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STUDIES ON READING DISABILITIES IN THE ELEMENTARY SCHOOL.

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A STUDY WAS CONDUCTED TO DETERMINE WHETHER THE FREQUENCY OF READING DISABILITY CASES COULD BE MARKEDLY DECREASED (A) BY A CAREFUL DIAGNOSIS OF THE CHILD'S READING READINESS AND GENERAL SCHOOL READINESS AND (B) BY THE ESTABLISHMENT OF AN APPROPRIATE TEACHING SITUATION FOR THOSE CHILDREN WHOSE DIAGNOSIS INDICATED POTENTIAL READING AND WRITING DIFFICULTIES. IN 1958 A PILOT STUDY WAS BEGUN WITH FIRST GRADERS AND WAS CONTINUED THROUGH GRADE 3. EXTENSIVE INFORMATION WAS OBTAINED FOR EACH CHILD THROUGH TESTS AND PARENTAL INTERVIEWS. SUBJECTS WHOSE DIAGNOSTIC REPORTS PREDICTED THAT READING DISABILITY WOULD RESULT IF NO AUXILIARY MEASURES WERE TAKEN WERE GIVEN SPECIAL HELP BY A READING CLINIC TEACHER AND BY THE CLASSROOM TEACHER. ON READING TESTS GIVEN AFTER THE FIRST, SECOND, AND THIRD GRADES, EXPERIMENTAL SUBJECTS ACHIEVED SIGNIFICANTLY HIGHER SCORES. THE MAIN STUDY FOLLOWED A SIMILAR DESIGN USING 466 CONTROL SUBJECTS AND 472 EXPERIMENTAL SUBJECTS. EIGHTY-THREE PERCENT OF THE CASES IDENTIFIED AS POTENTIAL READING DISABILITY CASES WERE PREVENTED. THE PROGNOSTIC VALUES OF THE PREDICTORS USED, THE STABILITY OF DIFFERENT TYPES OF CRITERIA, AND THE EFFECTS OF REMEDIAL TEACHING ARE DISCUSSED. THIS PAPER WAS PRESENTED AT THE INTERNATIONAL READING ASSOCIATION CONFERENCE (SEATTLE, MAY 4-6, 1967). (RH)

Studies on Reading Disabilities in the Elementary School*

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Linköping, Sweden

* Paper read at the 12th Annual Convention of the International Reading Association, Seattle, Washington, U.S.A.

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Eve Malmquist, Sweden
12th Annual IRA Convention
Seattle, May 5, 1967.

STUDIES ON READING DISABILITIES IN THE ELEMENTARY SCHOOL.

In recent years the leading specialists in reading have emphasized time and again, that only very rarely can reading disabilities be ascribed to a single causal factor. Usually it is a question of a whole complex of factors which may be interrelated with each other and with reading disabilities. It is not always possible, however, to determine the relationship between cause and effect.

Factors related to reading disabilities.

My own investigations in Sweden some years ago as regards factors related to reading disabilities in the first grade in the elementary school were rather extensive. (Malmquist, 1958.)

A relatively large number of factors were studied in the same population and at the same test session. In addition to the more conventional methods of investigation (comparisons between different groups of readers with regard to one variable at a time, and studies where each factor is considered separately in relation to reading ability) I studied several variables not only in isolation but also in interaction with other variables by the use of analysis of variance technique of higher order (multifactorial design).

I attempted to take into account the child's pre-school development (birth, health, speech development etc.) home background, social and economic status, the educational level of the parents and other home conditions. Moreover, the respective teachers evaluated a number of personality factors for each pupil.

Tests of vision, hearing, reading ability, visual perception, spelling ability, intelligence, etc. were administered. In addition certain teacher and school variables were included in the studies.

Out of more than forty variables investigated the following factors were found to be most intimately related to reading disabilities in the first grade, and further to most clearly differentiate the group of poor readers from the group of good readers.

(a) Intelligence, ability to concentrate, persistance, self-confidence and emotional stability - nervousness of the child.

(b) Spelling ability according to some spelling tests, and visual perception as measured by five visual perception tests.

(c) Social status and educational level of the parents, and reading interests in the home.

(d) Teaching experience of the child's teacher, as measured by number of years of service in the profession.

By using the case-analysis approach I have found that children with "special reading disabilities" (IQ above ninety according to the Terman-Merrill) deviated negatively, in a very marked manner, from the mean for the total population investigated, with regard to several other variables besides reading ability. Judging from my results, reading disabilities at first-grade level are never isolated defects. In all the cases investigated they were found to exist together with deficiencies, disturbances, or unfavourable conditions in several other areas.

Do the poorest readers represent a uniform group with regard to the type of errors in oral reading?

It is often maintained in medical science that qualitative differences exist between the various types of errors in reading made by children who are "wordblind", and those made by children with "reading disabilities of some other type", and by normal readers. (See for example Hermann, 1955, Hallgren, 1950.)

In my studies I was unable to find any facts in support of the medical hypothesis, that among poor readers there exists a specific group which can be clearly differentiated, and which suffers from a special form of disease; and moreover, that the qualitative character of the errors in reading made by this group differs from that of other groups of children with reading disabilities or even of normal readers.

All conceivable types of errors in oral reading were found also among good readers, though to a much smaller extent.

Our data demonstrated conclusively that the poorest readers were not differentiated from the others as a specific, sharply delimited group. On the contrary, we found a relatively smooth and continuous gradation from the poorest readers of the grade to the best.

Thus on the distribution curve for the reading tests used, it was not possible to determine where the best of the poor readers ended and the worst of the medium readers began.

Operational definition of the concept reading disabilities.

For purposes of practical education it may prove expedient to draw a line of demarkation through some point on the distribution curve, for the reading test, administered. The children who fall below this line may be termed children with reading disabilities or children suffering from dyslexia etc. We should always be fully aware, however, that this delimitation is operationally defined and depends upon the purpose which the delimitation is intended to serve.

For example we might draw the boundary line through a certain point on the distribution curve, because, in view of the schools resources, we think we are able to give just this number of children special teaching in reading or because we wish, for scientific purposes, to investigate a group of poor readers limitid to a certain size, etc.

Consequently, it is never a question of actual differences in essence, in kind, between the poor readers in the delimited group and the medium readers immediately above the line of intersection, but of differences only in degree.

Can the occurrence of reading disabilities be prevented? A six year study.

The research results and practical experiences reached upon from this study have been the starting point for two further investigations. These concern the development of reading ability at the primary stage and were carried out at the National School for Educational Research in Sweden.

Inasmuch as the purposes and the design of these two studies were practically the same and as they were both of them of a longitudinal character, they might be considered as parts of only one investigation, extending over a time period of six years (1958-1964).

Purposes of the investigation. Theory and hypotheses.

The main aims of this investigation have been the following:

1. To find an answer to the question, of whether it is possible to prevent the occurrence of special reading disabilities in grades 1-3 in the elementary school.
2. To study the prognostic value of school-maturity tests of a conventional type, as very commonly used in the Scandinavian countries, administered prior to the children's entering school before the first grade.

3. To construct and standardize further measuring instruments both for the diagnosis of children's reading and writing readiness before starting school and at the same time giving a satisfactory prediction of the reading and writing ability of children who have completed respectively the first, second and third grades of the elementary school.

The theory behind the design of the studies was the following:

The occurrence of special reading disabilities is dependent upon a whole complex of factors which are intimately interrelated, and are frequently difficult to separate, one from the other. In the majority of cases of special reading disabilities there are good prospects of exerting an influence in a positive direction, and at times this may be done to a very considerable extent.

In our special remedial reading classes and in our reading clinics many teachers are performing excellent work, entailing considerable self-sacrifice, in attempting to help children with reading disabilities and personality maladjustments, which often are associated with these difficulties.

Ideally, it would naturally be preferable to forestall and to prevent, the occurrence of the reading disabilities, in the first instance. One of the conditions for an effective program to prevent reading disabilities, would be the ability to diagnose, satisfactorily, even before the child begins school, his qualifications for the learning of reading.

Another necessary condition is, that it should be made possible for teachers in their methodical planning of instruction, to take into consideration the various aspects of various stages of development of each pupil from his very first day at school. How well the teacher may use findings from diagnostic tests and how effectively he may develop a program based on these findings will naturally be influenced by factors such as the teacher's

training and experience, the size and organisation of the class, the nature of the educational material, etc.

The following main hypothesis was advanced for our investigations: It is possible to decrease, markedly, the frequency of reading disability cases, by a careful diagnosis of the child's reading-readiness and general school readiness, and then, on the basis of these diagnostic findings, establish a teaching situation synthesizing on-going diagnosis - treatment - and teaching for those children who could be expected to experience special reading and writing difficulties.

The design of the pilot study. Used diagnostic instruments. Results.

In order to test this hypothesis experimentally we first administered a pilot study, starting in 1958, with a population of first graders, which was followed-up to grade 3 in 1961. Certain organizational and pedagogical arrangements were made.

The four parallel classes of grade 1 at the Research school in the school year 1958-1959 were made equivalent as far as possible as regards number of pupils in the class, sexdistribution, general intelligence, reading readiness, parent's social and economic status, teacher-competence etc. Two classes were assigned to the experimental group at random and two to the control group.

In the population studied even 8 grade 1-classes for the other compulsory schools of Linköping and 8 grade 1-classes from rural districts in various parts of the province Östergötland were included.

The results of the school readiness tests could be expected to give only moderate prognostic value. Therefore supplementary testings of the pupils were carried out by using specially constructed reading- and

writing readiness test.

These tests aim to give an idea of the beginners' level as regards the ability of visual perception, auditive perception, phonetic analysis, sound synthesis, and vocabulary. Further on, the pupils' speech, memory span, motoric manipulation ability, vision and hearing were tested.

By interviewing the parents of the beginners according to special rating scales and forms, certain information was obtained about the behaviour and development of the children from birth to school start.

Data of this kind were mostly not quantifiable but it was nevertheless assumed that they might be of some value for the prediction of the children's reading- and writing development.

The children in the experimental group, as well as those in the control group, were given a battery of school readiness tests (may be considered to be a kind of intelligence tests) as well as tests of their ability and knowledge in reading, writing, and arithmetic, before entering school, at the age of 7. The results of the studies of the beginners' attainments and proficiency in reading, writing and arithmetic before the teaching of these subjects was begun at school, have been reported in a special volume. (Malmquist 1961.)

From the results of the used diagnostic instruments we anticipated that certain children would get reading disabilities, if no special auxiliary measures were taken.

From the very beginning these children were then given special help by a reading clinic teacher, in cooperation with the teacher in the classroom, if they were part of the experimental group, but not if they belonged to the control group.

The remedial teaching was given by a reading clinic teacher who had to take care of pupils with reading disabilities from in all 12 classes at the primary stage within her total service.

Out of her weekly service time she devoted 8 hours to children within the experimental group in grade 1, 6 hours in grade 2 and 5 hours in grade 3.

The study was continued until the children had completed the third grade, in 1961.

From the results of the tests given at the end of the first, second and third grades, we found that the experimental group had reached significantly better results on reading tests, as compared to the control group. The number of cases of reading disabilities, as to the operational definitions used, was much lower in the experimental group than in the control group.

The results from this experiment were evidently very promising. Judging from the experiences of this pilot study we can anticipate that this kind of approach might effectively contribute to the prevention of the occurrence of special reading- and writing disabilities.

The main study.
Sample. Design.

In order to test the results reached upon in the pilot study, we started, in 1961, a new study of the same character, and with about the same design, but on a larger scale.

In this study 11 cities with 41 classes and in all 938 pupils fulfilled the conditions put forward for the comparative study in the first grade. (Control group n = 466, Experimental group n = 472.)

12 classes were ruled out from the study during their 2nd and 3rd grade because the local school administrations did not wish to exclude control group pupils from receiving special remedial help as needed.

218 individual pupils moved to other schools or were absent from school during test sessions. Complete data for grades 1-3 are available for 9 cities with in all 29 classes and 454 pupils. (Control group n = 230, Experimental group n = 224.)

Each class was divided in two halves, made as equivalent as possible as regards age, number of pupils, sex, intelligence, socio-economic status of parents etc. The two half-classes had the same teacher. Remedial teaching by a reading clinic teacher was given only to certain pupils belonging to that half of the class, which was randomly assigned to the experimental group, however, and not to pupils belonging to the other half of the class - the control group.

Statistical treatment of data.

Raw scores on the different variables included in the investigation were transformed into standard scores (Z-values, according to the formula: $Z_i = (X_i - \bar{X})/S_x$).

Composite indexes have been calcutated for various groups of variables by means of addition or subtraction of standard scores.

We have tested the differences between the experimental group (41 half-classes with in all 472 pupils) and the control group (41 half-classes with in all 466 pupils) by using analysis of covariance. The effect of possibly remaining initial differences between the two matched groups would in this way be statistically eliminated.

We have also used a special method of covariance analysis not depending upon the assumption of common slope for group regression lines, "the matched regression estimates" method as described in Walker - Lev (1953).

A series of multiple regression - and correlation analyses with the purpose of investigating the prognostic value of different predictors as regards the level of reading and writing ability in grades 1-3.have been made.

Table 1. The prognostic values of the three predictors Visual letter perception, School maturity and Reading readiness when used to predict performance in different criterion variables.

Criterion				R^2-component due to predictor		
Grade	Type	R	R^2	Reading readiness (1)	School maturity (2)	Visual letter perc. (3)
1	Reading accuracy	.507	.257	.183	.043	.031
1	Reading compreh.	.622	.387	.226	.076	.085
1	Spelling	.553	.306	.251	.023	.032
2	Reading accuracy	.421	.177	.148	.007	.027
2	Reading Compreh.	.457	.209	.124	.042	.043
2	Spelling	.529	.280	.223	.013	.044
3	Reading accuracy	.400	.160	.130	.006	.023
3	Reading compreh.	.433	.186	.121	.062	.003
3	Spelling	.527	.277	.237	.002	.038

Note: The squared multiple correlation coefficients (R^2) have been divided into its components using the formula

$$R^2_{y.123} = r_{y1}b^*_{y1.23} + r_{y2}b^*_{y2.13} + r_{y3}b^*_{y3.12}$$

(Symbols and subscripts according to Walker-Lev, Statistical Inference, N.Y. 1953, chapt. 13, pp. 315 ff.)

By means of these analyses it has been demonstrated that the number of the predicting instruments could be considerably reduced with an only negligible deterioration as regards prognostic value.

A group of three variables has been crystallized. Each one can be expected to contribute significantly to a good prognosis. First, the battery of reading readiness tests, second, one of the five visual perception tests (visual letter perception) and third, the battery of school maturity tests. Out of 30 criterion variables registered (10 variables at the end of each of grades 1, 2 and 3) we have calculated, with the use of transformation procedures earlier mentioned, composite indexes as regards the following three major groups of variables: Reading accuracy, Reading comprehension and Spelling.

Some results.

1. Prognostic values of the predictors used.

The school maturity tests used in this study have notably lower predicting values than the reading readiness tests. This observation applies to each of the three specially studied achievement variables: Reading accuracy, Reading comprehension and Spelling.

Only as far as the prediction of Reading comprehension is concerned the school maturity tests seem to be of some value.

Out of the different predictors studied the Reading readiness variable has throughout given the highest prognostic values, regardless of which criterion variable was examined.

The simple pair correlations between reading readiness results and different criterion variables are between 0.48 and 0.55 in grade 1, between 0.41 and 0.51 in grade 2, and between 0.39 and 0.51 in grade 3.

Table 1 summarizes the findings as regards the prognostic values of the three predictors Visual letter perception, School maturity and Reading readiness.

Table 2. Coefficients of correlation between different criterion variables.

Type	Type Grade	R.A. 1	R.A. 2	R.A. 3	R.C. 1	R.C. 2	R.C. 3	SP 1	SP 2	SP 3
R.A.	1		.829	.774	.848	.734	.471	.659	.682	.637
R.A.	2	.829		.922	.720	.797	.492	.592	.701	.712
R.A.	3	.774	.922		.654	.768	.523	.554	.667	.716
R.C.	1	.848	.720	.654		.745	.502	.661	.626	.555
R.C.	2	.734	.797	.768	.745		.551	.541	.576	.613
R.C.	3	.471	.492	.523	.502	.551		.462	.449	.442
SP	1	.659	.592	.554	.661	.541	.551		.700	.645
SP	2	.682	.701	.667	.626	.576	.449	.700		.785
SP	3	.637	.712	.716	.555	.613	.442	.645	.785	

Note: 1. Coefficients computed from data for control group (n=230).

2. R.A. = Reading Accuracy
   R.C. = Reading Comprehension
   S.P. = Spelling

3. The squares of the diagonal parts of the matrix marked above contain coefficents of correlation between criterion variables of the same type.

The squared multiple correlation coefficient (R^2) can be interpreted as a measure of the proportion of the total criterion variance, explained by variances of the three predictors.

It is obvious that a substantial part of the criterion variance remains unexplained concerning all criterion variables.

The accuracy of prediction decreases with increasing grade level (1-3) as regards all types of criteria. Between grades 2 and 3, however, this decrease is rather small.

The prediction of Spelling is more accurate than the prediction of the two reading criteria with the exception as regards grade 1. The prediction of Spelling also seems to be the most stable in the long run (there is only a small difference noted between R^2 for grade 1 (.306) and for grade 3 (.277).

The table also shows the prognostic values of each predictor when used to predict performance in different criterion variables. Under all circumstancies Reading readiness is by far the most efficient predictor.

As regards all the nine criteria its prognostic value is between 58 and 86 per cent of the combined prognostic value of the three predictors.

The predictor School maturity is evidently of some value as predictor of Reading comprehension, but it is of small or no value as predictor of Reading accuracy and Spelling - especially in grades 2 and 3 (R^2-components between .002 and .013).

The predictor Visual letter perception is obviously of some value as predictor of Spelling and Reading accuracy in grades 1-3. As a predictor of Reading comprehension it has some value in grades 1 and 2, but practically no value in grade 3 (R^2-component .003).

In a relatively long term prediction (over a three year period) it seems reasonable to reduce the number of predictors to two for each criterion: namely Reading readiness and Visual letter perception as predictors of Reading

accuracy and Spelling, and Reading readiness and School maturity as predictors of Reading comprehension.

2. Stability of different types of criteria through the grades.

Table 2 shows the coefficients of correlation between all pairs of criterion variables.

Of special interest are the coefficients of correlation between criteria of the same type at different grade levels (these coefficients are found in the 3 x 3 squares along the diagonal of the total matrix).

The criterion Reading accuracy is obviously the most stable of the three types with a correlation of .774 between grade 1 and grade 3 measures. This coefficient may in fact be interpreted as a long term retest coefficient, since this criterion is measured by means of the same test battery at all three grade levels.

The criteria Reading comprehension and Spelling have been measured through different tests at different grade levels and this may partly explain the lower stability (correlation between grade 1 and grade 3 measures: .645 for Spelling and .502 for Reading comprehension).

The rather low stability of Reading comprehension measures may also be due to an increasing complexity in the set of factors that influence reading comprehension performance. The decrease from grade level to grade level in correlation between Reading accuracy and Reading comprehension (.848 in grade 1, .797 in grade 2 and .523 in grade 3) also seems to indicate that these abilities become more and more differentiated.

Correlations between Reading comprehension and Spelling at successive grade levels show the same tendency (.661 in grade 1, .576 in grade 2 and .442 in grade 3). Correlations between Reading accuracy and Spelling on the other hand do <u>not</u> show any such tendency (.659 in grade 1, .701 in grade 2 and .716 in grade 3).

Analyses of differences between the total experimental group and the control group regarding the criterion Spelling, grade 3 (y), as a function of reading readiness (x).

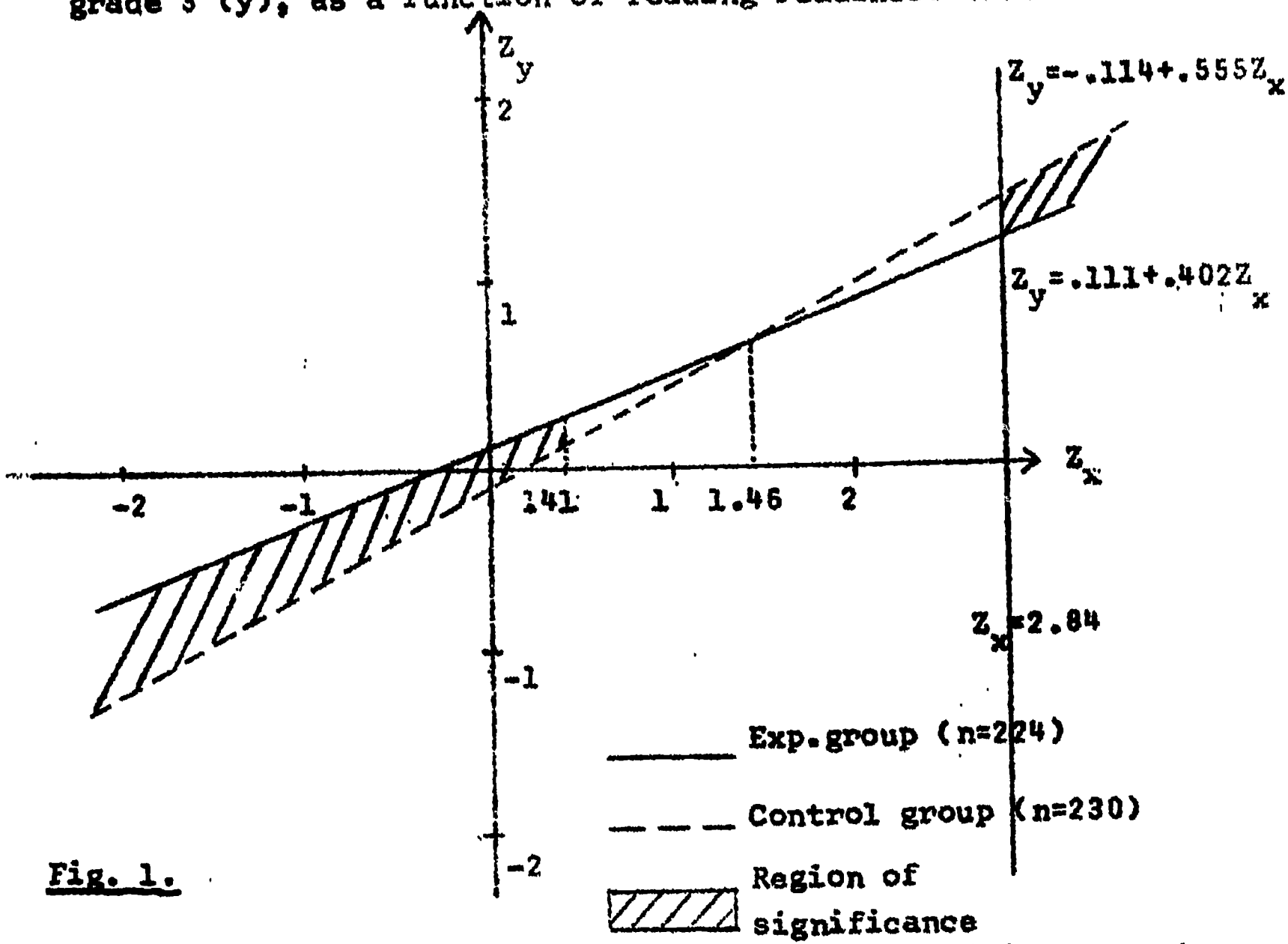

Fig. 1.

Note: Z_x values limiting the regions of significance and non-significance have been computed according to the method of "matched regression estimates" as described in Walker-Lev, Statistical inference, N.Y. 1953.

Comment: Two different regions of significance have been found. The upper region contains only one case in the control group and is therefore disregarded.

The lower region of significance contains more than 50 % of the total number of cases (454).
Within this region the experimental group pupils are superior in spelling ability (as measured in this study) in comparison with control group pupils at corresponding reading readiness levels.

It should be noticed that out of the 78 "reading clinic" pupils in the experimental group 72 are found within the lower region of significance.

It therefore seems reasonable to assume, that the reading comprehension ability during the primary stage becomes more and more differentiated from the two abilities - Reading accuracy and Spelling while these two abilities remain quite closely correlated to one another throughout the period.

3. Effects of remedial teaching.

Table 3 shows group means and differences as regards the three predictors and the nine criteria studied.

The control group was superior in two out of three predictors, although the differences are nonsignificant.

The experimental group was superior in all nine criterion variables with significant differences in five criteria: Reading accuracy, grades 1, 2 and 3, Spelling, grade 2 and 3.

The aim of the remedial teaching has been to prevent or eliminate reading and writing difficulties among pupils in the experimental group.

The criteria Reading accuracy and Spelling seems to be most fitted to indicate reading and spelling difficulties at this level. The fact that the analysis of these two types of criteria has yielded significant group mean differences favouring the experimental group in 5 cases of 6 strongly supports the hypothesis that the remedial teaching has had the expected effect.

The data also support the hypothesis, that there is an additive increase in this effect from grade level to grade level, especially when the criterion is Reading accuracy (group mean differences: +.191 in grade 1, +.236 in grade 2 and +.255 in grade 3).

The grade 3 criteria can be regarded as the ultimate criteria of reading and writing performance within this study. Group mean differences in the three criteria have been studied through covariance analysis using all three predictors Reading readiness, School maturity and Visual letter perception.

Table 3. Group means, group mean differences and significance of group mean differences. (n=454)

	Variable	Means Exp. group	Means Contr. group	Diff. E-C	Signif-icance
Predictors:	Reading readiness	+0.026	+0.026	-0.052	n.s.
	School maturity	+0.034	-0.034	+0.068	"
	Visual letter perc.	-0.049	+0.048	-0.097	"
Criteria:	Reading accuracy, gr.1	+0.097	-0.094	+0.191	$p < 0.05$
	- " - , gr.2	+0.120	-0.116	+0.236	$p < 0.05$
	- " - , gr.3	+0.129	-0.126	+0.25	$p < 0.01$
	Reading comprehension, gr.1	+0.078	-0.076	+0.154	n.s.
	- " - , gr.2	+0.066	-0.064	+0.130	"
	- " - , gr.3	+0.060	-0.059	+0.119	"
	Spelling, grade 1	+0.064	-0.062	+0.126	"
	-"- , grade 2	+0.104	-0.100	+0.204	$p < 0.05$
	-"- , grade 3	+0.101	-0.100	+0.201	$p < 0.05$

These analyses have yielded highly significant F-values as regards group mean differences in Reading accuracy (F=9.44) and Spelling (F=6.96) but a non significant F-value for Reading comprehension (F=2.94).

As the correlation and regression analyses in some cases yielded lower within group regression coefficients for the experimental group than for the control group, we have also used a method of "matched regression estimates" (cf Walker-Lev, 1953) studying Reading accuracy and Spelling grade 3 with Reading readiness as a single predictor.

As regards the criterion variable Reading accuracy this analysis did not yield any significance region in the predictor, i.e. the superiority of the experimental group in this criterion is about the same at all reading readiness levels.

The corresponding analysis of Spelling grade 3 did yield a region of significance (experimental group pupils were better than control group pupils at reading readiness levels below +.4z) and a region of nonsignificance (no significant difference between groups at reading readiness levels above +0.4z).

Thus the total experimental group superiority in spelling ability is mainly due to a superiority of experimental group pupils with low or medium initial reading readiness level. As 72 out of 78 "clinic" pupils belong to this category, it seems reasonable to conclude that this finding supports the hypothesis that the remedial teaching has significantly increased the spelling ability of the "clinic" pupils.

Out of the 78 pupils from the experimental group who received remedial instruction 42 had initial school maturity test results above -0.5z.

At the final testing session in grade 3 only 7 out of these 42 pupils reached results as regards Reading Accuracy below -1.0z.

Using our operational definition of special reading disabilities we find that 83 per cent of the cases identified as potential reading disability cases were prevented from occurring.

The study further shows that the optimistic hopes of totally eliminating reading disability cases through remedial procedures such as used within the experimental group were not fulfilled.

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