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The reliability of the check list used in the study Subject preferences of children

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THE RELIABILITY OF THE CHECK LIST USED IN THE STUDY

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A Phase of the Research Project

Subject Preferences

of

Children

Submitted by

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Subject Preferences of Fifth Grade Children

"Subject Preferences of Fifth Grade Children" is a cooperative study in which a number of graduate students have contributed to the total research project. It was facilitated through the cooperation of the New England School Development Council. This thesis is one of the studies in the project. Those completed and filed as graduate studies in June and August, 1948 were:

1. Subject Preferences in the Fifth Grade by Helen C. Blanchard

2. The Reliability of the Check List Used in the Study by Francis L. Thompson

3. An Analysis of Sex Differences in Fifth-Grade Children's Preferences for School Subjects by Eleanor M. Skahill

4. Preferences for Content, Skills, and Aesthetic Subjects in Five Communities by Ado Commito

5. Children's Evaluation of the Difficulty of Well-Liked School Subjects by Katherine M. Kinsley

6. Children's Evaluation of the Difficulty of Disliked School Subjects by Esther M. Sullivan

7. An Analysis of Fifth-Grade Pupils' Subject Preferences in Relation to Their Teachers' Preferences by Helen M. Sprague

8. High Morale Classrooms in the Subject Preference Study by George H. Englesby

9. An Analysis of the Influences of Intelligence and Age Differences Upon Fifth-Grade Children's Preferences for School Subjects by William L. Earley, Jr.

10. An Analysis of the Influence of Achievement on Preference for Reading and Arithmetic by Mary E. Cusack

11. Differences in Subject Preferences of High-Achievement Readers and Low-Achievement Readers by George H. Gardner

12. An Analysis of the Subject Preferences of 3,403 Third, Fourth, Fifth, and Sixth Grade Pupils in the Public Schools of Quincy, Massachusetts by Francis D. Mills

13. Techniques and Practices Used in Twenty Social Studies Classrooms by William A. Wolffer

THE RELIABILITY OF THE CHECK LIST USED IN THE STUDY

To check the reliability of the check list that had been used in the study of "Subject Preferences of Fifth-Grade Children" the same check list was given a second time to all fifth-grade children in town 45 after a lapse of two months. The first checking was done the first week in January, 1948, and the second during the second week in March, 1948. Town 45 was chosen for this purpose for two reasons: (1) it included all economic groups and (2) it provided a large number of the same for sampling. Wert claims that: "It is common experience that more confidence is placed in the larger sample than in the smaller."[1/]

There were 698 fifth-grade pupils in the first checking and 739 fifth-grade pupils in the second checking. The difference in these number was due to absences, transfers, and new enrollments. Matching the check lists of pupils who had done both checkings resulted in 653 paired lists.

The tallied results of both sets of papers are arranged in a series of tables to show:

(a) the significance of the difference of percentages in subject matter choices between the two samplings.

(b) the coefficient of correlation between subject choices in the two samplings.

1/ James E. Wert, Educational Statistics; New York: McGraw Hill Book Co., 1938, p. 145.

The significance of differences between two percentages was determined by application of the formula for critical ratio where the two percentages are shown by p_1 and p_2

$$C.R. = \frac{p_1 - p_2}{S.E.Diff\ p_1p_2}$$

The standard error of a difference between two percentages can be determined by the following formula:

$$S.E.Diff\ p_1p_2 = \sqrt{Se\ p_1^{\ 2} + SE\ p_2^{\ 2}}$$

The standard errors of percentages for the varying numbers of cases were obtained from Edgerton's tables. 1/

In using the critical ratio for analyzing data Wert says:

> Whenever this ratio is unit, the chances are 68 in 100 that the difference is too great to be the result of sampling fluctuations; whenever this ratio it two, the chances are 95 out of 100 that the difference is too great to be the result of sampling fluctuations; and whenever the ratio is three or more, it is a practical certainty that the difference is too great to be the result of sampling fluctuations. 2/

Another check for reliability is the coefficient of correlation by the rank difference method using the Spearman formula.

$$p = 1 - \frac{6\Sigma D^2}{N(N^2 - 1)}$$

1/ Harold A. Edgerton and Donald G. Paterson, "Table of Standard Errors and Probable Errors of Percentages for Varying Numbers of Cases," Journal of Applied Psychology, September, 1926.

2/ Op. cit., p. 145.

C. C. Ross says:

> To give two equivalent forms of a survey (check list in this case) to a large number of pupils, usually with only a short interval of time between the tests (check lists) the survey (check list) will then be said to be reliable if there is close agreement between the results. If such an agreement is perfect the correlation will be 1.00 but if there is no consistent relationship then the correlation will be .00 1/

Ross also states that:

> The rho (p) method has certain definite advantages. It is simple and economical of time if the number of cases is small, possibly not more than 30; and it is especially appropriate if the original data are in ranks. 2/

To indicate the ranks of the school subjects in both the first and second checking, the subject chosen the greatest number of times is listed first, then the subject chosen the next greatest number of times is listed second, and so on.

The comparison of per cents of choice in each subject field between the first checking and the second checking were used to determine the reliability of the check list as a measuring instrument. The differences being small as they are show that a close relationship does exist between the two checkings.

When the check list was first checked in January, 1948, 27.57% of 653 pupils made reading their first choice. Two months later,

1/ C. C. Ross, Measurement in Today's Schools, New York; Prentice Hall, Inc., 1947, pp. 237-239.

2/ Ibid.

Table 1

PERCENTAGE OF FIRST CHOICE PREFERENCES OF 653 PUPILS
ON THE CHECK LIST IN TWO DIFFERENT CHECKINGS

Subjects	First Checking						Second Checking					
	Boys		Girls		Totals		Boys		Girls		Totals	
	N	%	N	%	N	%	N	%	N	%	N	%
Reading	81	24.18	99	31.13	180	27.57	86	25.67	96	30.19	182	27.87
Arithmetic	83	24.78	80	25.16	163	24.96	69	20.60	76	23.90	145	22.21
Language	0	0	0	0	0	0	2	.60	5	1.57	7	1.07
Penmanship	4	1.19	8	2.52	12	1.87	3	.90	11	3.46	14	2.14
Spelling	33	9.85	39	12.26	72	11.03	39	11.64	41	12.89	80	12.25
Geography	1	.30	0	0	1	.15	0	0	0	0	0	0
History	4	1.19	1	.31	5	.77	2	.60	0	0	2	.31
Social Studies	23	6.87	9	2.83	32	4.90	20	5.97	7	2.20	27	4.13
Drawing	76	22.69	54	16.98	130	19.91	70	20.90	52	16.35	122	18.68
Music	10	2.99	23	7.23	33	5.05	15	4.48	15	4.72	30	4.59
Nature Study	15	4.48	4	1.26	19	2.91	22	6.56	1	.31	23	3.52
Health	5	1.49	1	.31	6	.92	7	2.09	14	4.40	21	3.22
Total Choice	335		318		653		335		318		653	

27.87% of these 653 pupils made reading their first choice, or a difference of .30%. Arithmetic has a difference of 2.75%; language a difference of 1.07%, no one chose language during the first sampling; penmanship showed a difference of .27%; spelling 1.22%; geography .15% difference with no one choosing geography the second time; history with a difference of .46%; social studies .77% difference; drawing 1.23% difference; music .45% difference; nature study a difference of .61% and health a difference of 2.30%.

Table 2

CRITICAL RATIO FROM DIFFERENCES OF PERCENTAGES
FOR FIRST CHOICES IN TWO DIFFERENT CHECKINGS.

Subjects	N	%	S.E.	Diff.	S.E. Diff.	C.R.
Reading - First Checking	180	27.57	3.3			
Reading - Second Checking	182	27.87	3.3	.30	4.61	.07
Arithmetic - First Checking	163	24.96	3.4	2.75	4.80	.57
Arithmetic - Second Checking	145	22.21	3.4			
Spelling - First Checking	72	11.03	3.7			
Spelling - Second Checking	80	12.25	3.6	1.22	5.16	.24
Social Studies - First Checking	38	5.82	3.9	1.38	6.17	.26
Social Studies - Second Checking	29	4.44	3.6			
Drawing - First Checking	130	19.91	3.5	1.23	5.03	.24
Drawing - Second Checking	122	18.68	3.6			
Music - First Checking	33	5.05	3.8	.46	5.50	.08
Music - Second Checking	30	4.59	4.0			

Table 2 shows very small critical ratios. In none of the subject areas was there a statistically significant difference in per cent of choices. This would apparently indicate consistency of the pupils in indicating first choices by use of such a check list.

In reading the per cent difference was .30 and the critical ratio of .07 shows that there are only 5 chances in 100 that this represents a true difference in favor of the second checking.

In arithmetic the per cent difference was 2.75 and the critical ratio of .57 shows that there are only 43 chances in 100 that this represents a true difference in favor of the first checking.

In spelling the per cent difference was 1.22 and the critical ratio of .24 shows that there are only 19 chances in 100 that this represents a true difference in favor of the second checking.

In social studies (geography and history per cents combined with social studies) the per cent difference was 1.38 and the critical ratio of .26 shows that there are only 20 chances in 100 that this represents a true difference in favor of the first checking.

In drawing the per cent difference was 1.23 and the critical ratio of .24 shows that there are only 19 chances in 100 that this represents a true difference in favor of the first checking.

In music the per cent difference was .46 and the critical ratio of .08 shows that there are only 6 chances in 100 that this represents a true difference in favor of the first checking.

Table 3

PERCENTAGE OF COMBINED FIRST, SECOND, AND THIRD CHOICE PREFERENCES OF 653 PUPILS ON THE CHECK LIST IN TWO DIFFERENT CHECKINGS

Subjects	First Checking						Second Checking					
	Boys		Girls		Totals		Boys		Girls		Totals	
	N	%	N	%	N	%	N	%	N	%	N	%
Reading	204	20.30	199	20.86	403	20.57	204	20.30	208	21.80	412	21.03
Arithmetic	198	19.70	178	18.66	376	19.19	199	19.80	193	20.23	392	20.01
Language	5	.50	17	1.78	22	1.12	8	.80	14	1.47	22	1.12
Penmanship	24	2.39	50	5.24	74	3.78	21	2.99	50	5.24	71	3.62
Spelling	139	13.83	172	18.03	311	15.88	135	13.43	164	17.19	299	15.26
Geography	5	.50	5	.52	10	.51	0	.00	0	.00	0	.00
History	16	1.59	7	.73	23	1.17	5	.50	2	.21	7	.36
Social Studies	82	8.16	38	3.98	120	6.13	92	9.15	36	3.77	128	6.53
Drawing	172	17.11	137	14.36	309	15.77	166	16.52	134	14.05	300	15.31
Music	64	6.37	98	10.27	162	8.27	60	5.97	89	9.33	149	7.61
Nature Study	68	6.77	24	2.52	92	4.70	91	9.05	22	2.31	113	5.76
Health	28	2.79	29	3.04	57	2.91	24	2.39	42	4.40	66	3.37
Total Choice	1005		954		1959		1005		954		1959	

In table 3 the first, second, and third choices were combined for each subject area. It is clear that a close relationship exists between what the pupils selected as their choices in the first checking and their choices in the second checking.

Table 3 shows small differences between the two checkings. For reading there is a difference of .46%; arithmetic a difference of .82%; language has no difference; penmanship a difference of .16%; spelling a difference of .62%; geography a difference of .51%, no one chose geography in the second sampling; history a difference of .81%; social studies a difference of .40%; drawing a difference of .46%; music, .66%; nature study, 1.06%; and health .46%.

Table 4

CRITICAL RATIO FROM DIFFERENCES OF PERCENTAGES FOR COMBINED FIRST, SECOND, AND THIRD CHOICES IN TWO DIFFERENT CHECKINGS

Subjects	N	%	S.E.	Diff.	S.E. Diff.	C.R.
Reading - First Checking	403	20.57	2.0			
Reading - Second Checking	412	21.03	2.0	.46	2.83	.16
Arithmetic - First Checking	376	19.19	2.0			
Arithmetic - Second Checking	392	20.01	2.0	.82	2.83	.29
Penmanship - First Checking	74	3.78	2.3	.16	3.25	.05
Penmanship - Second Checking	71	3.62	2.3			
Spelling - First Checking	311	15.88	2.1	.62	2.97	.21
Spelling - Second Checking	299	15.26	2.1			
Social Studies - First Checking	153	7.81	2.2	.92	3.11	.30
Social Studies - Second Checking	135	6.89	2.2			
Drawing - First Checking	309	15.77	2.1	.46	2.97	.15
Drawing - Second Checking	300	15.31	2.1			

Table 4 (continued)

Subjects	N	%	S.E.	Diff.	S.E. Diff.	C.R.
Music - First Checking	162	8.27	2.1	.66	3.04	.22
Music - Second Checking	149	7.61	2.2			
Nature Study - First Checking	92	4.70	2.3			
Nature Study - Second Checking	113	5.76	2.2	1.06	3.18	.33
Health - First Checking	57	2.91	2.3			
Health - Second Checking	66	3.37	2.1	.46	3.11	.15

Table 4 shows very small critical ratios. In none of the subject areas was there a statistically significant difference in per cent of choices between the two checkings.

In reading the per cent difference was .46 and the critical ratio of .16 shows that there are only 13 chances in 100 that this represents a true difference in favor of the second checking.

In arithmetic the per cent difference was .82 and the critical ratio of .29 shows that there are only 23 chances in 100 that this represents a true difference in favor of the second checking.

In penmanship the per cent difference was .16 and the critical ratio of .05 shows that there are only 4 chances in 100 that this represents a true difference in favor of the first checking.

In spelling the per cent difference was .62 and the critical ratio of .21 shows that there are only 17 chances in 100 that this represents a true difference in favor of the first checking.

In social studies (geography and history per cents combined with social studies per cent) the per cent difference was .92 the critical ratio of .30 shows that there are only 23 chances in 100 that this represents a true difference in favor of the first checking.

In drawing the per cent difference was .46 and the critical ratio of .15 shows that there are only 12 chances in 100 that this represents a true difference in favor of the first checking.

In music the per cent difference was .66 and the critical ratio of .22 shows that there are only 17 chances in 100 that this represents a true difference in favor of the first checking.

In nature study the per cent difference was 1.06 and the critical ratio of .33 shows that there are only 26 chances in 100 that this represents a true difference in favor of the second checking.

In health the per cent difference was .46 and the critical ratio of .15 shows that there are only 12 chances in 100 that this represents a true difference in favor of the second checking.

Table 5

COMPUTATION OF THE COEFFICIENT OF CORRELATION BY THE RANK DIFFERENCE METHOD FOR FIRST CHOICES IN TWO DIFFERENT CHECKINGS

	Percentages		Ranks			
Subjects	First Checking	Second Checking	First Checking	Second Checking	Diff.	D^2
Reading	27.57	27.87	1	1	0	0
Arithmetic	24.96	22.21	2	2	0	0
Drawing	19.91	18.68	3	3	0	0

Table 5 (continued)

Subjects	Percentages First Checking	Percentages Second Checking	Ranks First Checking	Ranks Second Checking	Diff.	D^2
Spelling	11.03	12.25	4	4	0	0
Music	5.05	4.59	5	5	0	0
Social Studies	4.90	4.13	6	6	0	0
Nature Study	2.91	3.52	7	7	0	0
Penmanship	1.87	2.14	8	9	+1	1
Health	.92	3.22	9	8	-1	1
History	.77	.31	10	11	+1	1
Geography	.15	.00	11	12	+1	1
Language	.00	1.07	12	10	-2	4

$$N=12 \quad p = 1 - \frac{6\Sigma D^2}{N(N^2-1)} = 1 - \frac{6 \times 8}{12(12^2-1)} = 1 - \frac{48}{1716} = 1 - .022 = .98 \qquad \Sigma D^2 = 8$$

Table 5 shows a coefficient of correlation of .98 between the two checkings on first choices as determined by the rank difference method. The first seven subjects kept their place for both samplings. These were in order: reading, arithmetic, drawing, spelling, music, social studies and nature study. Penmanship changed from eighth place the first time to ninth place for the second time. Health changed from ninth place the first time to eighth place the second time. History changed fron tenth place the first time to eleventh place the second

time. Geography changed from eleventh place the first time to twelfth place the second time. Language changed from twelfth place the first time to tenth place the second time.

Table 6

COMPUTATION OF THE COEFFICIENT OF CORRELATION BY THE RANK DIFFERENCE METHOD FOR COMBINED FIRST, SECOND, AND THIRD CHOICES IN TWO DIFFERENT CHECKINGS

	Percentages		Ranks			
Subjects	First Checking	Second Checking	First Checking	Second Checking	Diff.	D^2
Reading	20.57	21.03	1	1	0	0
Arithmetic	19.19	20.01	2	2	0	0
Spelling	15.88	15.26	3	4	+1	1
Drawing	15.77	15.31	4	3	-1	1
Music	8.27	7.61	5	5	0	0
Social Studies	6.13	6.53	6	6	0	0
Nature Study	4.70	5.76	7	7	0	0
Penmanship	3.78	3.62	8	8	0	0
Health	2.91	3.37	9	9	0	0
History	1.17	.36	10	11	+1	1
Language	1.12	1.12	11	10	-1	1
Geography	.51	.00	12	12	0	0

$$N=12 \quad p = 1 - \frac{6\Sigma D^2}{N(N^2-1)} = 1 - \frac{6 \times 4}{12(12^2-1)} = 1 - \frac{24}{1716} = 1 - .013 = .99 \qquad \Sigma D^2 = 4$$

Table 6 shows a coefficient of correlation of .99 between the two checkings on combined first, second, and third choices. When comparing the subjects as to their order it was found that reading and arithmetic, kept the same rank in both checkings but spelling changed from the third place in the first checking to fourth place in the second checking. Drawing changed from fourth place in the first checking to third place in the second checking. Music, social studies, nature study, penmanship and health all maintained the same rank in both checkings. History changed from tenth place the first time to eleventh place the second time. Language changed from eleventh place the first time to tenth place the second time. Geography kept twelfth place both times.

Conclusion. This reliability study shows that the check list used in the preference study is a highly consistent instrument. When 653 fifth-grade pupils in Town 45 used the check list at two different times two months apart, the analysis of the data show that there were no statistically significant differences in the percentage of choices in the various subject matter areas between the two checkings. The critical ratios between percentages in subjects for the two checkings on combined first, second, and third choices range from .05 to .33, and on first choices alone from .07 ~~and~~ to .57. The coefficient of correlation by the rank difference method on the order of preference of school subjects in the two checkings was .98 when first choices alone were considered and .99 when first, second, and third choices were combined.