

AN INDEX NUMBER FOR STATE SCHOOL SYSTEMS

LEONARD P. AYRES



**DEPARTMENT OF EDUCATION
RUSSELL SAGE FOUNDATION
130 EAST TWENTY-SECOND STREET
NEW YORK CITY**

E 141

**AN INDEX ~~NUMBER~~ FOR
STATE SCHOOL
SYSTEMS**

RANKS OF STATES AS SHOWN BY INDEX NUMBERS FOR FOUR PERIODS

1890	1900	1910	1918
1 D. C.	1 Mass.	1 Wash.	1 Mont.
2 Mass.	2 N. Y.	2 Cal.	2 Cal.
3 Cal.	3 D. C.	3 D. C.	3 Ariz.
4 N. Y.	4 Cal.	4 Mass.	4 N. J.
5 R. I.	5 Conn.	5 Nev.	5 D. C.
6 Conn.	6 R. I.	6 N. J.	6 Wash.
7 Colo.	7 Nev.	7 Mont.	7 Iowa
8 N. J.	8 Colo.	8 N. Y.	8 Utah
9 Mont.	9 N. J.	9 Utah	9 Mass.
10 Penn.	10 Mont.	10 R. I.	10 Mich.
11 Nev.	11 Utah	11 Ill.	11 Conn.
12 Md.	12 Ohio	12 Conn.	12 Ohio
13 Ohio	13 Ill.	13 Colo.	13 N. Y.
14 Ariz.	14 Wash.	14 Ohio	14 Colo.
15 Ill.	15 Penn.	15 Ore.	15 N. D.
16 Mich.	16 Ind.	16 Penn.	16 Nev.
17 Wis.	17 Neb.	17 Ind.	17 Ind.
18 Iowa	18 Mich.	18 Ariz.	18 Idaho
19 N. H.	19 Md.	19 Mich.	19 Minn.
20 Wash.	20 Vt.	20 Idaho	20 Ore.
21 Kans.	21 Minn.	21 Minn.	21 Penn.
22 Wyo.	22 N. D.	22 Neb.	22 Neb.
23 Vt.	23 Iowa	23 Wis.	23 Hawaii
24 Maine	24 Wis.	24 Kans.	24 Ill.
25 Ind.	25 S. D.	25 Wyo.	25 Wyo.
26 Minn.	26 N. H.	26 S. D.	26 R. I.
27 Del.	27 Maine	27 N. D.	27 Kans.
28 Utah	28 Ore.	28 N. H.	28 C. Z.
29 Fla.	29 Wyo.	29 Vt.	29 S. D.
30 Ore.	30 Mo.	30 Iowa	30 N. H.
31 Neb.	31 Kans.	31 Maine	31 N. M.
32 S. D.	32 Ariz.	32 Mo.	32 Vt.
33 Mo.	33 Del.	33 Md.	33 Wis.
34 N. D.	34 Idaho	34 Del.	34 Mo.
35 Ky.	35 W. Va.	35 Okla.	35 Maine
36 Texas	36 Ky.	36 W. Va.	36 Okla.
37 Idaho	37 N. M.	37 Texas	37 Md.
38 Va.	38 Texas	38 N. M.	38 Del.
39 Miss.	39 Okla.	39 La.	39 Texas
40 W. Va.	40 Fla.	40 Ky.	40 Fla.
41 Tenn.	41 Tenn.	41 Va.	41 W. Va.
42 Ark.	42 Va.	42 Fla.	42 P. R.
43 La.	43 La.	43 Tenn.	43 Va.
44 Ala.	44 Ga.	44 Ga.	44 Tenn.
45 N. C.	45 Ark.	45 Ala.	45 Ky.
46 Ga.	46 Miss.	46 Ark.	46 La.
47 S. C.	47 S. C.	47 Miss.	47 Ga.
48 N. M.	48 Ala.	48 N. C.	48 N. C.
	49 N. C.	49 S. C.	49 Ala.
			50 Ark.
			51 Miss.
			52 S. C.

AN INDEX NUMBER FOR STATE SCHOOL SYSTEMS

LEONARD P. AYRES



**DEPARTMENT OF EDUCATION
RUSSELL SAGE FOUNDATION
130 EAST TWENTY-SECOND STREET
NEW YORK CITY**

E 141

COPYRIGHT, 1920, BY
THE RUSSELL SAGE FOUNDATION

Printed April, 1920: 2,000 copies
Reprinted March, 1921: 1000 copies

WM. F. FELL CO. PRINTERS
PHILADELPHIA



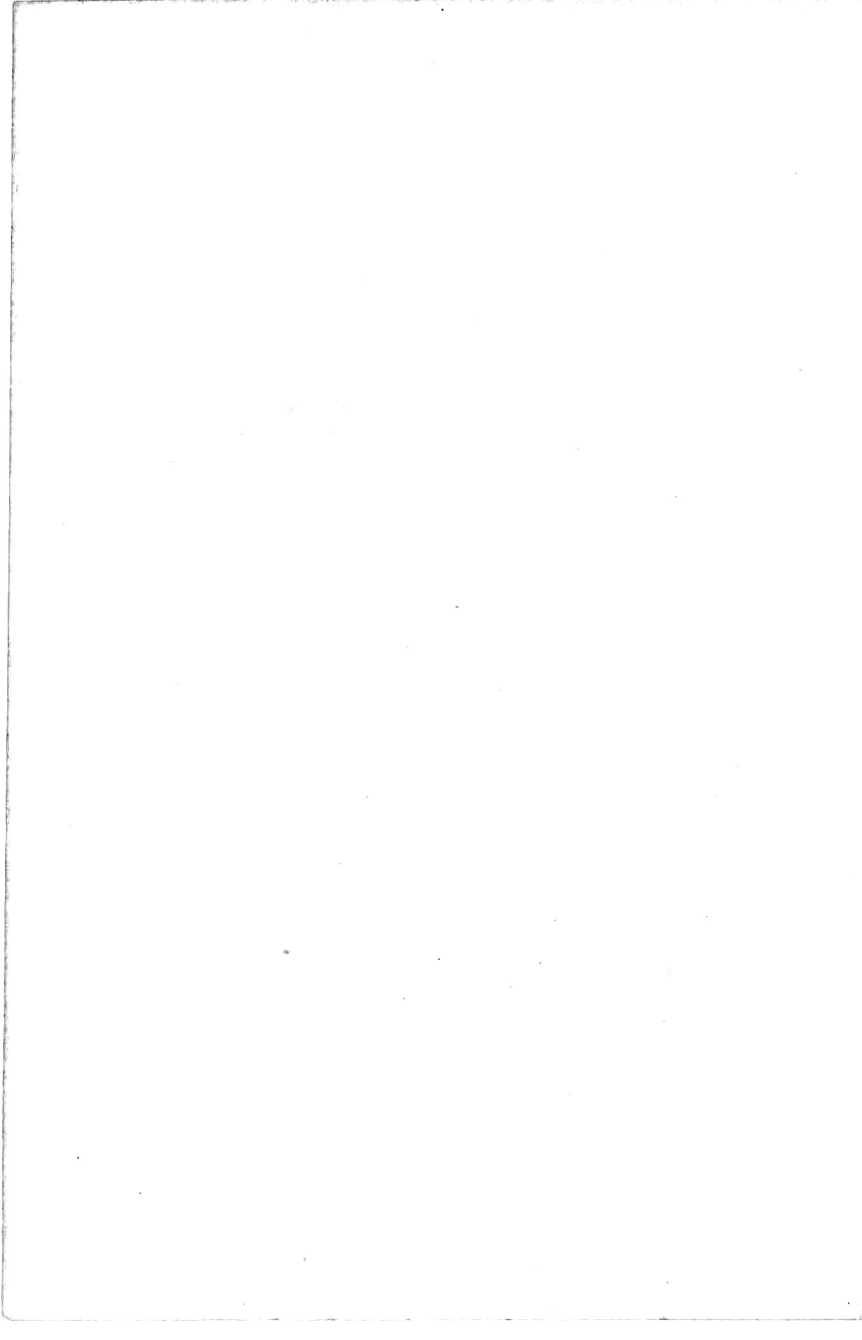
TABLE OF CONTENTS

	PAGE
List of Tables	7
Changes in Ten Years	10
Index Numbers	12
An Index Number for State School Systems	14
What Items of 100 Each Would Imply	19
The Computation of the Index Number	21
Data for 48 Years	23
Groups of States	27
Standing of the States in 1890	30
Standing of the States in 1900	32
Standing of the States in 1910	34
Standing of the States in 1918	36
Hawaii, the Canal Zone, and Porto Rico	38
Education in Porto Rico	38
Standing of the States in Four Decades	42
Standing of the States During Five Periods	46
The 48 States in 1918	48
Gains and Losses in 28 Years	50
Index Numbers Stated as Whole Numbers	52
Educational Results and Financial Expendi- tures	53
Correlations	56
Significance of the Index Number	57
Accuracy of Data	59

	PAGE
Private and Parochial Schools	60
Different Types of States	62
Purchasing Power of Money	63
High School Data	63
Teachers' Salaries	65
Limitations	66
Summary	68

LIST OF TABLES

TABLE	PAGE
1. Components and index numbers. United States. 1871 to 1918	25
2. Index numbers for divisions. Seven periods	28
3. Components and index numbers of states. 1890	31
4. Components and index numbers of states. 1900	33
5. Components and index numbers of states. 1910	35
6. Components and index numbers of states. 1918	37
7. Index numbers of states at four periods	43
8. Ranks of states as shown by index numbers for four periods	45
9. Ranks of states as shown by index numbers for five periods	47
10. Rank of each state in each component of the index in 1918	49
11. Changes in index numbers and in ranks of states. 1890 to 1918	51
12. Index numbers of states in 1918	53
13. Sum of five educational components and sum of five financial components of index number for each state in 1918	55



AN INDEX NUMBER FOR STATE SCHOOL SYSTEMS

During the past fifty years the United States Bureau of Education has published annual reports setting forth conditions in the public schools of each state in the Union. Each year it has gathered and made public the figures which measure certain of the larger and more important phases of the educational effort and attainment of the states. Included in these records are the figures which show how many of the children are attending the public schools and for how many days during the year, what numbers of the children are in the higher schools, and what price in dollars the state is paying to purchase this education for them. These figures reflect the diffusion, the amount, and the quality of the education that the children are receiving.

This collection of data is of unique value. There are few, if any, other governmental ac-

tivities for which so many significant facts have been gathered, by uniform methods, over so long a period of time. Certain of the fundamental records of the Bureau that run back in unbroken series for half a century contain a body of trustworthy information of the greatest value and of such a nature that, if the data had not been preserved, they could not now be collected by any agency or by any expenditure of effort and money.

During the winter of 1919-20, the Department of Education of the Russell Sage Foundation has been engaged in the task of selecting, from this mass of statistical material, figures that could be combined into a statistical measurement of the accomplishments of the school systems in the several states.

CHANGES IN TEN YEARS

The method which has been followed may be illustrated by considering at this point two sets of figures showing certain phases of educational conditions in the public schools of the nation in the years 1900 and 1910. The data are for the United States as a whole and, for the sake of simplicity, they are here set down as whole numbers with their decimal fractions omitted. They are as follows:

	1900	1910
1. Per cent of school population attending school daily	50	53
2. Average days attended by each child of school age	72	83
3. Average number of days schools were kept open	144	158
4. Per cent that high school attendance was of total attendance	5	7
5. Per cent that boys were of girls in high schools	71	78
6. Average expenditure per child in average attendance	\$20	\$33
7. Average expenditure per child of school age	\$10	\$18
8. Average expenditure per teacher employed	\$508	\$815
9. Expenditure per pupil for purposes other than teachers' salaries	\$7	\$13
10. Expenditure per teacher employed for salaries	\$325	\$485

These two sets of figures reflect in convincing manner improvements that took place in the administration of public education during the decade from 1900 to 1910. In every instance the figure for the later date is greater than that for the earlier one and in several cases the increase is most marked.

The proportion of children attending school increased, the school year was lengthened, the proportion of children attending high schools was enlarged, and the funds expended for the support of education were greatly augmented. These are true indicators of improved conditions in the school system and it is by com-

binning these measurements, by methods that will be explained, that an index number has been constructed for measuring the status of the public school systems of the states.

INDEX NUMBERS

The index number is a well established statistical device commonly used for measuring changes in wholesale and retail prices and rates of wages over long periods of time. Such a number may be constructed by securing each month the prices of a uniform list of commodities at a selected and unchanging list of establishments, and then computing the average price for the whole list for each month. As this average rises or falls it reflects the general changes taking place in the prices of the types of commodities represented. If some of the commodities are more important than others, or are commonly consumed in greater quantities, methods of weighting are used to make sure that each element shall exercise only its proper share of influence in the final result.

Such numbers are commonly reduced to percentages and the number for a given month is stated as being so many per cent of the figure for some previous period. Thus whole-

sale prices are commonly given as percentages of the average price for the decade from 1890 to 1900, when they reached the lowest point recorded. In a similar way the index number for the cost of living, compiled by the United States Bureau of Labor Statistics, takes the price in 1913 as 100 and states its figure from month to month on that basis. By the beginning of 1920 this index number had risen to 199.

There are several well established index numbers for the prices of investment stocks and in these cases there is usually no method of weighting employed, nor are the figures commonly stated in terms of a per cent variation from the figure for a determined point of departure. The reason for this is that the unit price of each stock is commonly 100 and the different stocks are considered as being of approximately equal significance so that weighting is unnecessary.

The 10 sets of educational data that have been considered are unusually well adapted for inclusion in an index number. Increases in them reflect improved educational conditions and decreases reflect worse conditions. The data for these 10 items have been gathered by substantially uniform methods from

identical establishments (the 48 states) over a long period of years. A third, and most important, characteristic is that each of the items can readily be stated in percentage terms. Like the stock prices they can all be measured in terms of a theoretical par value of 100, and because of this they can be combined in an index number that is a direct average instead of a relative percentage.

AN INDEX NUMBER FOR STATE SCHOOL SYSTEMS

The 10 sets of data from which the new index number has been constructed are the ones already referred to. These data are the following:

1. Per cent of school population attending school daily.
2. Average days attended by each child of school age.
3. Average number of days schools were kept open.
4. Per cent that high school attendance was of total attendance.
5. Per cent that boys were of girls in high schools.
6. Average annual expenditure per child attending.

7. Average annual expenditure per child of school age.

8. Average annual expenditure per teacher employed.

9. Expenditure per pupil for purposes other than teachers' salaries.

10. Expenditure per teacher for salaries.

The new index number is the average of the 10 figures corresponding to these 10 headings, after certain of them have been so multiplied or divided by constants as to bring each into comparability with a standard of 100. For example, the average number of days the schools were kept open in the United States as a whole in 1910 was 157.5. The standard or "par value" length of term is taken as 200 days. Hence the actual number of days for 1910, or 157.5, is divided by two, which gives the figure 78.75 as one of the 10 components of the final index number. In a similar way an average monthly salary of \$100 is taken as the standard for the last of the 10 items. The actual average in 1910 was \$485.22 for the year, or \$40.44 for each month and this number is included as one of the components without further change.

The other items are treated by similar methods, and, finally all 10 are added and the

average taken as the index number. This may be computed for the whole number of states, or any group of them, or any one among them, for any year. When so computed it expresses in a single number the degree to which the average of the 10 different measures taken together approaches the standard of 100.

The 10 numbered paragraphs which follow tell how the 10 items have been entered in the final index number and show how each one has been brought into relationship with a common basis, or educational par value, of 100. All the figures relate to public day schools.

1. The per cent of school population attending school daily. This item has been included as a percentage figure. It can never exceed 100. It is the per cent that the average daily attendance in day public schools is of the whole number of children of school age. The children of school age are those more than five and less than eighteen years old and these numbers are supplied by the United States Census.

2. Average days attended by each child of school age. This item has been included in the final total as one half of the number found by dividing the aggregate days of attendance by