7	1	58	15	8
113	16	10	45	3	7	114	17	15	42	2	8
115	12	3	50	8	6	116	12	3	54	11	7
117	13	3	41	2	3	118	13	4	44	3	4

# OTIS SELF-ADMINISTERING TESTS OF MENTAL ABILITY

By ARTHUR S. OTIS

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

## HIGHER EXAMINATION: FORM B

20

For High Schools and Colleges

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..... Class..... Date..... 19....  
Month Day

School or College..... 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:

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:

Which one of the five words below means the opposite of north?

1 pole, 2 equator, 3 south, 4 east, 5 west..... ( )

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

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:

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.*

Published by World Book Company, Yonkers-on-Hudson, New York, and 2126 Prairie Avenue, Chicago  
Copyright 1922 by World Book Company. Copyright in Great Britain. All rights reserved. OSATMA:EE:E 30

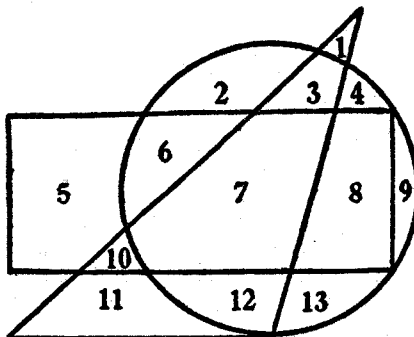
*This test is copyrighted. The reproduction of any part of it by mimeograph, hectograph, or in any other way, whether the reproductions are sold or furnished free for use, is a violation of the copyright law.*

## EXAMINATION BEGINS HERE :

1. The opposite of love is (?)  
1 like, 2 anger, 3 hate, 4 strange, 5 lover..... ( )
2. If 2 pencils cost 5 cents, how many pencils can be bought for 50 cents?..... ( )
3. A man does not always have (?)  
1 bones, 2 heart, 3 teeth, 4 nerves, 5 lungs..... ( )
4. What letter in the word WILMINGTON is the same number in the word (counting from the beginning) as it is in the alphabet?..... ( )
5. If the following words were arranged to make the best sentence, the first word of the sentence would begin with what letter? Print the letter as a capital.  
tests pupils mental thousands have of taken..... ( )
6. A word meaning the same as effect is (?)  
1 cause, 2 result, 3 affect, 4 change, 5 answer..... ( )
7. Gold is more costly than silver because it is (?)  
1 heavier, 2 scarcer, 3 yellower, 4 harder, 5 prettier..... ( )
8. A circle is related to a square in the same way that a sphere is related to (?)  
1 circumference, 2 cube, 3 round, 4 corners, 5 ball..... ( )
9. If 10 boxes full of oranges weigh 500 pounds, and each box when empty weighs 5 pounds, how many pounds do all the oranges weigh?..... ( )
10. The opposite of graceful is (?) 1 rough, 2 homely, 3 miserable, 4 awkward, 5 stout... ( )
11. Which one of the six statements below explains the following proverb? "A bird in the hand is worth two in the bush."..... ( )
  1. It is easier to carry eggs in two baskets than in one.
  2. A man of action has a loud voice.
  3. Tame birds are more expensive than wild ones.
  4. It is better to be content with what you have than to lose it gambling for more.
  5. It is safer not to risk all on one venture.
  6. What a man does is a better indication of his character than what he says.
12. Which statement explains this proverb? "Actions speak louder than words."..... ( )
13. Which statement explains this proverb? "Don't put all your eggs in one basket."..... ( )
14. In general it is safer to judge a man's character by his (?)  
1 voice, 2 clothes, 3 deeds, 4 wealth, 5 face..... ( )
15. Ordinary is related to exceptional as many is to (?)  
1 all, 2 none, 3 few, 4 common, 5 more..... ( )
16. A father is always (?) than his son.  
1 wiser, 2 stronger, 3 richer, 4 older, 5 taller..... ( )
17. The opposite of extravagant is (?)  
1 miser, 2 humble, 3 economical, 4 poor, 5 wasteful..... ( )
18. One number is wrong in the following series. What should that number be?  
1 5 2 6 3 7 4 9 5 9..... ( )
19. What people think about a person constitutes his (?)  
1 personality, 2 character, 3 reputation, 4 biography, 5 career..... ( )
20. A party consisted of a man and his wife, his three sons and their wives, and three children in each of the sons' families. How many were there in the party?..... ( )
21. At a wedding there is always (?)  
1 minister, 2 music, 3 flowers, 4 bride, 5 cake..... ( )
22. To insist that stones have thoughts is (?)  
1 absurd, 2 misleading, 3 improbable, 4 unfair, 5 wicked..... ( )
23. Which word is needed to begin the following sentence? — the four sides of a rectangle are equal, it is a square.  
1 Although, 2 If, 3 Since, 4 Now that, 5 Because..... ( )
24. If the first two statements following are true, the third is (?) All members of this committee are Democrats. Jones is not a Democrat. Jones is a member of this committee.  
1 true, 2 false, 3 not certain..... ( )
25. The opposite of always is (?)  
1 sometimes, 2 often, 3 occasionally, 4 seldom, 5 never..... ( )

26. Which one of these five things is most unlike the other four?  
1 nut, 2 turnip, 3 rose, 4 apple, 5 potato..... ( )
27. Sanitation is related to disease as (?) is to accident.  
1 doctor, 2 hospital, 3 bandage, 4 cleanliness, 5 care..... ( )
28. The two words pertinent and permanent mean (?)  
1 the same, 2 the opposite, 3 neither same nor opposite..... ( )
29. The opposite of loyal is (?)  
1 treacherous, 2 enemy, 3 thief, 4 coward, 5 jealous..... ( )
30. Count each Y in this series that is followed by an E next to it if the E is not followed by an S next to it. Tell how many Y's you count.  
Y E Y S F Z Y E S Z E Y E E S F Z S Y E F Y E S E Y Z E Y E Z..... ( )
31. If a boy can run at the rate of 5 feet in  $\frac{1}{2}$  of a second, how many feet can he run in 10 seconds?..... ( )
32. Which one of the six statements below explains the following proverb? "An ounce of discretion is worth a pound of wit."  
1. Storms wreck many ships.  
2. Food is seldom as well cooked as it might be.  
3. It is easy to appear wise after an event has happened.  
4. It is easier to keep out of trouble than to lie out of it.  
5. Leadership is easy when all goes well.  
6. Division of responsibility brings poor results.
33. Which statement explains this proverb? "Too many cooks spoil the broth."..... ( )
34. Which statement explains this proverb? "In a calm sea every man is a pilot."..... ( )
35. If the words below were rearranged to make a good sentence, the last word of the sentence would begin with what letter? Print the letter as a capital.  
preparation training life A excellent an college is for..... ( )
36. If the first two statements following are true, the third is (?) George is younger than Frank. James is younger than George. Frank is older than James.  
1 true, 2 false, 3 not certain..... ( )
37. One who pretends to be what he is not is said to be (?)  
1 sensitive, 2 artless, 3 vain, 4 hypocritical, 5 prejudiced..... ( )
38. The opposite of abolish is (?)  
1 alter, 2 create, 3 continue, 4 destroy, 5 change..... ( )
39. If  $2\frac{1}{2}$  yards of cloth cost \$2, how many dollars will 10 yards cost?..... ( )
40. Which of the five things following is most unlike the other four?  
1 ax, 2 knife, 3 razor, 4 hammer, 5 shears..... ( )
41. Sunlight is to darkness as (?) is to stillness.  
1 quiet, 2 sound, 3 dark, 4 loud, 5 moonlight..... ( )
42. The opposite of fickle is (?)  
1 silly, 2 constant, 3 stationary, 4 solid, 5 sober..... ( )
43. If the first two statements following are true, the third is (?) Some of our citizens are Methodists. Some of our citizens are doctors. Some of our citizens are Methodist doctors.  
1 true, 2 false, 3 not certain..... ( )
44. If  $3\frac{1}{2}$  yards of cloth cost 70 cents, how many cents will  $2\frac{1}{2}$  yards cost?..... ( )
45. A point is to a line as a line is to (?)  
1 surface, 2 pencil, 3 dot, 4 curve, 5 solid..... ( )
46. The two words superfluous and requisite mean (?)  
1 the same, 2 the opposite, 3 neither same nor opposite..... ( )
47. One can measure a city block — by pacing.  
1 evenly, 2 carefully, 3 cautiously, 4 approximately, 5 correctly..... ( )
48. Suppose that the first and second letters of the alphabet were interchanged, also the third and fourth, the fifth and sixth, etc. Write the letter which would then be the eighteenth letter of the series..... ( )
49. If a strip of cloth 36 inches long will shrink to 33 inches when washed, how many inches long will a 48-inch strip be after shrinking?..... ( )
50. Which one of the five words following is most unlike the other four?  
1 strong, 2 bad, 3 ripe, 4 round, 5 come..... ( )
51. A home always has (?)  
1 a mother, 2 hearth, 3 congeniality, 4 familiarity, 5 music..... ( )

52. A word meaning the same as controversy is (?)  
 1 dispute, 2 conversation, 3 discussion, 4 lawsuit, 5 dialogue..... ( )
53. Find the two letters in the word LATER which have just as many letters between them in the word as in the alphabet. Write the one of these two letters that comes first in the alphabet... ( )
54. The law of gravitation is (?)  
 1 obsolete, 2 absolute, 3 approximate, 4 conditional, 5 constitutional..... ( )
55. Which one of the five words below is most like these three: joy, anger, and fear?  
 1 habit, 2 memory, 3 hate, 4 life, 5 hearing..... ( )
56. A peninsula is to a continent as (?) is to the ocean.  
 1 river, 2 cape, 3 gulf, 4 lake, 5 island..... ( )
57. If all the even-numbered letters in the alphabet were crossed out, the tenth letter left, not crossed out, would be what letter? Print it. *Do not mark the alphabet.*  
 A B C D E F G H I J K L M N O P Q R S T U V W X Y Z..... ( )
58. A hotel serves a mixture of 3 parts cream and 2 parts milk. How many pints of cream will it take to make 25 pints of the mixture?..... ( )
59. Write the letter of the alphabet which is the third to the right of the letter which is midway between M and Q..... ( )
60. Which of the following is a trait of character?  
 1 wealth, 2 strength, 3 reputation, 4 loyalty, 5 admiration..... ( )
61. If a prosperous son neglects his poor, aged parents, he is considered (?)  
 1 thrifty, 2 extravagant, 3 unwise, 4 thoughtless, 5 shrewd..... ( )
62. One number is wrong in the following series. What should that number be?  
 1, 2, 4, 8, 16, 36, 64..... ( )
63. Evolution is to revolution as crawl is to (?)  
 1 baby, 2 floor, 3 stand, 4 run, 5 hands and knees..... ( )
64. How many of the following words can be made of the letters in the word FREIGHT, using any letter twice?  
 retire, height, grief, trigger, neither, thrift, relief, eighty..... ( )
65. If Frank can ride a bicycle 300 feet while George runs 200 feet, how many feet can Frank ride while George runs 300 feet?..... ( )
66. If the words below were rearranged to make a good sentence, the *fifth* word in the sentence would begin with what letter? Print the letter as a capital.  
 life friends valuable to The make asset in a is ability..... ( )
67. If the first two statements following are true, the third is (?) It takes perseverance to become a skillful juggler. This boy has perseverance. He will become a skillful juggler.  
 1 true, 2 false, 3 not certain..... ( )
68. If a wire 20 inches long is to be cut so that one piece is  $\frac{2}{3}$  as long as the other piece, how many inches long must the longest piece be?..... ( )
69. Find the letter which in this sentence itself appears a second time nearest the beginning..... ( )
70. Which of the five things following is most like these three: ivory, snow, and milk?  
 1 butter, 2 rain, 3 cold, 4 cotton, 5 water..... ( )
71. One number is wrong in the following series. What should that number be?  
 1 2 4 7 11 16 23..... ( )
72. What number is in the space which is in the rectangle and in the triangle but not in the circle? ( )



73. What number is in the same geometrical figure or figures as the number 6?..... ( )
74. How many spaces are there which are in any two but only two geometrical figures?..... ( )
75. What is the greatest number of spaces that could be made to be in any one but only one geometrical figure by overlapping any triangle, circle, and rectangle in any way?..... ( )

# University of Iowa Standard Tests and Scales



## IOWA HIGH SCHOOL CONTENT EXAMINATION

Devised by

G. M. RUCH

with the cooperation of

C. L. Huffaker, F. B. Knight, and W. Koerth

Name ..... Age ..... Sex .....  
(Last name) (First name) (Initial)

School ..... City .....

Date: Month and day ..... Year .....

### SUMMARY OF SCORES

	Raw Score	%-ile score
Section 1: English, Literature, etc.		
Section 2: Mathematics		
Section 3: Science		
Section 4: History and Social Sciences		
<b>TOTAL</b>		

### DIRECTIONS FOR TAKING THE EXAMINATION

Read each question and select the *best* answer to that question.

Record the *number* of the best answer on the dotted line, as shown in the following samples:

**Time allowed: 20 minutes per section. Total, 80 minutes. Do not waste time on a difficult item; omit it and go on to the next.**

*Samples:*

- 1 The capital of the United States is (1) Boston (2) Chicago (3) New York  
(4) Washington (5) Baltimore .....4...
- 2 An example of an insect is the (1) mosquito (2) clam (3) starfish (4) earth-  
worm (5) snake .....1...
- 3 Longfellow was a (1) musician (2) poet (3) statesman (4) movie actor (5) scientist .....2...

**DO NOT TURN OVER THE PAGE UNTIL THE SIGNAL IS GIVEN**

Copyright, 1924, by G. M. RUCH

Section 1

ENGLISH, LITERATURE, AND GRAMMAR

- 1 "Snowbound" was written by (1) Field (2) Markham (3) Whittier (4) Tennyson (5) Kipling
- 2 The Gettysburg address was given by (1) Abraham Lincoln (2) Daniel Webster (3) General Grant (4) Patrick Henry (5) Thomas Jefferson
- 3 The Pied Piper ridged Hamelin of (1) cats (2) snakes (3) rats (4) frogs (5) beggars
- 4 The god who held up the heavens was (1) Atlas (2) Hercules (3) Odysseus (4) Mercury (5) Thor
- 5 The best known work of Coleridge is (1) Childe Harold (2) Ancient Mariner (3) Ode to a Grecian Urn (4) Marmion (5) The Excursion
- 6 A phrase "a government of the people, for the people, and by the people" was uttered by (1) Washington (2) Clay (3) Calhoun (4) Lincoln (5) Wilson
- 7 "Gulliver's Travels" is the story of (1) an early traveler in America (2) one of the first African explorers (3) the life of a missionary (4) the struggles of a man to get into Heaven (5) the imaginary adventures of an English sea captain
- 8 Robinson Crusoe is noted for (1) its hidden allegorical meaning (2) its careful presentation of scientific facts (3) its clear and life-like story (4) its political significance (5) its intimate revelation of the hidden life of the author
- 9 "The Wreck of the Hesperus" was written by (1) Holmes (2) Longfellow (3) Riley (4) Stevenson (5) Whittier
- 10 "The House of Seven Gables" was written by (1) Dickens (2) Hawthorne (3) Poe (4) Cooper (5) Fielding
- 11 "The Pit and the Pendulum" was written by (1) Lowell (2) Whittier (3) Holmes (4) Bryant (5) Poe
- 12 One of Robin Hood's men was (1) Ivanhoe (2) Lancelot (3) Little John (4) Bill Sykes (5) Miles Standish
- 13 "The Call of the Wild" was written by (1) Cooper (2) Kipling (3) London (4) Stevenson (5) Sewell
- 14 The ferryman of the Styx was (1) Charon (2) Charybdis (3) Argus (4) Scylla (5) Typhon
- 15 Circe changed the men of Odysseus into (1) horses (2) stones (3) salt (4) swine (5) sheep
- 16 Such novels as Ivanhoe, Quentin Durward and Rob Roy are (1) historical novels (2) quiet domestic novels (3) careful character studies (4) novels written to reform (5) great novels of modern life
- 17 "The Last of the Mohicans" was (1) Mowgli (2) Hiawatha (3) Dunwoodie (4) Chingachgook (5) Uncas
- 18 The author of "Innocents Abroad" is (1) Hawthorne (2) Dickens (3) Stevenson (4) Carlyle (5) Mark Twain
- 19 "Ivanhoe" is a (1) ballad (2) elegy (3) essay (4) novel (5) short story
- 20 The messenger of the gods was (1) Mercury (2) Perseus (3) Zeus (4) Morpheus (5) Thor
- 21 The greatest poet in England before the age of Queen Elizabeth was (1) Langland (2) Chaucer (3) Robert Manning (4) Surrey (5) Dunbar
- 22 Burns' poetry is known for (1) its wide knowledge of life (2) its interpretation of the life of the humble people (3) its coldness and lack of feeling (4) its narrative power (5) its likeness to the work of Pope
- 23 Mark Twain's work is noted for (1) its humor (2) its careful character drawing (3) its profound insight into life (4) its perfect style (5) its scholarship
- 24 O. Henry is a writer of (1) novels (2) poems (3) plays (4) essays (5) short stories
- 25 "Nights with Uncle Remus" was written by (1) Barrie (2) Harris (3) Whittier (4) Mark Twain (5) Lanier
- 26 Pan is represented as partly (1) dog (2) fish (3) goat (4) snake (5) horse

- 27 Paradise Lost is about (1) the fall of man (2) the Civil War in England (3) the resurrection (4) the end of the world (5) the restoration of Charles II
- 28 Silas Marner is the story of (1) a prince in disguise (2) a great author (3) a soldier (4) a prominent statesman (5) a poor weaver
- 29 The Canterbury Tales are (1) a history (2) a set of stories in prose (3) a collection of sermons (4) a set of stories in verse (5) a paraphrase of the Bible
- 30 Guinevere is a character from (1) Idyls of the King (2) Paradise Lost (3) Vision of Sir Launfal (4) Ancient Mariner (5) Merchant of Venice
- 31 "The Man without a Country" was written by (1) Aldrich (2) Emerson (3) Cooper (4) Hale (5) Dana
- 32 The word "because" is (1) adjective (2) adverb (3) conjunction (4) preposition (5) verb
- 33 The past singular of the verb "to be" is (1) am (2) been (3) is (4) was (5) were
- 34 The correct expression for the blank in "It was.....who came to see you yesterday." is (1) myself (2) him (3) me (4) her (5) I
- 35 The goddess born from the head of Jupiter was (1) Diana (2) Juno (3) Minerva (4) Psyche (5) Clio
- 36 Mr. Worldly Wiseman occurs in (1) Paradise Lost (2) Paradise Regained (3) Pilgrim's Progress (4) Divine Comedy (5) Utopia
- 37 Little Nell is a character in (1) Old Curiosity Shop (2) Henry Esmond (3) David Copperfield (4) Romola (5) Elsie Venner
- 38 Addison and Steele are known as the writers of (1) Gulliver's Travels (2) Sir Roger de Coverley Papers (3) Duncaid (4) Absalom and Achitophel (5) Robinson Crusoe
- 39 The earliest of these writers was (1) Browning (2) Dickens (3) Milton (4) Chaucer (5) Shelley
- 40 An example of an allegorical tale is (1) Enoch Arden (2) Marmion (3) Pilgrim's Progress (4) Paul Revere's Ride (5) Ancient Mariner
- 41 An example of an epic is (1) Ancient Mariner (2) Hiawatha (3) Paul Revere's Ride (4) Thanatopsis (5) Vision of Sir Launfal
- 42 Stories of adventure have been written by (1) Bernard Shaw (2) Edgar Guest (3) Micawber (4) Lord Byron (5) Stevenson
- 43 The "Tale of Two Cities" tells of the (1) American Revolution (2) Civil War (3) French Revolution (4) Dark Ages (5) Feudalism
- 44 A character in "Les Miserables" is (1) Martin Chuzzlewit (2) Oliver Twist (3) Peter Grimm (4) Bill Sykes (5) Jean Valjean
- 45 The number of lines in a sonnet is (1) 8 (2) 14 (3) 16 (4) 24 (5) 37
- 46 A correct expression for the blank in "My friend studies much harder than....." is (1) I (2) me (3) mine (4) my (5) myself
- 47 "The Chambered Nautilus" was written by (1) Holmes (2) Longfellow (3) Coleridge (4) Lowell (5) Whittier
- 48 A character from David Copperfield is (1) Becky Sharp (2) Oliver Twist (3) Sinbad (4) Uriah Heep (5) John Ridd
- 49 Tense is a property of (1) adjectives (2) nouns (3) verbs (4) adverbs (5) pronouns
- 50 The correct expression for the blank in "I met a friend.....gave me a bunch of flowers." is (1) he (2) that (3) which (4) who (5) whom
- 51 Baldur was killed by an arrow of (1) ash (2) hazel (3) mistletoe (4) birch (5) yew
- 52 "The shrub was like a sheeted speeter" is an example of (1) hyperbole (2) metaphor (3) personification (4) simile (5) trochee
- 53 Pope is noted as the writer of (1) Rape of the Lock (2) Lycidas (3) Piers Ploughman (4) Tom Jones (5) Ode on Intimations of Immortality
- 54 The prefix "ante-" means (1) up (2) before (3) wrong (4) against (5) under
- 55 The tense of "I am going" is (1) future (2) future perfect (3) past (4) past perfect (5) present progressive
- 56 "The Gold Bug" has to do with (1) adventures in the Klondike (2) forty-niners rush to California (3) experiments with insects (4) hidden treasure (5) mythology

- 57 Whitman's "O Captain, My Captain" commemorates (1) Dewey (2) Lincoln  
(3) Napoleon (4) Roosevelt (5) Wellington .....
- 58 The name of the poem which begins "To him who in the love of Nature holds," is (1) Ben Bolt  
(2) Thanatopsis (3) Spring (4) The Skeleton in Armor (5) Daybreak .....
- 59 Bret Harte wrote (1) history (2) essays (3) stories of western life (4) accounts  
of European travel (5) tragedies .....
- 60 Maggie Tulliver is a character in (1) Adam Bede (2) Mill on the Floss (3) Romola  
(4) Silas Marner (5) Vanity Fair .....
- 61 Morpheus symbolizes (1) fertility (2) happiness (3) health (4) light (5) sleep .....
- 62 Spenser was a contemporary of (1) Chaucer (2) Shakespeare (3) Milton (4) Dryden  
(5) Pope .....
- 63 The poets of the Romantic movement were most influenced by (1) the revival of learning  
(2) the discovery of America (3) the invention of printing (4) the American Civil War  
(5) the French Revolution .....
- 64 "The Slough of Despond" is told about in (1) Hamlet (2) Last of the Mohicans  
(3) Tom Sawyer (4) Pilgrim's Progress (5) David Copperfield .....
- 65 Swift was a (1) great poet (2) famous novelist (3) the first writer of short stories  
(4) the greatest preacher of his time (5) a fierce satirist .....
- 66 Dickens was much impressed by (1) the need for social reform (2) the greatness of the  
British Empire (3) the importance of scientific truth (4) the wickedness of the Russians  
(5) the value of French literature .....
- 67 Thanatopsis is about (1) the adventures of an Indian chief (2) the American Revolution  
(3) the teaching of Nature about death (4) the coming of spring (5) the adventures of  
a snow bound family .....
- 68 Poe's poetry is noted for (1) its mystery and beauty (2) its lack of rhyme (3) its lack  
of music (4) its power of thought (5) its length and scholarship .....
- 69 Thoreau is noted as (1) a writer of novels (2) a student of nature (3) a writer of short  
stories (4) a political reformer (5) a famous soldier .....
- 70 A demonstrative pronoun is (1) either (2) some (3) what (4) that (5) who .....
- 71 To eliminate means to (1) extend (2) acknowledge (3) eject (4) invigorate (5) forfeit .....
- 72 "Ghosts" is a drama by (1) Ibsen (2) Maeterlinck (3) Synge (4) Schiller  
(5) Strindberg .....
- 73 A great Scandinavian dramatist is (1) Dryden (2) Shaw (3) Synge (4) Maeterlinck  
(5) Ibsen .....
- 74 The opposite of admirable is (1) profane (2) honorable (3) diminutive (4) detestable  
(5) delicate .....
- 75 Silas Lapham was a (1) minister (2) merchant (3) traveler (4) teacher (5) student .....
- 76 A poem with symbolic characters is a (1) limerick (2) epic (3) lyric (4) elegy  
(5) allegory .....
- 77 An example of a ballad is (1) Kidnapped (2) Midsummer Night's Dream (3) Romola  
(4) The Charge of the Light Brigade (5) Paradise Lost .....
- 78 Carlyle wrote (1) Apologia pro Vita Sua (2) Westward Ho (3) History of the French  
Revolution (4) History of England (5) Modern Painters .....
- 79 Webster in his debate with Hayne made a great plea for (1) slavery (2) abolition  
(3) a high tariff (4) a closer union (5) the Declaration of Independence .....
- 80 To accelerate means to (1) expedite (2) repel (3) exclude (4) improve (5) officiate .....
- 81 The number of Cerberus' heads was (1) 2 (2) 3 (3) 5 (4) 7 (5) 9 .....
- 82 The opposite of monotonous is (1) gigantic (2) transparent (3) delicate (4) varied  
(5) pictorial .....
- 83 Life in India was described by (1) Defoe (2) Gulliver (3) Kipling (4) Roosevelt  
(5) Stevenson .....
- 84 Hyperbole is an expression of (1) comparison (2) exaggeration (3) exclamation  
(4) interrogation (5) opposition .....
- 85 The Romantic movement was interested in (1) the spread of religion (2) the life and ideas  
of the Middle Ages (3) the problems of science (4) the maintaining of the existing order of  
things (5) a return to the Roman Catholic Church .....

- 86 The name of the poem which begins "Speak! Speak! thou fearful guest" is (1) The Raven  
(2) Nature (3) Amy Wentworth (4) The Haunted Palace (5) The Skeleton in Armor .....
- 87 The case of predicate nouns is (1) objective (2) nominative (3) possessive (4) accusative  
(5) dative .....
- 88 A famous French novelist is (1) Balzac (2) Bret Harte (3) Ibsen (4) Ibanez  
(5) Zangwill .....
- 89 "Mr. Britling Sees It Through" was written by (1) O. Henry (2) Rinehart  
(3) H. G. Wells (4) Cather (5) Churchill .....
- 90 A poem telling of country or farm life is called an (1) elegy (2) epic (3) satire  
(4) ballad (5) pastoral .....
- 91 Fielding is noted for his influence on (1) Defoe (2) Carlyle (3) Dickens (4) Thackeray  
(5) Scott .....
- 92 "The School for Scandal" was written by (1) Dryden (2) Shaw (3) Sheridan (4) Ibsen  
(5) Jonson .....
- 93 Frugal means (1) fragile (2) eccentric (3) uprightness (4) hateful (5) economical .....
- 94 The cause of better living conditions for the poor and more kindly treatment of children, etc., was  
much helped by the work of (1) Scott (2) Byron (3) Wordsworth (4) Coleridge  
(5) Dickens .....
- 95 George Eliot's novels impress on us (1) the advantage of having great wealth (2) the use-  
lessness of right living (3) the certainty of death (4) the importance of self-sacrifice  
(5) the value of learning .....
- 96 In the opinion of the people of his time the greatest living poet was (1) Pope (2) Addison  
(3) Steele (4) Defoe (5) Swift .....
- 97 Alfred Noyes is famous as a (1) journalist (2) novelist (3) orator (4) poet  
(5) essayist .....
- 98 The opposite of affirm is (1) refute (2) protest (3) vary (4) exclude (5) agree .....
- 99 The number of Muses was (1) 3 (2) 6 (3) 7 (4) 9 (5) 12 .....
- 100 The Prelude is about (1) the life of the poet Wordsworth (2) the American Revolution  
(3) the life of a great musician (4) an allegory of the life of the soul (5) a piece of music .....
- 101 The opposite of repugnant is (1) servile (2) prompt (3) obscure (4) essential  
(5) agreeable .....
- 102 Eccentric means (1) accelerated (2) singular (3) distinguished (4) familiar (5) peevish .....
- 103 Dickens, Thackeray, and Eliot were living at the time of (1) The World War (2) French  
Revolution (3) American Revolution (4) Signing of the Magna Charta (5) American Civil War .....
- 104 Emerson preached (1) the importance of social reform (2) the need for prohibition  
(3) the greatness of the individual soul (4) the need for a closer union (5) the end of the world .....
- 105 Hawthorne's stories are noted for (1) their humor (2) their hidden meanings (3) their  
faulty English (4) their clear pictures of great figures in history (5) their bitter anti-American tone .....
- 106 "Death tramples it to fragments" is an example of (1) irony (2) hyperbole (3) antithesis  
(4) personification (5) synecdoche .....
- 107 The poems of Browning are best known for (1) the vigor and force of their thought  
(2) their clearness and simplicity (3) the beauty and charm of their workmanship  
(4) the immoral character of their teachings (5) the ease with which they have been set to music .....
- 108 A famous oratorio by Handel is (1) "Elijah" (2) "The Messiah" (3) "Redemption"  
(4) "The Resurrection" (5) "The Annunciation" .....
- 109 The work of William D. Howells is distinguished for (1) romance (2) scholarship  
(3) historicity (4) crudeness (5) realism .....
- 110 Sara Teasdale is a (1) poetess (2) novelist (3) essayist (4) orator (5) actress .....

Score on Section 1 .....

## Section 2

## MATHEMATICS

- 1 The algebraic sum of 4 and  $-7$  is (1)  $-3$  (2)  $+3$  (3)  $-11$  (4)  $+4$  (5)  $+11$  .....
- 2 A straight line is the shortest distance between two (1) bisectors (2) circles (3) loci  
(4) points (5) theorems .....
- 3 If  $x+5=11$ , then  $x=$  (1) 4 (2) 5 (3) 6 (4) 7 (5) 16 .....
- 4 The algebraic fraction among the following terms is (1)  $.3$  (2)  $27/3$  (3)  $1/2$  (4)  $2a/c$   
(5)  $17/129$  .....
- 5 A general statement which is accepted as true without proof is called an (1) axiom  
(2) hypothesis (3) magnitude (4) postulate (5) theorem .....
- 6 The product of  $a^3$  and  $a^4$  is (1)  $a^7$  (2)  $a^{12}$  (3)  $a^1$  (4)  $3a^4$  (5)  $4a^8$  .....
- 7 A figure involving two dimensions is called a (1) line (2) plane (3) point (4) solid  
(5) vertex .....
- 8 The exponent in the term  $37y^4$  is (1) 3 (2)  $y$  (3) 7 (4) 37 (5) 4 .....
- 9 The sum of the angles of a triangle always equals (1)  $60^\circ$  (2)  $360^\circ$  (3)  $270^\circ$   
(4)  $120^\circ$  (5)  $180^\circ$  .....
- 10 The third term in the expression  $17x-32y+7z+21$  is (1)  $x$  (2)  $+$  (3)  $7z$   
(4)  $-32y$  (5)  $z$  .....
- 11 Lines that will not meet however far they are produced are said to be (1) adjacent  
(2) concentric (3) convergent (4) loci (5) parallel .....
- 12 The complement of an angle of  $37\frac{1}{2}^\circ$  is (1)  $75^\circ$  (2)  $56^\circ$  (3)  $89^\circ$  (4)  $52\frac{1}{2}^\circ$   
(5)  $37\frac{1}{2}^\circ$  .....
- 13 If  $x^2-9=0$ ,  $x$  equals (1) 1 (2)  $\pm 3$  (3) 3 (4)  $-3$  (5)  $-1$  .....
- 14 The intersection of two planes forms a (1) point (2) tangent (3) line (4) arc  
(5) sector .....
- 15  $a^5/a^3$  is the same as (1)  $a^2/a^5$  (2)  $a^4/a^4$  (3)  $3a$  (4)  $5/3$  (5)  $a^2$  .....
- 16 The supplement of an angle of  $30^\circ$  is (1)  $40^\circ$  (2)  $70^\circ$  (3)  $110^\circ$  (4)  $150^\circ$  (5)  $170^\circ$  .....
- 17  $(a-b)^2=$  (1)  $a^2+2ab+b^2$  (2)  $a^2-2ab+b^2$  (3)  $a^2+b^2$  (4)  $a^2-b^2$   
(5)  $a^2-ab^2$  .....
- 18  $(c-4)^2=$  (1)  $c^2-8c+16$  (2)  $c^2-16$  (3)  $c^2+16$  (4)  $c^2+8c+16$   
(5)  $c^2-4c+16$  .....
- 19  $(2x+3y)^2=$  (1)  $2x^2+3y^2$  (2)  $4x^2+9y^2$  (3)  $4x^2+6xy+9y^2$  (4)  $4x^2-6xy+9y^2$   
(5)  $4x^2+12xy+9y^2$  .....
- 20 The simplest expression of  $5a-8a+10a-12a$  is (1)  $3a-2a$  (2)  $-3a+2a$  (3)  $-3a-2a$   
(4)  $-25a$  (5)  $-5a$  .....
- 21 The square root of  $a^2+2ab+b^2$  is (1)  $ab$  (2)  $a-b$  (3)  $(a+b)^2$  (4)  $a+b$   
(5)  $(a-b)^2$  .....
- 22 The product of  $a^3b^2$  and  $ab^2c$  is (1)  $a^2c$  (2)  $a^4b^4c$  (3)  $a^3b^2c$  (4)  $a^3b^3c^3$  (5)  $ab^2c$  .....
- 23  $17r^3s^2 \div rs=$  (1)  $rs$  (2)  $17rs$  (3) 17 (4)  $17r$  (5)  $17r^2s$  .....
- 24 If one acute angle of a right triangle is  $40^\circ$ , the other is (1)  $20^\circ$  (2)  $40^\circ$  (3)  $50^\circ$   
(4)  $90^\circ$  (5)  $100^\circ$  .....
- 25 In the term  $14xyz$ , the coefficient of  $xyz$  is (1)  $x$  (2)  $z$  (3) 14 (4)  $xy$  (5)  $y$  .....

- 26 The number of acres in a square mile is (1)  $5\frac{1}{2}$  (2)  $16\frac{1}{2}$  (3) 160 (4) 320 (5) 640 .....
- 27 Since 3 feet make one yard, the number of feet in  $n$  yards is (1)  $3n$  (2)  $3+n$  (3)  $3-n$   
(4)  $n$  (5)  $n-3$  .....
- 28 A portion of the circumference of a circle is called a (1) tangent (2) diagonal (3) radius  
(4) arc (5) sector .....
- 29 If the equal angles of an isosceles triangle are  $70^\circ$ , the vertical angle is (1)  $20^\circ$  (2)  $40^\circ$   
(3)  $55^\circ$  (4)  $150^\circ$  (5)  $220^\circ$  .....
- 30 The first compiler of Geometry was (1) Aristotle (2) Demosthenes (3) Euclid  
(4) Herodotus (5) Xerxes .....
- 31  $(-2a)^3 =$  (1)  $8a^2$  (2)  $-8a^3$  (3)  $8a^3$  (4)  $-8a^3$  (5)  $-6a^3$  .....
- 32  $30x^3 - 10$  divided by 10 equals (1)  $3x-1$  (2)  $30x^2-10x$  (3)  $3x^3-1$  (4)  $30x^3-1$   
(5)  $3x^2-1$  .....
- 33  $\sqrt{36a^4b^{16}} =$  (1)  $+6a^2b^4$  (2)  $+6a^2b^8$  (3)  $+6a^4b^{16}$  (4)  $+18a^2b^8$  (5)  $+6a^3b^{16}$  .....
- 34 If two parallel lines are cut by a transversal, the alternate exterior angles are (1) unequal  
(2) supplementary (3) complementary (4) equal (5) tangent .....
- 35 The term which if added to  $x^2+m^2$  would make the expression a perfect square is (1)  $xm$   
(2)  $-xm$  (3)  $-2xm$  (4)  $4xm$  (5)  $-4xm$  .....
- 36  $8a^{10} \div 2a^2$  equals (1)  $4a^8$  (2)  $4a^5$  (3)  $6a^8$  (4)  $4a^{10}$  (5)  $8a^5$  .....
- 37 Given  $a=3$ ,  $b=1$ , and  $c=5$ , then  $2a-5b+c$  equals (1) 6 (2) 7 (3) 9 (4) 10 (5) 15 .....
- 38  $\frac{9x-18x^4}{-3x} =$  (1)  $(3x-6x)$  (2)  $(-3+6x^3)$  (3)  $(-3+6x^2)$  (4)  $(3-6x^3)$   
(5)  $(-3x-6x^3)$  .....
- 39 Where  $\frac{x}{m} = n$ ,  $x$  equals (1)  $\frac{n}{m}$  (2)  $\frac{m}{n}$  (3)  $m-n$  (4)  $mn$  (5)  $n-m$  .....
- 40 If one angle of a parallelogram is  $80^\circ$ , the consecutive angle is (1)  $20^\circ$  (2)  $80^\circ$  (3)  $100^\circ$   
(4)  $180^\circ$  (5)  $280^\circ$  .....
- 41 The part of a circle included between two radii and an arc is called a (1) chord (2) locus  
(3) diameter (4) sector (5) tangent .....
- 42 A quantity whose value remains unchanged is a (1) constant (2) limit (3) proportion  
(4) ratio (5) variable .....
- 43 A straight line drawn joining any two points in a circumference is called an (1) arc (2) chord  
(3) diameter (4) median (5) radius .....
- 44 The two binomials whose product is  $49x^2-1$  are (1)  $(7x+1)(7x+1)$  (2)  $(49x+1)(x-1)$   
(3)  $(7x-1)(7x-1)$  (4)  $(49x-1)(x+1)$  (5)  $(7x+1)(7x-1)$  .....
- 45 22.7 times zero = (1) 22.7 (2) zero (3) infinity (4) .227 (5) 2.27 .....
- 46  $(1/25)^{\frac{1}{2}} =$  (1) 5 (2)  $25/2$  (3)  $1/5$  (4)  $1/625$  (5)  $-5$  .....
- 47  $\sqrt[3]{27m^3n^3} =$  (1)  $-3mn$  (2)  $-9m^2n^2$  (3)  $+6mn$  (4)  $+3mn$  (5)  $-mn$  .....
- 48 If a central angle is  $40^\circ$ , its intercepted arc is (1)  $20^\circ$  (2)  $40^\circ$  (3)  $80^\circ$  (4)  $140^\circ$   
(5)  $320^\circ$  .....
- 49 The length of the hypotenuse of a right triangle whose sides are 3 and 4 inches long, respectively, is  
(1) 12 in. (2) 7 in. (3) 25 in. (4) 14 in. (5) 5 in. ....
- 50  $\frac{m^2n^2}{m^2n^3}$  reduced to lowest terms is (1) 0 (2) 1 (3)  $n$  (4)  $\frac{m}{n}$  (5)  $\frac{m^3}{n^3}$  .....
- 51  $2.246 \div \sqrt{.01} =$  (1) .02246 (2) .002246 (3) .2246 (4) 22.46 (5) 224.6 .....

- 52 Triangles having equal bases and equal altitudes are always (1) equilateral (2) equivalent  
(3) isosceles (4) scalene (5) synthetic
- 53  $\frac{-21a^2b^3}{-7a^3b^2} =$  (1)  $-3a^2b^3$  (2)  $3a^3b^2$  (3)  $3a^6b^4$  (4)  $3a^{12}b^8$  (5)  $-3a^6b^4$
- 54  $\sqrt[3]{-27m^3n^3} =$  (1)  $-3mn$  (2)  $-9m^2n^2$  (3)  $+6mn$  (4)  $-mn$  (5)  $3mn$
- 55 1 cm equals about (1) .1 in. (2) .2 in. (3) .4 in. (4) 1 in. (5) 1.4 in.
- 56 If a triangle containing 30 sq. ft. has an altitude of 6 ft., the base is (1) 5 (2) 18  
(3) 15 (4) 12 (5) 10
- 57 Of the angles of a triangle, two are always (1) acute (2) complementary (3) obtuse  
(4) reflex (5) right
- 58 When  $\frac{a}{x} = b$ , x equals (1) ab (2)  $\frac{a}{b}$  (3)  $\frac{b}{a}$  (4) b-a (5) a-b
- 59 Any parallelogram inscribed in a circle must be a (1) rhombus (2) square (3) rectangle  
(4) hexagon (5) trapezoid
- 60 The locus of points equidistant from a point is an (1) angle (2) circle (3) diameter  
(4) perpendicular bisector (5) triangle
- 61 The base of a triangle is b, the altitude is a. The area is (1) a/b (2) ab (3) b/a  
(4) ab/2 (5) 2/ab
- 62 A sector is the part of a circle that is bounded by (1) two arcs (2) chord and an arc  
(3) two radii and an arc (4) diameter and chord (5) semicircle and diameter
- 63 The area of a circle with a radius of 5 inches is (1)  $5\pi$  (2)  $10\pi$  (3)  $5\pi^2$   
(4)  $25\pi$  (5)  $25\pi^2$
- 64 If the sides of two triangles are respectively proportional, the triangles are (1) congruent  
(2) isosceles (3) proportional (4) scalene (5) similar
- 65 The factors of  $a^3 - b^3$  are (1)  $(a+b)(a^2+ab+b^2)$  (2)  $(a-b)(a^2-ab-b^2)$   
(3)  $(a-b)(a^2+ab+b^2)$  (4)  $(a-b)(a^2+2ab+b^2)$  (5)  $(a-b)(a+b)(a-b)$
- 66 If  $a : x = 1 : 2$ , x equals (1)  $\frac{1}{2}$  (2)  $\frac{2}{a}$  (3) 2 (4)  $\frac{a}{2}$  (5) 2a
- 67 The locus of points equidistant from two intersecting lines is (1) the bisector of the angle formed  
(2) a circle (3) the perpendicular bisector of lines (4) the vertex  
(5) a line parallel to one of the lines
- 68 The least common multiple of  $x^2+2xy+y^2$  and  $x+y$  is (1)  $x^2+y^2$  (2)  $x^2-y^2$   
(3)  $(x-y)(x-y)$  (4)  $x^2+2xy+y^2$  (5)  $(x^2+2xy+y^2)(x-y)$
- 69 A mean proportional between  $\frac{4}{a^3}$  and  $\frac{9}{ax^2}$  is (1)  $\frac{4}{a^2}$  (2)  $\frac{4}{ax}$  (3)  $\frac{6}{a^2x}$   
(4)  $\frac{6}{ax}$  (5)  $\frac{36}{a^4x^2}$
- 70 The perimeters of two similar triangles are 18 inches and 12 inches. If a side of the first is 3 in., the corresponding side of the second is (1) 2 (2) 6 (3) 10 (4) 12 (5) 18
- 71  $24.5 \div \text{zero} =$  (1) zero (2) 1.0 (3) infinity (4) 24.5 (5) 245
- 72 A quadratic equation is (1) a surd (2) an equation of the first degree (3) an equation of the third degree  
(4) an equation which contains the second power of an unknown, but nothing higher than the second power  
(5) a simple linear equation
- 73  $\frac{4x1}{2x4x0x6} =$  (1) 12 (2) zero (3)  $\frac{1}{4}$  (4)  $\frac{1}{12}$  (5) an expression without meaning
- 74 The sum of the interior angles of a pentagon equals (1)  $90^\circ$  (2)  $120^\circ$  (3)  $360^\circ$   
(4)  $720^\circ$  (5)  $540^\circ$
- 75 The equation which will always hold true for any values that may be assigned to a, b and x is  
(1)  $3x(a-b) = 3ax - 3bx$  (2)  $3x(a-b) = 3ax - bx$  (3)  $12ax - 4bx = 3(ax - bx)$   
(4)  $12ax - 12bx = 0$  (5)  $3ax - 4bx = 0$

Score on Section 2 .....

## Section 3

## SCIENCE

- 1 The house-fly is known to spread (1) bubonic plague (2) typhoid (3) yellow fever  
(4) malaria (5) small pox .....
- 2 An example of a chemical element of great significance in physiology is (1) carbon-dioxide  
(2) water (3) protein (4) oxygen (5) air .....
- 3 An animal which possesses antennae is the (1) earthworm (2) starfish (3) hydra  
(4) amoeba (5) grasshopper .....
- 4 The act of transfer of pollen from anther to stigma is called (1) pollination (2) reproduction  
(3) fertilization (4) transpiration (5) mitosis .....
- 5 A plant that lives as a parasite is (1) mistletoe (2) nasturtium (3) water lily  
(4) fern (5) dandelion .....
- 6 An example of a chemical change is the (1) dessication of spores (2) oxidation of sugar  
(3) dissolving of salt (4) osmosis of glucose (5) exchange of gases in the lungs .....
- 7 The freezing point on the Centigrade thermometer is (1)  $-273^{\circ}$  (2)  $0^{\circ}$  (3)  $32^{\circ}$   
(4)  $100^{\circ}$  (5)  $212^{\circ}$  .....
- 8 An example of a mechanical mixture is (1) chlorine (2) hydrogen (3) carbon dioxide  
(4) paint (5) copper sulphate .....
- 9 Barometers are used to measure (1) humidity (2) rainfall (3) air-pressure  
(4) gravity (5) electricity .....
- 10 The best temperature for living rooms is about (1)  $60^{\circ}$  (2)  $68^{\circ}$  (3)  $75^{\circ}$  (4)  $88^{\circ}$  (5)  $98^{\circ}$  .....
- 11 The center of our universe is the (1) earth (2) moon (3) sun (4) Jupiter (5) Mars .....
- 12 Combustion is another name for (1) freezing (2) drying (3) boiling (4) burning  
(5) melting .....
- 13 The best "all around" fertilizer is probably (1) bone meal (2) dried blood (3) manure  
(4) ammonium nitrate (5) calcium phosphate .....
- 14 A gas which supports combustion is (1) hydrogen (2) nitrogen (3) carbon dioxide  
(4) oxygen (5) carbon monoxide .....
- 15 A collection of tissues specialized for a definite function is called an (1) organism (2) cell  
(3) larva (4) organ (5) tissue .....
- 16 The atomic weight of oxygen is (1) 1 (2) 12 (3) 14 (4) 16 (5)  $35\frac{1}{2}$  .....
- 17 Mendel is chiefly noted for his studies of (1) bacteria (2) circulation of blood  
(3) heredity (4) cell structure (5) feeble-mindedness .....
- 18 The most conspicuous structure of the lima bean seed is the (1) cotyledons (2) plumule  
(3) hypocotyl (4) micropyle (5) epicotyl .....
- 19 Water enters the roots of plants by (1) capillarity (2) osmosis (3) solution  
(4) gravitation (5) suction .....
- 20 The watt is the unit of measurement of (1) resistance (2) current (3) velocity  
(4) power (5) potential .....
- 21 The material which forms the basis of life is the (1) plasma (2) endosperm  
(3) hemoglobin (4) cell-walls (5) protoplasm .....
- 22 The diameter of the earth is about (1) 4000 mi. (2) 5000 mi. (3) 8000 mi.  
(4) 25,000 mi. (5) 240,000 mi. ....
- 23 The length of a meter in inches is about (1) 12 (2) 27 (3) 39 (4) 72 (5) 144 .....
- 24 The symbol for mercury is (1) Pb (2) Sb (3) Hg (4) Ag (5) Mn .....

- 25 The processes by which foods are incorporated into living matter are termed (1) absorption  
(2) metamorphosis (3) circulation (4) digestion (5) assimilation .....
- 26 Hydrogen may be made by the action of hydrochloric acid on (1) zinc (2) sodium chloride  
(3) copper sulphate (4) sodium hydroxide (5) potassium chlorate .....
- 27 The formula for magnesium sulphate is (1) NaOH (2) HCl (3) HNO<sub>3</sub> (4) MgSO<sub>4</sub>  
(5) H<sub>2</sub>SO<sub>4</sub> .....
- 28 The protein-digesting enzyme of the pancreatic juice is (1) pepsin (2) trypsin  
(3) steapsin (4) diastase (5) amylopsin .....
- 29 Electric charges can be detected by means of (1) condenser (2) electroscope  
(3) dynamo (4) voltaic cell (5) spectroscope .....
- 30 Acids can be distinguished from bases by means of (1) catalyzers (2) anhydrides  
(3) indicators (4) colloids (5) solutes .....
- 31 The miner's safety lamp was invented by (1) Bunsen (2) Edison (3) Marconi  
(4) Davy (5) Jolly .....
- 32 The ampere is a measure of (1) resistance (2) gravitation (3) electric potential  
(4) heat (5) electric currents .....
- 33 A chemical element characteristic of the proteins but not found in carbohydrates or fats is  
(1) oxygen (2) carbon (3) nitrogen (4) hydrogen (5) chlorine .....
- 34 Boyle's Law states the relation between the volume of a gas and its (1) temperature  
(2) pressure (3) color (4) density (5) solubility .....
- 35 The circulation of the blood was discovered by (1) Harvey (2) Newton (3) Weismann  
(4) Darwin (5) Pasteur .....
- 36 Distance east and west around the earth is called (1) altitude (2) declination  
(3) inclination (4) latitude (5) longitude .....
- 37 The valence of chlorine is ordinarily (1) 1 (2) 2 (3) 3 (4) 4 (5) 6 .....
- 38 The north and south poles are cold because of (1) the short days (2) the sun's rays strike  
at angles (3) snow and ice (4) more water than land (5) high altitudes .....
- 39 High tide comes every (1) 6 hours (2) 12 hours (3) 24 hours (4) 7 days (5) 28 days .....
- 40 "Mature" rivers are characterized by (1) V-shaped valleys (2) numerous water falls  
(3) upland swamps (4) swift currents (5) U-shaped valleys .....
- 41 The formula for hydrochloric acid is (1) NaOH (2) HCl (3) HNO<sub>3</sub> (4) MgSO<sub>4</sub>  
(5) H<sub>2</sub>SO<sub>4</sub> .....
- 42 A beam of light striking a mirror at an angle of 30° is reflected at an angle of (1) 15°  
(2) 30° (3) 45° (4) 60° (5) 120° .....
- 43 The sepals of a flower are collectively known as the (1) corolla (2) receptacle  
(3) bracts (4) calyx (5) stamens .....
- 44 The planet which is nearest the sun is (1) Earth (2) Mars (3) Mercury  
(4) Jupiter (5) Uranus .....
- 45 The percentage of O<sub>2</sub> in air is about (1) 4% (2) 20% (3) 50% (4) 80% (5) 96% .....
- 46 One of the first telescopes was made by (1) Galileo (2) Bacon (3) Newton  
(4) Kepler (5) Archimedes .....
- 47 An example of a sedimentary rock is (1) granite (2) schist (3) marble  
(4) obsidian (5) sandstone .....
- 48 Entomology is the science of (1) fishes (2) words (3) insects (4) birds (5) minerals .....
- 49 Pascal's Law is involved in the (1) siphon (2) thermometer (3) prism  
(4) electro-magnet (5) hydraulic press .....
- 50 If 100 cubic centimeters of ice weigh 93 grams, the specific gravity is (1) 0.93 (2) 1.00  
(3) 9.30 (4) 1.08 (5) 10.00 .....

- 51 The most ductile of these metals is (1) iron (2) copper (3) platinum (4) zinc (5) lead .....
- 52 An example of a lever of the first class is the (1) nutcrackers (2) forearm (3) lemon  
squeezer (4) wheelbarrow (5) scissors .....
- 53 A substance often used in testing for chlorides is (1) silver nitrate (2) iodine  
(3) ammonia (4) ferrous sulphate (5) barium chloride .....
- 54  $H_2SO_4 + BaCl_2 = 2HCl$  and (1)  $H_2O$  (2)  $Ba(OH)_2$  (3)  $SO_3$  (4)  $BaSO_4$  (5)  $H_2ClO_3$  .....
- 55 The force needed to raise a weight of 1200 pounds on a hydraulic press whose piston areas stand in the  
ratio of 1:6 is (1) 100 lbs. (2) 200 lbs. (3) 300 lbs. (4) 600 lbs. (5) 2400 lbs. ....
- 56 An instrument depending on atmospheric pressure for its operation is the (1) siphon  
(2) hydraulic press (3) thermometer (4) telephone (5) voltaic cell .....
- 57 The attraction between molecules of a body is called (1) capillarity (2) adhesion  
(3) magnetism (4) inertia (5) cohesion .....
- 58 The velocity of sound in air in feet per second is about (1) 980 (2) 240,000 (3) 186,000  
(4) 1100 (5) 93,000,000 .....
- 59 The number of calories of heat needed to raise the temperature of 10 grams of water from  $15^\circ$  to  $16^\circ$  is  
(1) 1/10 (2) 1 (3) 10 (4) 100 (5) 1000 .....
- 60 The work done by a 50 pound ball falling 20 feet in foot-pounds is (1) 0.4 (2) 2.5  
(3) 20.0 (4) 50.0 (5) 1000 .....
- 61 The distinguishing feature of the mammals is the possession of (1) backbones (2) two  
pairs of legs (3) warm blood (4) milk glands (5) nervous system .....
- 62 The normal pulse rate is about (1) 18 (2) 48 (3) 70 (4) 98 (5) 112 .....
- 63 The process of conjugation occurs in the (1) fern (2) Paramoecium (3) butterfly  
(4) clam (5) frog .....
- 64 Lines of equal temperature are called (1) equators (2) parallels (3) meridians  
(4) isotherms (5) isobars .....
- 65 Relative humidity is often measured by means of (1) barometers (2) thermometers  
(3) hydraulic rams (4) galvanometers (5) hygrometers .....
- 66 The intensity of light varies (1) inversely as the distance (2) directly as the square of  
the distance (3) indirectly as the square of the distance (4) directly as the distance  
(5) inversely as the square root of the distance .....
- 67 The process of energy release in the tissues of living organisms is called (1) transpiration  
(2) excretion (3) expiration (4) respiration (5) photosynthesis .....
- 68 The one of these substances having the highest specific heat is (1) water (2) glass  
(3) copper (4) soil (5) rubber .....
- 69 The production of embryos from unfertilized eggs is termed (1) parthenogenesis  
(2) hermaphroditism (3) symbiosis (4) mitosis (5) recapitulation .....
- 70 In passing through a prism the rays which are most refracted are the (1) red (2) yellow  
(3) green (4) blue (5) violet .....
- 71 Low-voltage alternating currents are "stepped up" by means of (1) interrupters  
(2) condensers (3) rheostats (4) dynamos (5) transformers .....
72. The name for  $NH_4BR$  is (1) hydrobromic acid (2) bromine (3) ammonium bromide  
(4) nitrogen bromide (5) ammonia bromine .....
- 73 The point of attachment of the seed to the pod is called the (1) hilum (2) petiole  
(3) ventricle (4) hypocotyl (5) micropyle .....
- 74 The "LeBlanc Process" is used in the manufacture of (1) white lead (2) vinegar  
(3) sulphuric acid (4) sodium carbonate (5) iodine .....
- 75 Substances which hasten a chemical action without themselves undergoing any chemical change are  
called (1) catalysts (2) electrolytes (3) ionogens (4) allotrops (5) anhydrides .....

- 76 A formula used for stating Ohm's Law is (1)  $S = \frac{1}{2}gt^2$  (2)  $I = \frac{V}{R}$  (3)  $W = I^2RT$   
 (4)  $W = FD$  (5)  $F = \frac{mv^2}{r}$  .....
- 77 Heat can pass through a vacuum only by means of (1) convection (2) conduction  
 (3) capillarity (4) radiation (5) gravitation .....
- 78 The negative plate of an electrolysis apparatus is called the (1) electrolyte (2) anode  
 (3) cation (4) anion (5) cathode .....
- 79 The light rays of highest vibration frequency are the (1) red (2) yellow (3) violet  
 (4) green (5) blue .....
- 80 The greatest mechanical advantage which can be obtained by the use of 4 movable pulleys is  
 (1) 4 (2) 5 (3) 6 (4) 7 (5) 9 .....
- 81 A famous astronomer was (1) Agassiz (2) Copernicus (3) Huxley (4) Harvey  
 (5) Lamarck .....
- 82 Another term for an anti-cyclone is a (1) low-pressure area (2) tornado (3) hurricane  
 (4) high-pressure area (5) typhoon .....
- 83 An example of a metamorphic rock is (1) limestone (2) sandstone (3) marble  
 (4) obsidian (5) pumice .....
- 84 Carbohydrates are stored in the liver and known as (1) glycogen (2) hormones  
 (3) diastase (4) ptomaines (5) vitamins .....
- 85 The valence of sulphur in sulphuric acid is (1) one (2) two (3) three (4) four  
 (5) six .....
- 86 Water-vascular systems are characteristic of the (1) hydra (2) starfishes  
 (3) Paramoecium (4) jellyfishes (5) sponges .....
- 87 Nitric acid can be made from ammonia by (1) electrolysis (2) double decomposition  
 (3) reduction (4) oxidation (5) neutralization .....
- 88 "Mercator's projection" is a term used in connection with (1) maps (2) mountains  
 (3) winds (4) magnets (5) planets .....
- 89 The pitch of an open pipe compared with a closed pipe of the same dimensions is (1) 1 octave  
 lower (2) the same (3) 1 octave higher (4) 2 octaves lower (5) 2 octaves higher .....
- 90  $CO_2 + Ca(OH)_2 = H_2O$  and (1)  $CaCO_3$  (2)  $2CO_2$  (3)  $CH_3OH$  (4)  $CaOH$  (5)  $CaCO_2$  .....
- 91 An example of an igneous rock is (1) granite (2) marble (3) sandstone  
 (4) limestone (5) chalk .....
- 92 Telluride is an ore containing (1) lead (2) zinc (3) gold (4) mercury (5) nickel .....
- 93  $CH_3OH$  is the formula for (1) grain alcohol (2) formaldehyde (3) wood alcohol  
 (4) chloroform (5) glycerine .....
- 94 The unit of electric quantity is called the (1) volt (2) erg (3) dyne (4) coulomb  
 (5) calorie .....
- 95 The latent heat of vaporization for water in calories per gram is about (1) 32 (2) 80  
 (3) 212 (4) 536 (5) 1728 .....
- 96 Drumlins are a kind of (1) springs (2) lakes (3) water-falls (4) coast-lines (5) hills .....
- 97  $p_v = p'v'$  refers to (1) gas pressures (2) pendular vibrations (3) falling bodies  
 (4) reflection of light (5) levers .....
- 98 The unit of electric capacity is called a (1) dyne (2) farad (3) ohm (4) watt  
 (5) ampere .....
- 99 One degree of longitude at the equator equals about (1) 45 mi. (2) 70 mi. (3) 24 mi.  
 (4) 360 mi. (5) 180 mi. ....
- 100 The age of fishes was the (1) Carboniferous (2) Tertiary (3) Quaternary (4) Devonian  
 (5) Archeozoic .....

Score on Section 3 .....

Section 4

HISTORY AND SOCIAL SCIENCE

- 1 The American Revolution began in (1) 1762 (2) 1775 (3) 1783 (4) 1789 (5) 1812 .....
- 2 Cornwallis surrendered at (1) Yorktown (2) Jamestown (3) Saratoga (4) Appomattox  
(5) Valley Forge .....
- 3 The Civil War ended in (1) 1871 (2) 1867 (3) 1870 (4) 1861 (5) 1865 .....
- 4 The president of the Confederacy was (1) Lee (2) "Stonewall" Jackson (3) Jefferson  
Davis (4) Thomas (5) McClellan .....
- 5 The War of 1812 was between (1) England and France (2) England and the U. S.  
(3) Ireland and England (4) Germany and France (5) France and the U. S. ....
- 6 The man who marched from Atlanta to the Sea was (1) Sheridan (2) Grant (3) Thomas  
(4) Sherman (5) Lee .....
- 7 Martin Luther was a (1) missionary (2) pope (3) philosopher (4) soldier  
(5) reformer .....
- 8 Peter the Great was a ruler of (1) England (2) Holland (3) Russia (4) Gaul  
(5) Denmark .....
- 9 Jesus was betrayed by (1) Herod (2) Judas (3) Pilate (4) John (5) Lazarus .....
- 10 The "Iliad" was written by (1) Homer (2) Sappho (3) Virgil (4) Thucydides  
(5) Cicero .....
- 11 Xerxes was a king of (1) Athens (2) Sparta (3) Rome (4) Persia (5) Thrace .....
- 12 The greatest empire in the ancient history was the (1) Persian (2) Greek (3) Roman  
(4) Mohammedan (5) Egyptian .....
- 13 The number of U. S. senators to which each state is entitled is (1) 1 (2) 2 (3) 3  
(4) 4 (5) 6 .....
- 14 The Athenian Golden Age was attained during the time of (1) Tyrants (2) Lycurgus  
(3) Solon (4) Homer (5) Pericles .....
- 15 Bismark's chief work was (1) unification of Germany (2) establishment of schools  
(3) establishment of freedom of people (4) a great Navy (5) industrial development .....
- 16 Haig commanded the forces of (1) Russia (2) France (3) Italy (4) Bulgaria  
(5) England .....
- 17 First state to secede from the Union was (1) Virginia (2) South Carolina (3) Delaware  
(4) Connecticut (5) Missouri .....
- 18 The Spanish American War started in (1) 1890 (2) 1895 (3) 1898 (4) 1902 (5) 1914 .....
- 19 The story of the Creation is found in (1) Exodus (2) Revelation (3) Leviticus  
(4) Genesis (5) Proverbs .....
- 20 Demosthenes was a great (1) ruler (2) dramatist (3) orator (4) philosopher  
(5) general .....
- 21 The Boxer Uprising took place in (1) America (2) Russia (3) Japan (4) China  
(5) South America .....
- 22 Roger Williams was a (1) colonizer (2) judge (3) merchant (4) naval officer  
(5) traitor .....
- 23 Hannibal was a general of the (1) Romans (2) Persians (3) Franks (4) Goths  
(5) Carthaginians .....
- 24 The Mohammedan bible is the (1) Bagavadgita (2) Koran (3) Zend-Avesta  
(4) Rig-Veda (5) Book of the Dead .....
- 25 Cyrus was king of (1) Lydia (2) Carthage (3) Sparta (4) Persia (5) Rome .....
- 26 The most prominent form of business organization to-day is the (1) corporation (2) partnership  
(3) trust (4) association (5) individual .....
- 27 The Socialist Party has generally advocated (1) closed shops (2) high tariff (3) government  
ownership (4) wage reduction (5) anti-strike laws .....
- 28 Labor unions believe in (1) blacklist (2) lockouts (3) strike (4) open shop  
(5) strike breakers .....
- 29 A war with Mexico was fought in (1) 1789 (2) 1848 (3) 1898 (4) 1879 (5) 1812 .....
- 30 Wellington led the English in the battle of (1) Crecy (2) Austerlitz (3) Orleans  
(4) Jena (5) Waterloo .....

- 31 The Roman Empire was destroyed by the (1) Saracens (2) Turks (3) Carthaginians  
(4) Vandals (5) Sicilians -----
- 32 Solon was a (1) musician (2) commander (3) lawgiver (4) poet (5) sculptor -----
- 33 A voter has to be at least (1) 18 years old (2) 19 years old (3) 20 years old  
(4) 21 years old (5) 25 years old -----
- 34 The name of a Bolsheviki leader is (1) d'Annunzio (2) Lenine (3) Viviani  
(4) Poincaré (5) Ebert -----
- 35 The British Prime Minister in 1918 was (1) Asquith (2) Balfour (3) Lloyd George  
(4) Lord Northcliffe (5) Winston Churchill -----
- 36 Venizelos is a (1) Greek (2) Italian (3) Irishman (4) Russian (5) Turk -----
- 37 The Peace Treaty of 1919 is known as the Treaty of (1) Berlin (2) London  
(3) Versailles (4) Westphalia (5) Austerlitz -----
- 38 New York was settled by the (1) French (2) Dutch (3) English (4) Spanish  
(5) Portuguese -----
- 39 "54-40 or fight" was a slogan used during the (1) Civil War (2) settlement of Texas  
(3) Revolutionary War (4) settlement of Oregon boundary (5) War of 1812 -----
- 40 The Dred Scott decision pertained to (1) free silver (2) immigration (3) tariff  
(4) negroes (5) trial by jury -----
- 41 The Missouri Compromise admitted Missouri into the Union as (1) a free state (2) a slave  
state (3) half slave and half free (4) neutral (5) without mentioning slavery -----
- 42 Our common numerals originated in (1) Arabia (2) Egypt (3) Phoenicia  
(4) Rome (5) Greece -----
- 43 The economic reward of the laborer is (1) profit (2) interest (3) rent (4) capital  
(5) wages -----
- 44 The incident starting the World War occurred at (1) Sarajevo (2) Prague (3) Khartum  
(4) Basra (5) Santiago -----
- 45 The Peace of Westphalia was signed in (1) 1215 (2) 1548 (3) 1618 (4) 1648 (5) 1789
- 46 A man who helped to unite Italy was (1) Cervantes (2) da Vinci (3) Garibaldi  
(4) Venizelos (5) Bismarek -----
- 47 The Roman Empire fell to the barbarians in (1) 150 B.C. (2) 150 A.D. (3) 476 A.D.  
(4) 765 A.D. (5) 1000 A.D. -----
- 48 The Romans can be described best as being (1) artistic (2) practical (3) imaginative  
(4) poetic (5) idealistic -----
- 49 The outstanding feature of the industrial stage of economic history is (1) agriculture  
(2) factory system (3) domestic system (4) shipping (5) guild system -----
- 50 Charlemagne became emperor at about (1) 50 B.C. (2) 250 A.D. (3) 800 A.D.  
(4) 1280 A.D. (5) 1520 A.D. -----
- 51 The law of diminishing returns deals with (1) consumption (2) transportation (3) location  
(4) distribution (5) production -----
- 52 The law of supply and demand applies to (1) utility (2) value (3) profit (4) free goods  
(5) price -----
- 53 The process of changing free goods to economic goods is called (1) production (2) invention  
(3) consumption (4) distribution (5) extension -----
- 54 The unit of society is the (1) individual (2) clan (3) tribe (4) family (5) state -----
- 55 The President is elected directly by the (1) congress (2) electors (3) people  
(4) cabinet (5) governors -----
- 56 The 18th amendment deals with (1) income tax (2) prohibition (3) woman suffrage  
(4) negroes (5) tariff -----
- 57 A famous governor of New York was (1) Walter Raleigh (2) William Penn (3) Peter  
Stuyvesant (4) John Smith (5) Roger Williams -----
- 58 John Winthrop was the governor of (1) Massachusetts Bay (2) Virginia (3) Plymouth  
(4) Maryland (5) New York -----
- 59 The date of Magna Charta is (1) 787 (2) 1066 (3) 1215 (4) 1612 (5) 1648
- 60 The early shipbuilders were the (1) Arabs (2) Egyptians (3) Persians  
(4) Phoenicians (5) Romans -----

- 61 The Treaty of Versailles was not ratified by (1) England (2) France (3) Italy  
(4) Japan (5) America
- 62 A person connected with Hull House is (1) Clara Barton (2) Jane Addams (3) Woodrow  
Wilson (4) Julia Lathrop (5) Mary E. Richmond
- 63 A socialistic party leader of Germany was (1) Friedrich Geiber (2) Wilhelm Goetz  
(3) Ellwood (4) Hobhouse (5) Karl Marx
- 64 Slavery was introduced into the American colonies in (1) 1498 (2) 1564 (3) 1619  
(4) 1742 (5) 1815
- 65 Poland lost its place as an independent nation (1) by revolution (2) weak colonial policy  
(3) partition between neighboring powers (4) lack of democratic principles (5) religious  
differences
- 66 The battle of Thermopylae was fought in (1) 480 B.C. (2) 166 B.C. (3) 100 B.C.  
(4) 100 A.D. (5) 325 A.D.
- 67 Plutarch was a great (1) biographer (2) emperor (3) scientist (4) mathematician  
(5) sculptor
- 68 Price is essential to (1) consumption (2) production (3) exchange  
(4) manufacturing (5) raising crops
- 69 The amount of immigration to-day is influenced chiefly by (1) economic conditions (2) religion  
(3) education (4) politics (5) presidential elections
- 70 The first book of importance on economic theory was written by (1) Emerson (2) Plato  
(3) Adam Smith (4) Malthus (5) John Stuart Mill
- 71 Alexander Hamilton's name is associated with (1) slavery (2) tariff (3) steel industry  
(4) finance (5) ship building
- 72 The battle of Tours was fought by France against the (1) English (2) Mohammedans  
(3) Spanish (4) Poles (5) Prussians
- 73 The last book of the New Testament is (1) Exodus (2) Proverbs (3) Ephesians  
(4) Numbers (5) Revelation
- 74 "Absentee landlordism" is a serious problem in (1) France (2) Germany (3) Holland  
(4) Ireland (5) Russia
- 75 Each state has the power to (1) coin money (2) declare war (3) establish schools  
(4) tax imports (5) appoint postmasters
- 76 Monopoly is based on limitation of (1) supply (2) cost (3) utility (4) demand  
(5) value
- 77 The most brilliant writer in France in the 18th century was (1) Darwin (2) Dumas  
(3) Bunyon (4) Pericles (5) Voltaire
- 78 The Lord appeared in the burning bush to (1) Aaron (2) Moses (3) Esau  
(4) Elijah (5) Lot
- 79 The Lawgiver of civilization was (1) Blackstone (2) Justinian (3) Caesar (4) Draco  
(5) Aristotle
- 80 Cicero gave his orations against Catiline in (1) 271 B.C. (2) 63 B.C. (3) 381 B.C.  
(4) 267 A.D. (5) 476 A.D.
- 81 The Sinn Fein movement took place in (1) Czecho-Slovakia (2) Fiume (3) Ireland  
(4) Poland (5) Russia
- 82 The French at the battle of Quebec were under the command of (1) Wolfe (2) Burgoyne  
(3) Braddock (4) Montcalm (5) Murray
- 83 One of the greatest prophets of the Bible was (1) Elijah (2) St. Paul (3) John  
(4) Peter (5) Mark
- 84 Craft guilds of England might be compared to our (1) clubs (2) unions (3) lodges  
(4) Ku Klux Klan (5) political parties
- 85 The handicraft stage of economic history is characterized by (1) trades (2) management  
(3) domestication (4) nomadism (5) slavery
- 86 The most serious disease from which modern civilization suffers is (1) measles (2) diphtheria  
(3) scarlet fever (4) tuberculosis (5) typhoid fever
- 87 The architectural style of the great cathedral at Amiens is (1) Corinthian (2) Gothic  
(3) Ionic (4) Doric (5) Roman

- 88 A name commonly connected with Juvenile Court work is that of (1) Ben Lindsay  
 (2) Roosevelt (3) Wm. Daniels (4) Henry Ford (5) John R. Commons .....
- 89 A German province taken over by Japan in 1915 was (1) Chosen (2) Formosa  
 (3) Chengtu (4) Kiau-chau (5) Yap .....
- 90 The extent of demand for any commodity is determined by (1) interest (2) rent  
 (3) price (4) production (5) marginal utility .....
- 91 The most important battle of the Civil War was fought at (1) New Orleans (2) Vicksburg  
 (3) Gettysburg (4) Petersburg (5) Lookout Mountain .....
- 92 The "Open Door" policy concerns (1) Cuba (2) Philippines (3) Japan (4) California  
 (5) China .....
- 93 The first president to make excessive use of "spoils system" was (1) Jackson (2) Adams  
 (3) Madison (4) Grant (5) Roosevelt .....
- 94 A name associated with forest conservation is that of (1) Gompers (2) Lindsay  
 (3) Hoover (4) Pinchot (5) Elihu Root .....
- 95 The Supreme Judicial body of England to-day is (1) Court of Common Pleas (2) House of  
 Lords (3) House of Commons (4) Cabinet of Prime Minister (5) Court of Exchequer .....
- 96 Zoroaster was the prophet of (1) Hebrews (2) Egyptians (3) Indians (4) Spartans  
 (5) Persians .....
- 97 A measure which safeguards the people's rights is the (1) income tax (2) revenue tax  
 (3) prohibitions (4) protective tariff (5) referendum .....
- 98 The acanthus leaf in architecture characterizes the (1) Corinthian (2) Ionic (3) Tuscan  
 (4) Doric (5) Gothic .....
- 99 Sanscrit was an ancient language of the (1) Aryans (2) Chinese (3) Egyptians  
 (4) Greeks (5) Hebrews .....
- 100 A famous early advocate of public schools was (1) Washington (2) James G. Blaine  
 (3) Ben Franklin (4) Henry Clay (5) Horace Mann .....
- 101 Architecture characterized by the pointed arch is (1) Corinthian (2) Doric (3) Gothic  
 (4) Roman (5) Tuscan .....
- 102 The theory of geometric progression in population and arithmetical progression in production was pro-  
 nounced by (1) Jevons (2) Marshall (3) Mills (4) Malthus (5) Adam Smith .....
- 103 The development of the west after the Civil War was stimulated principally by (1) Indian wars  
 (2) building of railroads (3) discovery of gold (4) inflow of emigrants (5) free lands .....
- 104 The first transcontinental railroad was the (1) Southern Pacific (2) Santa Fe  
 (3) Northern Pacific (4) Union Pacific (5) Great Northern .....
- 105 A person appointed by a will to carry out its provisions is (1) executor (2) administrator  
 (3) referee (4) administratrix (5) clerk .....
- 106 The right of a stated percentage of voters to propose a law is known as (1) referendum  
 (2) executive (3) political influence (4) initiative (5) amendment .....
- 107 The divorce rate to-day is highest in (1) Germany (2) England (3) France  
 (4) Spain (5) United States .....
- 108 An adjective that fitly describes Machiavelli is (1) cowardly (2) devout (3) unscrupulous  
 (4) generous (5) stupid .....
- 109 From 1881-1893 the problem receiving the greatest attention was (1) ballot reform (2) tariff  
 reform (3) financial reform (4) change of immigration laws (5) civil service reform .....
- 110 The theory of "unearned increment" applies to (1) capital (2) labor (3) machinery  
 (4) social organization (5) land .....
- 111 An author who described an ideal state was (1) Homer (2) Herodotus (3) Justinian  
 (4) Plato (5) Pythagoras .....
- 112 A statement consisting of a summary of all changes of title affecting a piece of land is a  
 (1) deed (2) abstract (3) mortgage (4) lien (5) contract .....
- 113 The first Atlantic cable was laid in (1) 1830 (2) 1844 (3) 1856 (4) 1876 (5) 1889 .....
- 114 Passports are issued by the (1) Department of State (2) Department of Commerce  
 (3) Department of Interior (4) Department of War (5) Department of Labor .....
- 115 A name associated with the industrial reorganization of Germany is that of (1) Trotsky  
 (2) Wirth (3) Rathenau (4) Stinnes (5) Tchitcherin .....

Score on Section 4 .....