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An experimental study of Academic Achievement as a Function of Homogeneous Grouping

William Francis Koontz
College of William & Mary - School of Education

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AN EXPERIMENTAL STUDY OF ACADEMIC ACHIEVEMENT
AS A FUNCTION OF HOMOGENEOUS GROUPING

A Thesis
Presented to
the Faculty of the Department of Education
The College of William and Mary

In Partial Fulfillment
of the Requirements for the Degree
Master of Arts

by
William Francis Koons
August 1957
ACKNOWLEDGEMENTS

The author wishes to express his appreciation to Mr. Richard R. Brooks, Dr. Kenneth H. Cleston, and Dr. George J. Oliver for their helpful criticisms and suggestions.

To Mr. V. Leon Jones, Principal of the school in which the experiment was conducted, for his cooperation, the author also is indebted.
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CHAPTER I

THE PROBLEM AND DEFINITION OF TERMS USED

For many years our public schools have recognized that pupils have a wide range of abilities, interests, and degrees of motivation. In order to provide for these individual differences many schools have grouped their classes homogeneously. In the past, this homogeneous classification has been determined by various criteria, used singly or in varied combinations. The kinds of measures, commonly used, included those of previous achievement, mental ability, school grades, and reading tests.¹

This early class grouping was done with no empirical proof of its efficacy; and even today, there is inconclusive evidence as to the instructional value of homogeneous grouping.

I. THE PROBLEM

Statement of the problem. It was the purpose of this experimental study to determine what effect, if any,

homogeneous grouping would have upon the academic achievement of eighth grade public school pupils. The hypothesis of this study was that pupils who were placed in classes on the basis of a greater degree of similarity in terms of their intellectual ability, general academic status, reading status, and motivation would achieve more than students who were in classes where a wider range of such differences was present.

**Importance of the study.** Educators have been giving their attention to the problem of adapting education to the wide range of individual differences for many years, and in most educational circles it is an accepted fact that some provisions should be made for these differences. In high schools throughout the country the curriculum -- the courses offered -- has been expanded to the extent that a number of possible courses of study are open for the individual pupil to follow. Although there are a variety of possible courses for the pupil to pursue many courses are basic -- they are required for graduation.

It is obvious that some high school subjects -- notably college preparatory mathematics, science, and languages -- attract relatively homogeneous groups. Pupils tend to make realistic decisions in selecting these more difficult courses, basing their choices on past school achievement and future plans. In other words, it is rare
that a weak pupil will choose a difficult academic subject as an elective.

The more specialized classes then, usually consist of a more or less highly selected group. But in the required classes this condition does not exist. The teacher of the required class is faced with the problem of adapting the course to meet the needs of pupils with a wide range of abilities and achievement. The required course, if effective for all, must be adapted to meet the needs of the pupil with dull intelligence and the needs of the pupil with superior intelligence. Provision should be made for the advanced reader, and so on. For the teacher this is a difficult task, to say the least.

Moreover, contrary to earlier times, this range of differences does not necessarily narrow in high school. Compulsory education has increased the problem of providing for an increased range of individual differences.

Present conditions of greatly increased enrollments, plus advances made in the improvement of instruction and test and measurement instruments, should create more interest in this problem of teaching pupils of varying ability. The contemporary need for skilled manpower and the loss to higher education of some of our more able pupils, due to non-stimulating education, should arouse educators to seek ways of making education more effective.
Also, the pressure is on many school administrators to "do something" about the gifted child. The absence of concrete evidence as to the relative value of the various possibilities, such as homogeneous grouping, acceleration, or enrichment, is lacking. Reisner said,

"It seems...that the needs of our heterogeneous school population will be met only as we succeed more and more completely in getting the right children together to follow those school experiences that are adapted to their abilities."

Homogeneous grouping is one method of "getting pupils together." Possibly this grouping will make for more effective instruction.

II. DEFINITIONS OF TERMS USED

In this study there were two experimental groups and two control groups. The experimental groups were homogeneous and the control groups were heterogeneous.

Homogeneity. Homogeneity of the experimental groups, as defined in this study, was determined on the basis of four variables. Those variables were:

1. General academic status. Here status was defined as that sample of behavior measured by a standardized achievement test.

2. Intelligence. Intelligence was defined in terms of the intelligence quotient derived from that sample of behavior measured by a standardized test of intelligence.

3. Reading status. Reading status was defined in terms of the results of a standardized reading achievement test.

4. Motivation. For a measure of motivation the experimental and control subjects were rated by their teachers on the characteristic of industriousness as applied to their school tasks.

All four of these preceding measures were obtained on the pupils during the 7th grade and the results used for the grouping procedures.

Academic Achievement. The dependent variable in this study was academic achievement. Two equivalent forms of a standardized achievement test measured this variable, at the beginning and end of the experiment, in the following areas:

1. Language usage
2. Arithmetic reasoning
3. Arithmetic computation
4. Spelling

III. ORGANIZATION OF THE REMAINDER OF THE THESIS

Chapter II is a review of the literature pertinent to the problem of this investigation. Chapter III is a
presentation of the procedure and materials used. Chapters IV and V describe the results and summarize the experiment.
CHAPTER II

REVIEW OF THE LITERATURE

Homogeneous grouping versus heterogeneous grouping has been a perennial issue, and educators continue to have differing opinions on the question. A recent nationwide poll\(^1\) of school administrators indicated a 60 to 40 split in favor of heterogeneous grouping.

Proponents of each of these viewpoints equally are convinced of the advantages of their respective positions—they disagree about grouping no matter what the grouping criterion or criteria.\(^2\)

Advocates of homogeneous grouping point out that the method recognizes and provides for individual differences.\(^3\) Coxe, in 1939, stated that "grouping for instruction is as important for the pupils as the subject

\(^1\)__________, "Opinion Poll," The Nation's Schools. 56:6, November, 1956.


\(^3\)Joseph Rediger, "Shall We "Group" Students in Our High School?" American School Board Journal. 129:28-30, November, 1931.
matter they study."4 Others who favor this procedure justify their position on the supposed aid it offers the classroom teacher.5

Opponents of grouping answer such statements readily. They point out that such a plan produces small changes in academic achievement. Moreover, they believe that personal and social learning are as important as academic learning.6 Too, critics feel grouping to be undesirable because it is undemocratic.7 But this statement is answered by those who feel the practice to be "democratic and desirable."8 Other critics say that such "segregation is a by-product of a planned society" and in life "those of lesser ability look to those of greater ability for advice, counsel, and leadership but not on a segregated level."9 In general, the major


5 J. Wayne Wrightstone, op. cit., p. 254.

6 Ibid., p. 254.

7 Ibid., "Educational News and Editorial Comment," The School Review. 44:491-3, June, 1936.


precise of this critical stand is the desirability of advancing intergroup and interpersonal understanding. Homogeneous grouping hinders this.  

Much deliberative argumentation, of the preceding type, can be found in the literature. But very little experimental research has been reported that would support either position substantially.

Approximately twenty-two years ago it was reported that the literature on research had been carefully reviewed, and the most significant conclusion from it all was how little it had "brought of clearly incontestable knowledge." In 1936, the authors of the NSSE Yearbook agreed that the experimental literature yielded no universally accepted conclusions on ability grouping. Even today there is inconclusive evidence as to the value of the homogeneous group. Professor Passov, in 1958, stated there

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10 Radiger, op. cit., p. 29.


was no "significant unanimity of findings."

Schools which have established homogeneous classes have relied on many variables as a basis. Different measures of physical development, intelligence, achievement, motivation, social factors, special abilities and disabilities, and interests have been used singly and in combinations. However, most approaches have depended on intellectual ability and achievement as criteria.

One critical evaluation and synthesis of the research indicated that the evidence slightly favored ability grouping over heterogeneous grouping where adaptation of teaching methods, and so forth, had accompanied. But there is inadequate evidence as to the proper adaptations. Also, parents favor, and children are happy in this type program. The relative effectiveness of several bases has not been established.

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13 Harry A. Passov, "The Enrichment of Education For Gifted Children." This manuscript was prepared as a chapter in the Fifty-Seventh Yearbook of the Society for the Study of Education titled The Education of Gifted Children. The volume will appear in early 1956, p. 49.


The failure of ability grouping to realize its possibilities has been attributed, by some, to the negative attitudes of participating administrators and teachers. This has been the type of argument used in the absence of empirical evidence. More research is needed. Even the earlier work, of an "experimental" nature, was lacking in adequate controls.

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CHAPTER III
TECHNIQUES USED AND GROUPS STUDIED

After surveying the literature on ability grouping, it appeared evident to the investigator that academic intelligence was too narrow a basis for grouping homogeneously. For this reason a combination of some of the factors, previously mentioned, was selected for grouping the experimental and control classes.

Pupils used in the experiment were male and female eighth grade public school pupils. From the cumulative school record of each pupil, data were collected. All data gathered from these records were of recent nature, i.e., all test scores resulted from measurements administered during the previous school year. From each cumulative record the following data were collected:

1. Intelligence Quotients resulted from an administration of the California Short-Form Test of Mental Maturity.1 A combination of the verbal and non-language I.Q.'s, the total I.Q., was used.

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1Elizabeth T. Sullivan, Willis W. Clark, and Ernest V. Tiernan, California Short-Form Test of Mental Maturity. Los Angeles: California Test Bureau, 1950.
2. Median grade placements were determined from the (Intermediate Battery; Partial, Form J) Stanford Achievement Test. This grade placement was the median of sub-tests grade placements on paragraph meaning, word meaning, spelling, language, arithmetic reasoning, and arithmetic computation.

3. Reading grade placements were determined on the basis of results from the (Elementary Form Aa) Iowa Reading Test. The median grade placement derived from the eight sub-tests (rate, comprehension, directed reading, word meaning, paragraph comprehension, sentence meaning, alphabetizing, and use of the index) of this instrument was used.

4. A measure of the pupil's industriousness as applied to class work was obtained by the use of a rating scale. Seventh grade teachers were first presented with this 15-point rating scale with instructions for marking. The instructions included a brief account of those errors that might be expected in using rating scales, viz., the

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4See Appendix for a reproduction of this scale.
errors\(^3\) of central tendency, the halo effect, logical error, and personal bias error. Teachers then rated their respective pupils.

These four measures were compiled, and each score for each pupil was converted to a standard score (z score)\(^6\). For each pupil the four standard scores were averaged. This average standard score then served as a basis for assigning the pupil a rank in the total group. Beginning with the highest average standard score, pupils were ranked in descending order from 1 to 136.

The composition of the experimental and control groups was determined on the basis of the pupils' rank numbers. First, all pupils with odd rank numbers 1, 3, 5, \ldots \text{to 67} were chosen to form an experimental group which was called Experimental Group I. They were placed in the same homeroom class and remained intact, as a group, throughout the school day. With the exception of physical education, home economics, and industrial arts, they attended all classes together.

Experimental Group II consisted of the remaining pupils with odd rank numbers 69, 71, 73, \ldots \text{to 133}.

---


This group was assigned to the same homeroom and re-
mained intact in all classes, with the same exceptions
as Experimental Group I.

It becomes evident that the application of
homogeneity here refers to a narrowing of the range
of differences by approximately one-half. Experimen-
tal Groups I and II represent eighth grade public school
classes homogeneous with respect to the four factors
listed above. Experimental Group I represents those
pupils ranging from average to above average, and Ex-
permental Group II consists of those pupils who range
from average to below average.

The remaining pupils, all with even rank num-
bers, became control pupils. These controls included
all even ranks beginning with two and ending with 154
and were in classes containing the entire range of pos-
sible differences.

For purposes of comparison, control pupils were
matched with the experimental pupils. This was accom-
plished by choosing all pupils above the median even
rank number, \( \frac{n}{2} \), to serve as controls for Exper-
imental Group I. These pupils are referred to as Con-
trol Group I.

The Comparability of these two groups may be
seen from an inspection of Table A below. For the degrees of freedom involved here a t of 1.68\(^7\) is necessary to indicate a significant mean difference at the ten per cent level of confidence.

**TABLE A**

**COMPARISON OF MEAN SCORES OF EXPERIMENTAL AND CONTROL GROUPS I ON GROUPING VARIABLES**

<table>
<thead>
<tr>
<th></th>
<th>Experimental Group I Mean</th>
<th>Control Group I Mean</th>
<th>Difference of Means</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>I.Q.</td>
<td>106.00</td>
<td>104.04</td>
<td>1.96</td>
<td>.18</td>
</tr>
<tr>
<td>Reading Achievement</td>
<td>9.17</td>
<td>8.78</td>
<td>.38</td>
<td>.97</td>
</tr>
<tr>
<td>Average Achievement</td>
<td>7.12</td>
<td>7.48</td>
<td>.36</td>
<td>.97</td>
</tr>
<tr>
<td>Teacher Rating</td>
<td>.67</td>
<td>.92</td>
<td>.15</td>
<td>.32</td>
</tr>
</tbody>
</table>

Since none of the t's reach the ten per cent level the obtained mean differences must be regarded as "non-significant."

The remaining control pupils 70, 73, 74, ... to

---

136 were matched with Experimental Group II and are henceforth referred to as Control Group II.

In terms of the grouping variables, these groups were not significantly different. For these two groups a \( t \) of 1.23 is required for significance at the ten percent level.

**TABLE B**

**COMPARISON OF MEAN SCORES OF EXPERIMENTAL AND CONTROL GROUPS II ON GROUPING VARIABLES**

<table>
<thead>
<tr>
<th></th>
<th>Experimental Group II Mean</th>
<th>Control Group II Mean</th>
<th>Difference of Means</th>
<th>( t )</th>
</tr>
</thead>
<tbody>
<tr>
<td>I.Q.</td>
<td>91.65</td>
<td>88.39</td>
<td>3.26</td>
<td>1.23</td>
</tr>
<tr>
<td>Reading Achievement</td>
<td>5.47</td>
<td>5.56</td>
<td>.09</td>
<td>.03</td>
</tr>
<tr>
<td>Average Achievement</td>
<td>5.12</td>
<td>5.05</td>
<td>.07</td>
<td>.16</td>
</tr>
<tr>
<td>Teacher Rating</td>
<td>-.62</td>
<td>-.48</td>
<td>.14</td>
<td>.07</td>
</tr>
</tbody>
</table>

Again, although the control subjects were in classes where the entire range of differences were present they were matched with the above-average Experimental Group as Control Group I and matched with the below-average Experimental Group II.

---

Group as Control Group II.

After this grouping was effected, no other changes in the school program were made. Only the principal of the school had knowledge of the plan. Changes, in teaching approach made by teachers as a result of this grouping, can be assumed to have occurred as a result of needs arising and not due to a knowledge of the study. Such changes, if caused by the composition of the classes, would be legitimate and desirable.

During the first month of the eighth grade all groups were given the Advanced Battery - Partial, Form G of the Stanford Achievement Test as the initial measure of the dependent variable.

Almost exactly nine months later the achievement of the pupils was measured again with Form II of the same test.

---

CHAPTER IV

RESULTS OF THE EXPERIMENT

It has been demonstrated that the experimental and control groups were not significantly different in terms of grouping factors. To further insure comparability, the groups were measured at the beginning of the experiment in terms of the dependent variable—achievement.

A lack of significant differences between group means in achievement may be seen as indicated in Tables C and D which follow.

TABLE C

COMPARISON OF MEAN SCORES OF EXPERIMENTAL AND CONTROL GROUPS I ON BEGINNING ACHIEVEMENT

<table>
<thead>
<tr>
<th></th>
<th>Experimental Group I Mean</th>
<th>Control Group I Mean</th>
<th>Difference of Means</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arithmetic Reasoning</td>
<td>7.34</td>
<td>7.41</td>
<td>.07</td>
<td>.95</td>
</tr>
<tr>
<td>Arithmetic Computation</td>
<td>18.65</td>
<td>18.27</td>
<td>.38</td>
<td>.18</td>
</tr>
<tr>
<td>Spelling</td>
<td>22.34</td>
<td>21.03</td>
<td>.71</td>
<td>.60</td>
</tr>
</tbody>
</table>
TABLE D

COMPARISON OF MEAN SCORES OF EXPERIMENTAL AND CONTROL GROUPS II ON BEGINNING ACHIEVEMENT

<table>
<thead>
<tr>
<th></th>
<th>Experimental Group II Mean</th>
<th>Control Group II Mean</th>
<th>Difference of Means</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lang. Usage</td>
<td>10.30</td>
<td>11.38</td>
<td>1.68</td>
<td>.58</td>
</tr>
<tr>
<td>Arithmetic Reasoning</td>
<td>3.30</td>
<td>2.55</td>
<td>.75</td>
<td>.88</td>
</tr>
<tr>
<td>Arithmetic Computation</td>
<td>5.05</td>
<td>7.95</td>
<td>.70</td>
<td>.45</td>
</tr>
<tr>
<td>Spelling</td>
<td>7.76</td>
<td>7.19</td>
<td>.69</td>
<td>.21</td>
</tr>
</tbody>
</table>

For significant difference, at the ten per cent level of confidence, $t$'s of 1.68 and 1.68 are required for groups I and II respectively.

The groups numbered approximately 34 subjects each at the beginning of the study. However, it should be known, for the final analysis, Experimental Group I had a $N$ of 33; Control Group I's $N = 32$; Experimental Group II's $N = 29$; and Control Group II's $N = 17$.

Some subjects withdrew from school due to transfer or other reasons. Other pupils did not take the initial or final test of achievement due to circumstances

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1Garrett, loc. cit.
beyond control of the investigator. In order to have the groups comparable on the initial measure of the dependent variable—achievement, a few others were excluded for the final analysis.

The critical test of the hypothesis consisted in the comparison of the final mean raw scores of the experimental and control groups. The results of this test are revealed in Tables 2 and 3 below.

**TABLE 2**

**Comparison of mean scores of experimental and control groups I on final achievement**

<table>
<thead>
<tr>
<th></th>
<th>Experimental Group I Mean</th>
<th>Control Group I Mean</th>
<th>Difference of Means</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lang. Usage</td>
<td>39.56</td>
<td>32.62</td>
<td>6.96</td>
<td>.33</td>
</tr>
<tr>
<td>Arithmetic Reasoning</td>
<td>11.69</td>
<td>11.18</td>
<td>.51</td>
<td>.31</td>
</tr>
<tr>
<td>Arithmetic Computation</td>
<td>29.21</td>
<td>35.72</td>
<td>6.51</td>
<td>1.16</td>
</tr>
<tr>
<td>Spelling</td>
<td>26.17</td>
<td>25.81</td>
<td>.36</td>
<td>.11</td>
</tr>
</tbody>
</table>
TABLE V

COMPARISON OF MEAN SCORES OF EXPERIMENTAL AND CONTROL
GROUPS II ON FINAL ACHIEVEMENT

<table>
<thead>
<tr>
<th></th>
<th>Experimental Group II Mean</th>
<th>Control Group II Mean</th>
<th>Difference of Means</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lang. Usage</td>
<td>13.45</td>
<td>15.88</td>
<td>2.43</td>
<td>.71</td>
</tr>
<tr>
<td>Arithmetic Reasoning</td>
<td>6.1</td>
<td>5.62</td>
<td>.55</td>
<td>.56</td>
</tr>
<tr>
<td>Arithmetic Computation</td>
<td>13.60</td>
<td>10.94</td>
<td>2.66</td>
<td>1.41</td>
</tr>
<tr>
<td>Spelling</td>
<td>12.68</td>
<td>13.52</td>
<td>.12</td>
<td>.14</td>
</tr>
</tbody>
</table>

For the number of cases involved in Experimental and Control Groups I a \( t \) of 1.68\(^2\) was required for acceptance of the hypothesis at the ten per cent level of confidence.

To accept the hypothesis for Experimental and Control Groups II, at the ten per cent level of confidence, a \( t \) of 1.69\(^3\) was necessary.

The \( t \) scores listed in the preceding tables indicated that the mean difference between experimental and control groups was not significant for language usage, arithmetic reasoning, arithmetic computation, nor spelling.

\(^2\) Loc. cit.
\(^3\) Loc. cit.
The hypothesis, that academic achievement is influenced in a positive fashion by greater school class homogeneity in terms of intelligence, general academic status, reading status, and motivation, has not been proved tenable by this study.
CHAPTER V

SUMMARY AND CONCLUSIONS

Previous researches have failed to settle the controversy over the value of homogeneous grouping for instructional purposes, and this study is no exception. Here, too, homogeneous grouping failed to realize its theoretical possibilities. Perhaps heterogeneity of the groups was insufficiently reduced. No doubt many of these illusive variables, that need to be controlled in experimentation with human behavior, evaded control. Some have stressed the need for adaptation of teaching methods and materials, when homogeneous groups are taught. Although the investigator recognized this need, he purposely did nothing about it, for the experimental variable was limited to the described grouping. However, it was hoped that such adaptations would follow as a result.

In conclusion, the need for additional research should be emphasized. Such a need, relating to social, emotional, and personality adjustments as well as academic achievement, is obvious.

An experimental study, of a longitudinal nature, should be worthwhile. Such a study might be made through
the elementary school years with a large number of experimental and control subjects.

More specifically, pupils entering elementary school would be placed in the various subject matter classes in terms of prior achievement in that particular area. For example, pupils would be classified in terms of arithmetic achievement and placed in arithmetic classes according to their achievement level. This would be done in English class, reading class, and so forth. Each group would be presented subject matter corresponding to its level of attainment.

The composition of such groups would not remain static but would change at least once a year due to varying growths in achievement. Group composition then, to some extent, would be determined by effort and would answer the frequent charge that such classification is undemocratic. The investigator believes the concept of democracy does not imply that each child should receive the same educational experiences; but rather, it implies that each child should be afforded educational experiences compatible with the realization of his fullest potential. In view of the accepted fact of individual differences, it follows, educational offerings should be different.

To answer the criticism that such a procedure has
doubtful value in relation to personal and social learn-
ings, this proposed study would include personality and
social measurements. This, of course, could be done with
a number of methods and devices.

Non-academic school groups deliberately might be
made heterogeneous. No special grouping would occur in
homeroom, physical education, etc.

The theoretical possibility still exists that edu-
cational experiences can be made more pointed, and more
meaningful, when teachers can plan them for a class with
a narrower range of differences. The only evidence avail-
able is the opinion of principals and teachers. At pres-
ent, the answer would be based on philosophy, administra-
tive and teaching experience, or conjecture, rather than
on research.

An open-minded, experimental approach is necessary
to determine the value of homogeneous grouping, and eval-
uation should be made in terms of the attainment of edu-
cational objectives by pupils.
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A. BOOKS


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E. UNPUBLISHED MATERIALS

APPENDIX

RATING SCALE

INDUSTRIOUSNESS

<table>
<thead>
<tr>
<th>Pupil's Name</th>
<th>Indolent effort</th>
<th>Frequently does not complete work</th>
<th>Gets required but no more</th>
<th>Steady worker</th>
<th>Eager usually does more than required</th>
</tr>
</thead>
</table>

1Adapted from Froehlich and Barley, op. cit., p. 111. (Teachers rated by circling the appropriate diagonal marks. The points on the scale were given values ranging 1 to 15.)