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## A COMPARISON OF TWO METHODS OF COLLEGE INSTRUCTION<sup>1</sup>

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The literature on the subject of college methods of instruction is replete with theoretic discussions and treatments. Studies devoted to scientific appraisal of specific methods, however, are few in number. The constant demand for efficiency in dealing with the rapidly increasing college enrollment necessitates scientific measurement of the effectiveness of particular methods.

This study was undertaken to determine measureable differences of achievement in elementary psychology as a result of the two different methods of instruction conducted at the State University of Iowa during the academic year 1925-1926, namely, the lecture-conference method and the method of "individualized" instruction. It subsumes that in addition to theoretic evaluation of techniques which is open to the suspicion of being the product of fact and wishes of interested directors, the ultimate effectiveness of particular class-room techniques is further determined only by actual measurement of results. Justification for the study is based on the fact that since, obviously, neither method is static or fixed, further development of either method may be guided by an interpretation of collected data.

The details of the respective methods of instruction differed radically in many respects. The degree of control extended to the following factors:

1. Each method was used to give instruction for a six semester hour course extending over the same period of time, one academic year.
2. The work was carried on in the same department of the State University of Iowa, thus having the same libraries, laboratories and general equipment available.
3. Throughout the year the instructors of each method were unaware of the fact that the results of their teachings would be compared. Normal conditions, rather than a spirit of competitive rivalry, were thus maintained.
4. The instructors of each method conscientiously endeavored

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<sup>1</sup> This study was directed by F. B. Knight, State University of Iowa. J. E. Bathurst of the Bureau of Public Personnel Administration, Washington, D.C., directed the statistical treatment of the data.

to develop and utilize the features of their respective methods.

5. The aim of the methods was common.

6. The course content of each method was selected from the same general field with a view of best developing the common aim. The same basic texts were used.

7. In this study students of comparable scholastic ability were selected to represent each method.

8. An objective test, constructed by a disinterested authority in the field, was submitted to the students of each method.

9. The conditions under which the test was given were uniform.

*Criteria for Achievement.*— Scores made on an objective test over the general field of elementary psychology were accepted as the criterion for achievement in psychology. The differences in scores made by comparable students of the two methods of instruction were accepted as the criterion of differences in achievement as a result of two methods.

Since there is no concensus of authoritative opinion in regard to whether ratings in competitive intelligence tests or class grades is the better index of scholastic ability of a student, the selection of comparable students representing each method of instruction was made in three ways:

1. By pairing students of the two methods on the basis of grade points made during the first collegiate year,

2. By pairing students of the two methods on the basis of comparable percentile rankings attained in the freshman entrance examinations, and

3. By pairing on the basis of combined percentile rankings and grade points when converted into comparable scores.

The grade points forming a basis for selecting students of comparable scholastic ability were those customarily awarded by the State University of Iowa for class grades. The number of points granted for each semester grade are as follows:

A	4 points	Incomplete	0 point
B	3 points	Conditioned	- 1 point
C	2 points	Failed	- 2 points
D	1 point		

The freshman entrance examination as given at the State University of Iowa included the following series of tests.<sup>1</sup>

“(1) A general ‘intelligence’ test, *viz.*, the ‘Thorndike intelligence examination for high-school graduates,’ Part I, Form B.

“(2) A test of reading comprehension, the ‘Iowa comprehension test,’ D-2.

<sup>1</sup> Ruch, G. M., “College Qualifying Examinations,” *School and Society*, Vol. XXI, No. 542, May 16, 1925.

“(3) A test of knowledge of the high-school subjects, the ‘Iowa high-school content examination,’ Form B.”

“*The Iowa comprehension test* consists of three passages selected from materials suitable for inclusion in college text-books in English, history and science respectively. The student reads the passages, selecting numbered passages which answer questions, 12 to each selection, based upon the material read. This type of test has been proved to be highly predictive of college success. . . The correlations with college grades are above 0.50 for a single semester’s work.

“*The Iowa high-school content examination* is composed of four hundred multiple response items covering the four major groups of high-school subjects, *viz.*, English, the social sciences, the natural sciences and mathematics. A range of scores of more than three hundred points is found among the members of a single entering class. The reliability of this test has been figured at 0.95 and its correlation with a single semester’s marks is above 0.50.”

*Determining Students of Comparable Scholastic Ability.* — In order to determine the specific students that might be paired, the probable error of the mean of each distribution<sup>2</sup> (based on 103 cases of each method of instruction) was computed. The following results were found:

P. E. = probable error

M<sub>per cent</sub> = mean percentile ranking

M<sub>gr. pt.</sub> = mean grade points

Lecture-conference method

$$P. E. M_{\text{per cent}} = .6745 \frac{\sigma}{\sqrt{N}} = .6745 \frac{20.615}{10.344} = 1.344$$

$$P. E. M_{\text{gr. pt.}} = .6745 \frac{\sigma}{\sqrt{N}} = .6745 \frac{.560}{10.344} = .0364$$

In the case of the combined values the means are the same. Individualized method

$$P. E. M_{\text{per cent}} = .6745 \frac{\sigma}{\sqrt{N}} = .6745 \frac{21.500}{10.15} = 1.419$$

$$P. E. M_{\text{gr. pt.}} = .6745 \frac{\sigma}{\sqrt{N}} = .6745 \frac{.640}{10.15} = .042$$

In the case of the combined values the means are the same.

Since the P. E. M<sub>per cent</sub> in the lecture-conference method was found to be 1.344, on the basis of the P. E. of the mean, a student

<sup>2</sup> Otis, A. S., *Statistical Method in Educational Measurement*, World Book Co., 1925, p. 262.

having a percentile ranking of 77 could be paired with a student having 76, 77, or 78 in the individualized method. The probable error of 0.136 in grade points made it possible to pair values ranging from 1.96 to 2.04 with a grade value of 2.

The values of the individualized method are given above.

*The Psychology Test.*—The psychology test<sup>3</sup> used to obtain the criterional scores was entirely objective. It consisted of one hundred true-false statements and was not confined to any particular text-book, but covered the general field of psychology. In scoring each right response was accredited one point, thus making a maximum possible score 100.

The validity of the test was based on the authority of the deviser of the test. His extensive training and teaching experience in the general field of psychology and in the technique of test construction, as well as actual text-book analysis, apparently warranted the assumption of validity.

The statistical reliability of the test was computed by the Pearson-product-moment method of correlation<sup>4</sup> combined with the application of Brown's<sup>5</sup> formula. The coefficient of reliability was found to be 0.7204. This coefficient could be raised to 0.090 by lengthening the test to about 360 items. This is computed by substituting 0.90 for  $r_{nn}$  and solving for  $n$  as follows:

$$.90 = \frac{n .72}{1 + (n - 1) .72}$$
$$n = 3.6$$

In the given formula  $n$  is the number of similar tests necessary to raise the reliability coefficient to 0.90. Since  $n$  is 3.6 and the test given was composed of 100 items, the same test lengthened to 360 items would give a reliability of 0.90.

Only 100 items were used because of lack of available time for testing. The regular semester examinations could not be used as a basis for evaluating the methods since a test devised by instructors of either method would in all probability be inclined to favor the method of the particular instructors.

*Conditions under which the Test was Given.*—The test was included in the final examination form given to the students at the end of the second semester. In order to obtain sincere responses on the test submitted for experimental purposes as well as to keep faith with the students by giving them a fair semester examination,

<sup>3</sup> Devised by H. H. Remmers, Purdue University.

<sup>4</sup> Rugg, H. O. *Statistical Methods Applied To Education*. Houghton, Mifflin Co., 1917, p. 219.

<sup>5</sup> Garrett, H. E. *Statistics in Psychology and Education*. Longmans, Green and Co., 1926, p. 269.

the following announcement was read at the beginning of the two hour examination period:<sup>6</sup>

“For the purpose of obtaining material for a doctorate thesis we have inserted some items on subjects presented last semester. There will be plenty of time to respond to all the items. But because it is unfair to grade you individually on matter which you have not reviewed and because by agreement with us you were to be examined only on this last semester’s work, your responses to such items will not in any way affect your grade on this examination or on your work for the semester. You are urged, however, to do the very best that you can do with *all* the items on these sheets because the achievement of this section of the class is to be compared with another division of the class. I want you to uphold the high standard of work achieved by your section.”

The pages comprising the test under experimentation were separated from the complete form at the end of the examination and graded. A comparison and interpretation of the grades made by the students representing the two methods of instruction was then made.

A DESCRIPTION OF THE TWO METHODS OF INSTRUCTION THAT WERE  
COMPARED IN THIS STUDY

*The Lecture-Conference Method of Instruction.* — The regular classes in elementary psychology at the State University of Iowa were conducted by the lecture-conference method. The primary aim of the course as established by Dean C. E. Seashore, Head of the Department of Philosophy and Psychology, was to “train the student in the observation and explanation of mental facts.”<sup>7</sup> The course content material, consisting of lectures, individual experiments, class demonstrations, required readings, as well as suggestions for optional readings, was selected with the view of enabling the individual student to realize this aim as effectively and as economically as possible. The work of the year was divided into six weeks periods. At the beginning of each six weeks the students were given mimeographed sheets announcing the lectures, the required preparations, and the suggested readings for the particular periods.

In accordance with the lecture-conference plan the students, numbering approximately five hundred, met twice each week in a large auditorium for a one hour lecture which was customarily delivered by the regular staff lecturer. Lectures by specialists were interspersed when the course material extended to specialized fields.

<sup>6</sup> Announcement formulated by Professor C. A. Ruckmick, State University of Iowa.  
<sup>7</sup> Seashore, C. E., *Psychological Review Monograph*, Vol. XXII, No. 4, p. 82.

Once each week the students, sectioned into groups of twenty to twenty-five each, met for conferences over the work covered during the week. The method of conducting these hours varied with the particular group personnel, but in general it maintained the commonly accepted techniques of the class-discussion or class-recitation. The students were required to make a two hour preparation for the lectures and for the conference periods, to outline the readings, and to take notes on the lectures. Individual experiments were assigned freely as required preparations and class demonstrations often supplemented the lectures. Written exercises and reports on experiments, when included in the work of the week, were submitted to the instructors in charge of the conferences, who checked and returned them to the students.

The sectioning of the students for the conference groups was based on the ability of the students as predicted by their percentile rankings in the freshman entrance examination and by the grades made during their first collegiate year. Three levels of ability were recognized, which were commonly designated as the *high*, the *middle*, and the *low*, sections. The original sectioning was tentative and subject to readjustment on the basis of achievement at the end of each six weeks period throughout the school year. As far as was administratively possible the three levels of sections were conducted at the same hours thus giving complete flexibility for sectional readjustment at any time *without* involving a conflict with any student's regular schedule of courses.

At the end of each six weeks the students were tested objectively over the work covered in the particular period and at the end of each semester an examination over the work of the entire semester was given.

*The Individualized Method of Instruction.* — In an attempt to recognize the individual differences in students more adequately than by the lecture-conference method, Professor C. E. Seashore directed the experimental development of an individualized instruction method for teaching elementary psychology. The objective established for his regular introductory course in psychology — to train the student in the observation and explanation of mental facts — was retained as the aim for this particular course. Course content material was selected from every available source, including text-books, magazines, monographs, encyclopediae as well as technical and popular literature.

The outstanding features of the method were the provisions for directing study, for supervising study and for offering the individ-

ual student opportunity to receive help compatible with his particular needs. Compulsory lecture attendance and customary recitations were eliminated in this method.

A large well-lighted room, forty-eight by seventy-two feet, equipped with one hundred oak tables and chairs for the use of the students, apparatus for experimentation and a well stocked library, was kept open from eight to twelve three days each week. Each student was required to study in this room for two hours at each scheduled meeting of the class.

The work of the year was divided into units of approximately one month each. At the beginning of each month the student was given a mimeographed outline for the work of that unit. This material included references to the required readings, to additional suggested readings, and a skeletal outline of the required readings designating the major points and showing the relationship of subsidiary points. These outlines were intended to direct the student in his study. With the assignment of the work of a single unit at hand each student was allowed to work at his own rate and to some extent according to his own interests. He was privileged to move about the room, to speak to class-mates, to ask questions of the instructor in charge, and to go to departmental libraries for reference work. For more detailed explanations and discussions on any topic he was permitted to attend voluntary conferences that were conducted in an adjoining room during the study periods. Library privileges and study were thus combined with the opportunity for questions, explanations and discussions at a time when it was thought the student could profit most by them.

The student entered into informal conversation with the instructor and the instructor sought out the individual student to give encouragement and guidance. Work habits of the students were studied and suggestions for improvements were made when possible. Although great freedom was given to the students in apportioning their time dawdling study habits were rigorously prohibited. Habits of unnecessarily detailed note-taking, unexcusably long "warming up" periods, dissipation of effort, readiness to attend to distractions, general restlessness, and endless other habits of inefficiency were checked by the instructor and the students were held to a strenuous program of concentrated study for the full two hours of each scheduled meeting of the class.

Each student worked independently. The superior student was not held in leash or hindered by an inferior or a group of inferior students. The slow student was allowed to proceed at his own rate



with the amount of guidance necessary in his particular case. He was not required to keep a pace beyond his ability. When a student was ready to perform an experiment he procured the necessary apparatus and proceeded. He usually compared his results with those of his class-mates. Divergent data frequently resulted in a repetition of the experimentation for verification.

In order to enable the student to make specific investigations or applications of psychology along particular lines of interest, as well as to give some training in the selecting, evaluation and organizing of material, provision was made for the development of one optional topic for the work of each unit.

Two or three demonstrations of experiments requiring special apparatus were made by the instructor before the class as a whole. At all other times, after a few preliminary remarks made on the opening day, the instructor refrained from addressing the class. Necessary announcements were made on a black-board. Objective examinations were given at the end of each month and at the end of each semester.

All preliminary planning and preparing for the materialization of this method as well as changes in the experimental development of the method were directed toward making the individual rather than the class the educative unit. It was hoped that the characteristic techniques would foster responsibility and initiative in the individual student in attaining the aim of the course. The disposal of time on the part of the students and of the instructor, the nature and amount of course content material, and the opportunities for individual help and guidance were all directed toward a realization of the aim.

The problem now is to determine whether this aim has been realized. Has the individualized method of instruction succeeded in training the student to observe and to explain mental facts? How does its effectiveness compare with the lecture-conference method?

Since the technique of the individualized method was directed toward realising the aim of the course, a measurement of the results might be considered a measurement of the technique, and a comparison of the results of the individualized method with the results of the lecture-conference method might be considered a measure of the relative effectiveness of the two methods of instruction.

*Data Used in Study.* — The actual data used in this study can be obtained from the education library of the State University of Iowa, Iowa City, Iowa.

*Summary and Interpretation.* — The following is a tabular summary of the experimental results:

*Tabular Summary of Mean Scores of Psychology Test Attained by the Students of Each Method of Instruction*

PAIRED ON BASIS OF	LEC.-CON. MEAN TEST SCORES	INDIV. MEAN TEST SCORES	DIFF. IN MEAN SCORES	P. E. <sub>d</sub>	P.E.'s
Grade points	66.67	67.08	.41	.826	.469
Percentile rankings	67.03	66.92	.11	.755	.145
Combined grade percentile	65.73	67.46	1.73	.687	2.519

The table gives a schematic presentation of the mean scores on the psychology test for the two methods of instruction. Computing the reliability of the differences of the means shown in the table in terms of the probable errors of the differences,<sup>8</sup> the following values were obtained:

Using grade points as criterion

$$P. E. M_L = .6745 \frac{7.54}{\sqrt{80}} = .568$$

$$P. E. M_I = .6745 \frac{7.96}{\sqrt{80}} = .600$$

$$P. E. d \sqrt{.568^2 + .600^2} = .826$$

Using percentile rankings as criterion

$$P. E. M_L = .6745 \frac{6.64}{\sqrt{80}} = .500$$

$$P. E. M_I = .6745 \frac{7.52}{\sqrt{80}} = .567$$

$$P. E. d \sqrt{.500^2 + .567^2} = .775$$

Using the combined grade points and percentile rankings as the criterion

$$P. E. M_L = .6745 \frac{6.90}{\sqrt{100}} = .465$$

$$P. E. M_I = .6745 \frac{7.51}{\sqrt{100}} = .506$$

$$P. E. d \sqrt{.465^2 + .506^2} = .687$$

Converting each of these differences of the probable errors into

<sup>8</sup> Garrett, H. E. *Statistics in Psychology and Education*, Longmans, Green and Co., 1926, pp. 133-134.

probable error units by the formula  $\frac{\text{diff.}}{\text{P. E.}_d}$  we get, 0.469 P. E.'s in the case of grade points, 0.145 in the case of percentile rankings and 2.519 in case of combined values of grade points and percentile rankings.

In none of the three cases are the probable error units three times the P. E. and they are therefore not considered significant. This may be interpreted as showing that as far as the mean psychology test scores of the lecture-conference and of the individualized method of instruction are concerned, if differences in the relative effectiveness of the two methods of instruction do exist they exist in such small amounts that this particular study is unable to find them.

#### CONCLUSIONS

In so far as the relative effectiveness of the lecture-conference and the individualized methods of instruction is determined by the procedure used in this particular study, and applicable only to the respective methods as conducted during the academic year 1925-1926, the conclusion that these two methods of instruction are of equal effectiveness in teaching elementary psychology seems to be warranted by the following facts:

1. The non-significant difference between the mean psychology test scores when freshman grade points are used as the criterion for scholastic ability.
2. The non-significant difference between the mean psychology test scores when percentile rankings attained in the freshman entrance examinations are used as the criterion for scholastic ability.
3. The non-significant difference between the mean psychology test scores when the combined values of the grade points and percentile rankings are used as the criterion for scholastic ability.