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AUTHOR Creemers, Bert
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ABSTRACT

This paper discusses the results of a literature study concerning the investigation of models of reading and theories of learning to read, method comparison research, and research on teacher effectiveness. It relates the findings of these studies to a study of teaching behavior in the process of teaching children to read. This latter study included 31 teachers and 671 first grade pupils, selected according to age, school career, reading ability, and completeness of research data. From each teacher 35 lessons were observed during the first six months of reading instruction in the first grade. The observation scale used for studying the task behavior resulting from the task demands of the method consisted of 44 categories (32 tasks, of which six had three forms--auditory, visual, and auditory and visual). The results indicated that teachers can be separated into groups on the basis of their task setting behaviors, that a relationship exists between teaching styles and the achievement of pupils, and that such relationship generally do not appear to be different among groups of pupils with different initial characteristics. Seven tables involved in the study are included. (WR)

Maliebaan 103, Utrecht, The Netherlands.

METHOD AND ACHIEVEMENT IN EARLY READING

Bert Creemers
State University of Utrecht
Dept. of Educational Research

1. Introduction.

In so far as the question of evaluating various alternatives arises with regard to instruction and teaching in general, it also applies to the instruction and teaching of reading in particular.

Within the field of reading instruction different factors can be distinguished which have been, and still are being, investigated; amongst others these are models of reading and learning to read, reading methods, objectives and styles of teaching.

In the next section we shall give the results of the literature study concerning

1. The investigation of models of reading and theories of learning to read.
2. Method comparison research.
3. Research on teacher effectiveness.

The comments of several authors and from ourself are the startingpoint for the theoriebuilding in section 3. The sections 4 and 5 give the results of the investigation based on this theory. Finally we shall discuss the results of our research in section 6.

In the following it may be gradually appear that the title of this paper does not fit after all the content i.e. the investigation, however we started with the method.

2. Research on theories and methods for learning to read and teacher effectiveness

This section reports on the results of the literature study which provided the background to the investigation. We give only a brief summary of the results and refer to the several reviews of the research on the different topics.

1. Research based on theories and models of reading and learning to read. It would be a fruitful approach to the study of reading method if as a first step a valid theory or model of the reading process would be developed. From these theoretical formulations, models for initial reading and the learning process could then be constructed and empirically tested. In this way, a body of knowledge concerning the reading proces would be construed, providing a firm base for the construction of optimized reading methods. Also, such a body of knowledge could be used as a starting point for research into the methods by which reading is taught at the present moment.

Our review of the existant literature substantiates the findings of Williams (1973) that, although quite some theories of reading are indeed formulated, theories of the learning process are almost lacking. Moreover, these theories and models have as yet been insufficiently substantiated by empirical evidence.
We have to conclude, then, that at present there are no theories and models for initial reading on which "better" reading methods can be based or which could be used in descriptive research of initial reading.

2. Method comparison research.
One of the approaches to reading research is the comparison of the many different methods schools use in teaching reading to young children. In fact, the field of reading research has for a long period been dominated by investigations to discover

which method is the most effective. In other words, this implies a form of evaluative research in which pupil achievement is criterion. Investigations in which methods are compared can be carried out between methods derived from different basic forms or between methods which share a common basic form. The latter appears most meaningful since even methods which share a common basic form can differ very greatly in their actual construction. In the Netherlands, van Oorsouw (1971) conducted an investigation of this type into two structural reading methods.

Method comparison investigations have also been conducted in other countries where other basic forms and methods, displaying even greater differences, are in use.

Among others Müller (1964), Chall (1967), Wittick (1968) and Della-Piana & Endo (1973) give reviews of such research. The results of the method comparative investigations did not provide evidence in favour of any one specific method. As Robinson has demonstrated in 1968, many comparative investigations contain serious shortcomings.

It is evident that in future, research should also take the teacher into consideration (e.g. Bond & Dijkstra, 1967; 123, Robinson, 1968; 407).

3. Research into teacher effectiveness.

In the past, there has been much research to establish the influence of specific personality variables of the teachers and their teaching activities on the achievements of pupils. The results of this research are, as appears from the reviews of Rosenshine (1971, a, b, c) and Rosenshine & Furst (1971, 1973), extremely disappointing. According to these authors only a limited number of variables can be considered worthy of further investigation.

Others e.g. Bloom (1972), Davies (1972) and, in the field of reading instruction, Artley (1969), state that research should, in future, be directed towards what teachers do, i.e. concrete teaching behaviour.

In summarizing the literature study, it seems that it is worthwhile to continue with theoretical formulations and research into teaching behaviour within a specific curriculum or method, and within a specific model of (initial) reading and also to investigate the relationship between this teaching behaviour and the achievements of pupils.

3. A theory about teaching reading within a specific method.

Taking the conclusions of the literature study as point of departure, a preliminary theory with regard to teaching behaviour in the process of learning to read is formulated.

This theory is limited to teaching behaviour within a specific curriculum, in this case the reading method "Zo/Veilig leren lezen". The central point of the theory is the distinction between two different components of the teaching act. The first component consists of task setting behaviour, the second component refers to optimization behaviour.

The task setting component includes all actions by the teacher through which in his opinion the objectives as stated in the teaching method can be attained. Tasks, in this definition, are specific behaviours the teacher demands of the children in order that they attain objectives. Since we limitated ourselves to one specific teaching method all task setting behaviours were derived from the objectives of this method. The behaviour manifested within this component is the result of individual selection on the part of each teacher.

The optimization component consists of the actions or qualities of the tasks whereby the teacher is able to improve on or accelerate the learning process towards the given objectives. The actual form assumed

by the optimization behaviour is the result of the individual selection of each teacher from the optimization component.

The methodological task setting component is that which is peculiar to and distinctive of those teachers who use the same method. Within this group, differences can arise in the manner in which the task setting component is put into practice, however, for the present we regard this as being less important. Far more important are the differences in the frequency displayed by teachers with regard to the task setting component. This frequency of application is not exclusively confined to the individual since there are whole groups of teachers who differ (as a group) from others on grounds of frequency of application of the tasks as demanded by a method.

Such similarities, which include the total configuration of the task as well as the frequencies within that whole, are here called teaching styles. A teaching style is teaching behaviour characterized by the sum total of the tasks set by a method, which are carries out with a specific frequency.

The relationship between teaching style and optimization behaviour is not yet clearly defined. For the time being, the two concepts (i.e. teaching style and optimization behaviour) are considered as being separate from each other.

In our opinion the differences in teaching styles lead to differences in pupil achievement which cannot be fully accounted for by initial differences in pupil characteristics such as sex, social milieu and intelligence. In the evaluation of the different teaching styles distinguished, an investigation will be made of descriptive value of the concept "teaching style". Furthermore, based on the experiences with the Attitude Treatment Interaction research, an investigation

will be carried out to determine the relationship between teaching styles and the achievements of different pupils distinguished on grounds of sex, intelligence and social milieu.

The following questions were framed on the basis of theoretical formulations, which thus take on a concrete form for an investigation within the method "Zo/Veilig Leren Lezen":

1. Is it possible to distinguish groups of teachers who use the method "Zo/Veilig Leren Lezen" on grounds of frequencies of application of aspects of the tasks demanded by the method?
2. Does a relationship exist between teaching styles on one hand and reading and language achievements of pupils on the other?
3. Are the relationships between teaching styles and reading and language achievements different for groups of pupils with different initial variables such as social milieu, intelligence and sex?

4. Design and instruments of the investigation.

In the following the operationalization and instrumentalization of some central terms are given:

- methodological task setting component: i.e. the totality of all tasks set by a specific method. To establish whether the tasks set by the method had been adequately identified and described in the method analysis, the original method constructor was consulted and asked to give his expert opinion on this matter. The investigation into the task setting behaviour was conducted by means of an observation scale.

  The observation scale for studying the task behaviour resulting from the task demands of the method consisted of 44 categories, (32 tasks, of which 6 took 3 forms, namely: auditory, visual and auditory + visual).

For example:

Task setting 13: reading with sharpened articulation. The teacher presents auditory or visually a word to the pupils and asks them further to pronounce one of the letters of that word.

Each task is rated on a 5-point scale to enable an indication to be made of the degree to which the execution of tasks by the teacher was bound by the method.

The reliability of the scale appeared to be reasonably high. Furthermore the 6 observers ratings of the method agreed to a high degree (83%) with the standard criterion (set by the instructor).

- teaching styles: the definition was formulated on the basis of the tasks set by the method which were executed with a specific frequency by a group of teachers.
- optimization component: i.e. the summation of all those actions distinguished from the literature study as leading to optimization.

The investigation into the optimization behaviour was carried out by means of a rating scale.

The rating scale for the investigation of the optimization behaviour consisted originaly of 35 items, which concerned: language behaviour, classroom climate and the organization of the teaching-learning situation.

For example:

Item 18: the teacher suddenly interrupts the activities of one pupil to restimulate the attention of another.

After the analysis of the discrimination power and reliability, 13 items were retained. For a further description of the teacher groups, use was made of:

* data concerning the language behaviour of the teacher, i.e. the number of words used in average by a teacher during the first three,middle three and last three minutes of a half-our lesson.

* interview material concerning attitude towards and knowledge of the method.

The evaluation of the teaching styles was carried out in an investigation into the relationship between the teaching styles and pupil achievement.

Indications for potentialities present in the pupils which were investigated in this study, are:

- sex
- milieu
- intelligence
- attitude towards reading

The evaluation was carried out with regard to a wide scale of objectives (i.e. technical reading ability, reading comprehension, attitude towards reading and language). A formative and summative evaluation was made of the technical reading ability.

For the pupil investigation, use was made of existing instruments i.e. for the investigation of intelligence, reading skill, reading comprehension and spelling ability. The reliability of these instruments for investigating initial characteristics and pupil achievements was high.

Further tests developed particularly for this study were:

- Reading Attitude Scale

  The pupil is required to make his choice from each of 18 alternative situations in which (initial) reading is represented in one way or another. The reliability (KR20) of the scale was found to be .82.

- Criterion - referenced tests

  Criterion - referenced tests were designed for each of the 5 reading books of the method. The reliability (KR20) of the tests was very high (about .90).

- Language Test

The pupils are here required to place the words of a sentence in the proper sequence. Reliability was calculated at .94.

The investigation included 31 teachers and 671 pupils, selected according to age, school career, reading ability and completeness of research data. From each teacher 35 lessons were observed during the first 6 months of reading instruction in the first grade. Evaluation of pupil achievement took place at several points in the year.

5. The results of the investigation.

First it was established whether the teachers both in their own opinion and that of the observer had been influenced in their teaching behaviour by the observation procedures. This appeared not to be the case. In the judgement of the observer it appeared that, in their execution of the methodological tasks, the teachers differed neither from each other nor from the method. This is important, since it can now be assumed that the teachers were comparable as far as their methodological task setting behaviour was concerned. For each of the teachers a standard lesson was established i.e. the frequency with which the tasks demanded by the method were applied in a lesson of 30 minutes. A cluster analysis was carried out on the standard lessons of the 31 teachers in order to establish the groups which contained the most similarities qua task setting behaviour.

The cluster analysis on a correlation matrix showed that the teacher groups did not differ clearly from one another (see table 1.)

Insert table 1 about here

The cluster analysis on a mean squared distance matrix distinguished definite groups of teachers (see table 2.)

Insert table 2 about here

The analysis was continued with those teachers who could be allocated to a specific group (see table 3)

Insert table 3 about here

For each group of teachers a profile of the standard lesson was computed. The total number of tasks executed by teachers with a specific frequency is called a teaching style. The 8 styles can described briefly as follows:

Teaching style 1.

The teaching behaviour of this style is characterized by the fact that there are, in comparison with the other styles, less task settings concerning the reading of the children but more task settings concerning the writing of the children.

In general there are few task settings directed at the learning, analysing and synthesizing new words.

The auditory aspect of the task settings gets only few attention.

Task settings directed at the learning of the language also happen only a few times.

Teaching style 2.

This teaching style is characterized by a strong emphasis on the reading of the children self. Task settings directed at the learning of new words, the analysis and synthesis of these new words only happen

a few times. The accent in analysis and synthesis lies on the visual aspects and also tasks for associative learning. Here too there is a relative lack of attention for language learning.

Teaching style 3.

This teaching style is characterized by the fact that the teacher not only gives task settings on reading and writing but also sets tasks directed on the learning of new words and the analysis and synthesis of these words.
There is also attention for technical exercises, which may be support the learning of reading.

Teaching style 4.

This teaching style pays less attention at reading and exercises which support reading. The main emphasis lies on language development.

Teaching style 5.

This style includes teaching behaviour characterized by task setting which concern the writing by teachers and children. Other task settings for example the learning of new words happen relatively fewer.
In this style there is a balance between the auditory and visual aspect in the several exercises.

Teaching style 6.

This teaching style is characterized by the great emphasis on the analysis of new words into components. There is not much attention for language development, the learning of new words and the synthesis of letters or sounds into words.

Teaching style 7.

Centrally in this style is the reading of children. The teacher sets much tasks which demand that the children read. Reading comprehension gets also much attention.
Task settings directed at the writing of the children and association exercises occur only a few times.

Teaching style 8.

There are in this style only a few task settings directed at the learning of new words, the analysis and synthesis of them and also few task settings directed at language development. There is a strong emphasis on the reading of the children self. The background of this style seems to be "You learn to read only by reading".

As could be expected from the results of the cluster analysis, these teaching styles differ from each other. The difference being found does not concern the configuration of the methodological tasks but the frequency within a more or less similar configuration.
There was no agreement as regards optimization behaviour between teachers who taught with the same teaching style. The similarities and differences in optimization behaviour cut across the different teaching styles.
The similarities and differences also seem to cut across teaching style where satisfaction with and knowledge of method are concerned. Within teaching styles, there appeared to be a similarity between teachers only with regard to methodological task setting activities. These teachers differ from each other in other aspects of teaching.

In the investigation of the effects of teaching styles multivariate analysis of variance was used and in the case of the reading attitude multivariate covariate analysis.

Testing of hypothesis takes place on three levels:

1. On the first level is established whether the effects of teaching style deviate significantly from 0. If so, then:
2. On the second level is investigated whether the effect of a specific teaching style minus the effect of each subsequent teaching style differs significantly from 0. If so, then:
3. On the third level the effect of each teaching style is compared individually with every subsequent teaching style.

These analysis are carried out separately using the following pupil characteristics

- sex
- social milieu
- intelligence (the mathematical model did not coincide with the empirical data, therefor there are no results of the MANOVA in this case).

These analysis were also carried out individually for 4 groups of tests:

- criterion-referenced tests
- norm-referenced tests
- tests for reading comprehension
- language tests

For the example the tables 4, 5, 6 and 7 give the results of the MANOVA with sex as pupil characteristic.

Insert tables 4, 5, 6 and 7 about here

On the first level the effect of teaching style mostly appears to be significant at the 1% level. A number of significant results were also obtained on the second and third level.

This indicates that the effect of specific teaching styles minus the effect of subsequent teaching styles differs significantly from 0. These other teaching styles are distinguished from each other on the basis of their effect.

On the third level the effects of certain teaching styles appear to be similar in their significant/non-significant differences with regard to other teaching styles.

This is however not consistent among either the different categorization criteria or the different groups.

A significant teaching effect also appears in the reading attitude. The interaction-effect of teaching style and the categorization criterion (the pupil characteristics) does not, on the whole, deviate from 0.

For the present, while research based on theories and models for (initial) reading fails to provide information concerning the relationship between tasks and pupil achievement, interpretation is difficult and unreliable. It can only be assumed that the totality of methodological task settings which are executed with a specific frequency by a group of teachers (the teaching style) must be held responsible for the significance/non-significance.

Generally spoken teaching styles 1, 3, 7 and 8 lead to lower pupil achievements than the other styles. Teaching style 8 also leads to lower results on the reading attitude scale. It seems to be that teaching which includes a low frequency of task settings or teaching that puts the only accent on reading by the children self leads to inferior results.

6. Discussion.

First, the research questions posed on the basis of theoretical formulations in section 3 are to be answered.

- It appears that teachers can be distinguished into groups on grounds of their task setting behaviour (the teaching style).
- A relationship exists between these teaching styles and the achievements of pupils.
- Such relationships generally do not appear to be different among groups of pupils with different initial characteristics.

Cross-validation by way of a replication study is needed. Furthermore in order to facilitate the interpretation of the research results, an investigation should be made into the relationship between specific tasks and the achievements of pupils. For the time being those who are involved in the field of practical teaching should use the results with caution.

Even with the restrictions mentioned above the results of the investigation have some importance for educational practice.

It seems to be worthwile to give attention in the development of curricula and methods for initial reading on the promotion of more successfull teaching styles. This is possible by describing the teaching styles within a specific method or curriculum which lead to better results. In the investigation with the method "Zo/Veilig Leren Lezen" it appears that teaching styles with diverse task settings lead to better results. This conclusion can be inserted in new edition of the teacher manual. In the pre-service and in-service training of teachers the more successfull teaching styles can be learned.

The question remains whether it is worth the money, time and manpower to make such a profound study of each curriculum and method as we undertook in this case.

I think there is an other way of approaching the problem. I propose to make a better use of the teacher's guide which accompanies the learning materials. In their present form these guides often give only more or less comprehensive directions for the teaching behaviour. I think that if these guides would give more information concerning goals, processes and task settings of the method the possibility that less suitable or even incorrect teaching styles are generated by the teacher, is minimalized. Such information sets clear boundaries for successful teaching behaviour, even if the teacher does not know all possible teaching styles.

In this case one may even avoid one of the most striking results of our investigation, i.e. that most teachers use only a very few number of the prescribed task settings. Each individual teacher in our investigation uses only the half of the possible task settings.

I think one has to make clear for teachers that the teaching of reading is more than they think at this moment. Then maybe there will be a differentiated teaching behaviour within the limits of a specific curriculum.

This is the reason why I think after all a better title of this paper should be "Teacher behaviour and pupil achievement".

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METHOD AND ACHIEVEMENT IN EARLY READING

Bert Creemers
State University Utrecht
Dept. of Educational Research
The Netherlands

Table 1. Results of a hierarchical cluster analysis on a correlationmatrix

Cluster	1e participant	2e participant	intra-cluster correlation	number of teachers
1001	18	12	.975	2
1002	21	17	.973	2
1003	27	25	.969	2
1004	22	9	.969	2
1005	11	4	.966	2
1006	1004	5	.964	3
1007	1001	7	.962	3
1008	1003	16	.959	3
1009	23	13	.952	2
1010	1002	1007	.951	5
1011	1006	20	.946	4
1012	1008	1010	.942	8
1013	29	15	.941	2
1014	1009	19	.941	3
1015	28	1	.938	2
1016	1012	1014	.931	11
1017	30	1013	.928	3
1018	1011	10	.928	5
1019	31	24	.921	2
1020	1018	8	.917	6
1021	26	2	.914	2
1022	1016	1021	.912	13
1023	1020	1005	.909	8
1024	1017	1022	.906	16
1025	1019	3	.905	3
1026	1024	1015	.883	18
1027	1025	1026	.880	21
1028	1027	6	.860	22
1029	1028	1023	.855	30
1030	1029	14	.781	31

Table 2. Results of a hierarchical cluster analysis on a mean squared distance matrix

Cluster	1e participant	2e participant	intra-cluster MSD	number of teachers
1001	25	27	3.34	2
1002	12	18	3.46	2
1003	17	21	3.64	2
1004	1003	22	4.15	3
1005	5	10	4.33	2
1006	16	1001	4.34	3
1007	1002	1006	4.87	5
1008	7	28	5.88	2
1009	13	30	5.96	2
1010	29	1004	5.12	4
1011	26	1009	6.71	3
1012	4	11	7.09	2
1013	23	24	7.68	2
1014	19	31	8.05	2
1015	2	1011	7.48	4
1016	1007	1010	6.94	9
1017	6	1014	9.44	3
1018	1015	1016	8.66	13
1019	3	1013	9.76	3
1020	1	1008	9.58	3
1021	1017	1018	9.61	16
1022	20	1012	10.34	3
1023	9	1005	10.36	3
1024	1020	1021	10.68	19
1025	8	1022	14.91	4
1026	1019	1024	11.66	22
1027	1023	1025	15.11	7
1028	14	1026	12.20	23
1029	1027	1028	17.06	30
1030	15	1029	18.35	31

Table 3. Distinguished teacher groups (on account of differences in the frequency of task settings

Teacher group	Clusternumber	number of teachers
1	1007	5
2	1010	4
3	1015	4
4	1017	3
5	1020	3
6	1019	3
7	1022	3
8	1005	2

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Table 4. Results of the testing of hypotheses for teaching style x sex x achievements of pupils on criterion-referenced tests.

Hypotheses	df		F-ratio
first level			
1. H_0: Sex-,style- and interaction effect = 0	105	3274	2.14**
2. H_0: Interaction effect = 0	49	2594	1.41*
3. H_0: Sex effect = 0	7	510	3.84**
4. H_0: Teaching style effect = 0	49	2594	2.67**
second level			
5. H_0: $\begin{pmatrix}\alpha_1 - \alpha_2\\ \alpha_1 - \alpha_8\end{pmatrix} = 0$	49	2594	2.67**
6. H_0: $\begin{pmatrix}\alpha_2 - \alpha_3\\ \alpha_2 - \alpha_8\end{pmatrix} = 0$	42	2396	2.62**
7. H_0: $\begin{pmatrix}\alpha_3 - \alpha_4\\ \alpha_3 - \alpha_8\end{pmatrix} = 0$	35	2148	2.89**
8. H_0: $\begin{pmatrix}\alpha_4 - \alpha_5\\ \alpha_4 - \alpha_8\end{pmatrix} = 0$	28	1840	2.21**
9. H_0: $\begin{pmatrix}\alpha_5 - \alpha_6\\ \alpha_5 - \alpha_8\end{pmatrix} = 0$	21	1465	2.27**
10. H_0: $\begin{pmatrix}\alpha_6 - \alpha_7\\ \alpha_6 - \alpha_8\end{pmatrix} = 0$	14	1020	2.17**
11. H_0: $\alpha_7 - \alpha_8 = 0$	7	510	1.87
third level			
12. H_0: $\alpha_1 - \alpha_2 = 0$	7	510	3.83**
13. H_0: $\alpha_1 - \alpha_3 = 0$	7	510	.71
14. H_0: $\alpha_1 - \alpha_4 = 0$	7	510	3.72**
15. H_0: $\alpha_1 - \alpha_5 = 0$	7	510	3.92**
16. H_0: $\alpha_1 - \alpha_6 = 0$	7	510	3.14**
17. H_0: $\alpha_1 - \alpha_7 = 0$	7	510	2.26*
18. H_0: $\alpha_1 - \alpha_8 = 0$	7	510	2.55*
19. H_0: $\alpha_2 - \alpha_3 = 0$	7	510	5.26**
20. H_0: $\alpha_2 - \alpha_4 = 0$	7	510	1.12
21. H_0: $\alpha_2 - \alpha_5 = 0$	7	510	.93
22. H_0: $\alpha_2 - \alpha_6 = 0$	7	510	1.90
23. H_0: $\alpha_2 - \alpha_7 = 0$	7	510	1.81
24. H_0: $\alpha_2 - \alpha_8 = 0$	7	510	1.18
25. H_0: $\alpha_3 - \alpha_4 = 0$	7	510	5.27**
26. H_0: $\alpha_3 - \alpha_5 = 0$	7	510	5.65**
27. H_0: $\alpha_3 - \alpha_6 = 0$	7	510	3.82**
28. H_0: $\alpha_3 - \alpha_7 = 0$	7	510	2.41*
29. H_0: $\alpha_3 - \alpha_8 = 0$	7	510	3.01**
30. H_0: $\alpha_4 - \alpha_5 = 0$	7	510	1.83
31. H_0: $\alpha_4 - \alpha_6 = 0$	7	510	3.16**
32. H_0: $\alpha_4 - \alpha_7 = 0$	7	510	1.50
33. H_0: $\alpha_4 - \alpha_8 = 0$	7	510	1.98
34. H_0: $\alpha_5 - \alpha_6 = 0$	7	510	2.25*
35. H_0: $\alpha_5 - \alpha_7 = 0$	7	510	2.67**
36. H_0: $\alpha_5 - \alpha_8 = 0$	7	510	2.10*
37. H_0: $\alpha_6 - \alpha_7 = 0$	7	510	2.42*
38. H_0: $\alpha_6 - \alpha_8 = 0$	7	510	2.19*

* significant at .05 level
** significant at .01 level

Table 5. Results of the testing of hypotheses for teaching style x sex x achievements of pupils on norm-referenced tests.

Hypotheses	df		F-ratio
first level			
1. H_0: Sex-, style- and interaction effect = 0	45	1569	3.29**
2. H_0: Interaction effect = 0	21	1517	1.48
3. H_0: Sex effect = 0	5	528	5.39**
4. H_0: Teaching style effect = 0	21	1517	4.68**
second level			
5. $H_0: \begin{pmatrix} \alpha_1 - \alpha_2 \\ \alpha_1 - \alpha_8 \end{pmatrix} = 0$	21	1517	4.68**
6. $H_0: \begin{pmatrix} \alpha_2 - \alpha_3 \\ \alpha_2 - \alpha_8 \end{pmatrix} = 0$	18	1494	4.75**
7. $H_0: \begin{pmatrix} \alpha_3 - \alpha_4 \\ \alpha_3 - \alpha_8 \end{pmatrix} = 0$	15	1458	5.07**
8. $H_0: \begin{pmatrix} \alpha_4 - \alpha_5 \\ \alpha_4 - \alpha_8 \end{pmatrix} = 0$	12	1397	4.85**
9. $H_0: \begin{pmatrix} \alpha_5 - \alpha_6 \\ \alpha_5 - \alpha_8 \end{pmatrix} = 0$	9	1285	4.82**
10. $H_0: \begin{pmatrix} \alpha_6 - \alpha_7 \\ \alpha_6 - \alpha_8 \end{pmatrix} = 0$	6	1056	3.61**
11. $H_0: \alpha_7 - \alpha_8 = 0$	3	528	1.67
third level			
12. $H_0: \alpha_1 - \alpha_2 = 0$	3	528	6.90**
13. $H_0: \alpha_1 - \alpha_3 = 0$	3	528	.83
14. $H_0: \alpha_1 - \alpha_4 = 0$	3	528	3.54*
15. $H_0: \alpha_1 - \alpha_5 = 0$	3	528	10.77**
16. $H_0: \alpha_1 - \alpha_6 = 0$	3	528	6.39**
17. $H_0: \alpha_1 - \alpha_7 = 0$	3	528	2.72*
18. $H_0: \alpha_1 - \alpha_8 = 0$	3	528	.77
19. $H_0: \alpha_2 - \alpha_3 = 0$	3	528	5.82**
20. $H_0: \alpha_2 - \alpha_4 = 0$	3	528	6.76**
21. $H_0: \alpha_2 - \alpha_5 = 0$	3	528	1.12
22. $H_0: \alpha_2 - \alpha_6 = 0$	3	528	1.99
23. $H_0: \alpha_2 - \alpha_7 = 0$	3	528	5.55**
24. $H_0: \alpha_2 - \alpha_8 = 0$	3	528	3.44*
25. $H_0: \alpha_3 - \alpha_4 = 0$	3	528	6.32**
26. $H_0: \alpha_3 - \alpha_5 = 0$	3	528	8.41**
27. $H_0: \alpha_3 - \alpha_6 = 0$	3	528	5.26**
28. $H_0: \alpha_3 - \alpha_7 = 0$	3	528	4.74**
29. $H_0: \alpha_3 - \alpha_8 = 0$	3	528	1.94
30. $H_0: \alpha_4 - \alpha_5 = 0$	3	528	10.89**
31. $H_0: \alpha_4 - \alpha_6 = 0$	3	528	6.84**
32. $H_0: \alpha_4 - \alpha_7 = 0$	3	528	.59
33. $H_0: \alpha_4 - \alpha_8 = 0$	3	528	1.17
34. $H_0: \alpha_5 - \alpha_6 = 0$	3	528	2.67*
35. $H_0: \alpha_5 - \alpha_7 = 0$	3	528	9.16**
36. $H_0: \alpha_5 - \alpha_8 = 0$	3	528	6.57**
37. $H_0: \alpha_6 - \alpha_7 = 0$	3	528	4.07**
38. $H_0: \alpha_6 - \alpha_8 = 0$	3	528	4.96**

* significant at .05 level
** significant at .01 level

Table 6. Results of the testing of hypotheses for teaching style x sex x achievements of pupils on a reading comprehension test.

Hypotheses	df		F-ratio
first level			
1. H_0: Sex-, style- and interaction effect = 0	15	562	4.12**
2. H_0: Interaction effect = 0	7	562	1.32
3. H_0: Sex effect = 0	1	562	8.78**
4. H_0: Teaching style effect = 0	7	562	4.22**
second level			
5. $H_0 : \begin{pmatrix} \alpha_1 - \alpha_2 \\ \alpha_1 - \alpha_8 \end{pmatrix} = 0$	7	562	4.22**
6. $H_0 : \begin{pmatrix} \alpha_2 - \alpha_3 \\ \alpha_2 - \alpha_8 \end{pmatrix} = 0$	6	562	3.69**
7. $H_0 : \begin{pmatrix} \alpha_3 - \alpha_4 \\ \alpha_3 - \alpha_8 \end{pmatrix} = 0$	5	562	3.88**
8. $H_0 : \begin{pmatrix} \alpha_4 - \alpha_5 \\ \alpha_4 - \alpha_8 \end{pmatrix} = 0$	4	562	1.39
9. $H_0 : \begin{pmatrix} \alpha_5 - \alpha_6 \\ \alpha_5 - \alpha_8 \end{pmatrix} = 0$	3	562	1.85
10. $H_0 : \begin{pmatrix} \alpha_6 - \alpha_7 \\ \alpha_6 - \alpha_8 \end{pmatrix} = 0$	2	562	1.02
11. $H_0 : \alpha_7 - \alpha_8 = 0$	1	562	.05
third level			
12. $H_0 : \alpha_1 - \alpha_2 = 0$	1	562	9.74**
13. $H_0 : \alpha_1 - \alpha_3 = 0$	1	562	.61
14. $H_0 : \alpha_1 - \alpha_4 = 0$	1	562	5.58*
15. $H_0 : \alpha_1 - \alpha_5 = 0$	1	562	11.87**
16. $H_0 : \alpha_1 - \alpha_6 = 0$	1	562	2.68
17. $H_0 : \alpha_1 - \alpha_7 = 0$	1	562	2.20
18. $H_0 : \alpha_1 - \alpha_8 = 0$	1	562	1.24
19. $H_0 : \alpha_2 - \alpha_3 = 0$	1	562	13.13**
20. $H_0 : \alpha_2 - \alpha_4 = 0$	1	562	.18
21. $H_0 : \alpha_2 - \alpha_5 = 0$	1	562	.41
22. $H_0 : \alpha_2 - \alpha_6 = 0$	1	562	1.51
23. $H_0 : \alpha_2 - \alpha_7 = 0$	1	562	1.30
24. $H_0 : \alpha_2 - \alpha_8 = 0$	1	562	1.72
25. $H_0 : \alpha_3 - \alpha_4 = 0$	1	562	8.34**
26. $H_0 : \alpha_3 - \alpha_5 = 0$	1	562	15.24**
27. $H_0 : \alpha_3 - \alpha_6 = 0$	1	562	3.01
28. $H_0 : \alpha_3 - \alpha_7 = 0$	1	562	4.17*
29. $H_0 : \alpha_3 - \alpha_8 = 0$	1	562	2.77
30. $H_0 : \alpha_4 - \alpha_5 = 0$			could not be tested because H_0 8 could not be rejected
31. $H_0 : \alpha_4 - \alpha_6 = 0$			
32. $H_0 : \alpha_4 - \alpha_7 = 0$			
33. $H_0 : \alpha_4 - \alpha_8 = 0$			
34. $H_0 : \alpha_5 - \alpha_6 = 0$			could not be tested because H_0 9 could not be rejected
35. $H_0 : \alpha_5 - \alpha_7 = 0$			
36. $H_0 : \alpha_5 - \alpha_8 = 0$			
37. $H_0 : \alpha_6 - \alpha_7 = 0$			could not be tested because H_0 10 could not be rejected
38. $H_0 : \alpha_6 - \alpha_8 = 0$			

* significant at .05 level
** significant at .01 level

Table 7. Results of the testing of hypotheses for teaching style x sex x achievements of pupils on language tests.

Hypotheses		df		F-ratio
first level				
1. H_0: Sex-, style- and interaction effect = 0		30	1042	2.65**
2. H_0: Interaction effect = 0		14	1042	.70
3. H_0: Sex effect = 0		2	521	7.87**
4. H_0: Teaching style effect = 0		14	1042	3.86**
second level				
5. H_0: $\begin{pmatrix}\alpha_1 - \alpha_2\\ \alpha_1 - \alpha_8\end{pmatrix}$	= 0	14	1042	3.86**
6. H_0: $\begin{pmatrix}\alpha_2 - \alpha_3\\ \alpha_2 - \alpha_8\end{pmatrix}$	= 0	12	1042	3.29**
7. H_0: $\begin{pmatrix}\alpha_3 - \alpha_4\\ \alpha_3 - \alpha_8\end{pmatrix}$	= 0	10	1042	3.39**
8. H_0: $\begin{pmatrix}\alpha_4 - \alpha_5\\ \alpha_4 - \alpha_8\end{pmatrix}$	= 0	8	1042	2.57**
9. H_0: $\begin{pmatrix}\alpha_5 - \alpha_6\\ \alpha_5 - \alpha_8\end{pmatrix}$	= 0	6	1042	1.92
10. H_0: $\begin{pmatrix}\alpha_6 - \alpha_7\\ \alpha_6 - \alpha_8\end{pmatrix}$	= 0	4	1042	1.71
11. H_0: $\alpha_7 - \alpha_8$	= 0	2	521	.34
third level				
12. H_0: $\alpha_1 - \alpha_2$	= 0	2	521	9.51**
13. H_0: $\alpha_1 - \alpha_3$	= 0	2	521	.33
14. H_0: $\alpha_1 - \alpha_4$	= 0	2	521	11.38**
15. H_0: $\alpha_1 - \alpha_5$	= 0	2	521	7.55**
16. H_0: $\alpha_1 - \alpha_6$	= 0	2	521	5.53**
17. H_0: $\alpha_1 - \alpha_7$	= 0	2	521	.91
18. H_0: $\alpha_1 - \alpha_8$	= 0	2	521	.99
19. H_0: $\alpha_2 - \alpha_3$	= 0	2	521	8.50**
20. H_0: $\alpha_2 - \alpha_4$	= 0	2	521	1.86
21. H_0: $\alpha_2 - \alpha_5$	= 0	2	521	.08
22. H_0: $\alpha_2 - \alpha_6$	= 0	2	521	1.36
23. H_0: $\alpha_2 - \alpha_7$	= 0	2	521	2.65
24. H_0: $\alpha_2 - \alpha_8$	= 0	2	521	3.19*
25. H_0: $\alpha_3 - \alpha_4$	= 0	2	521	9.49**
26. H_0: $\alpha_3 - \alpha_5$	= 0	2	521	7.23**
27. H_0: $\alpha_3 - \alpha_6$	= 0	2	521	4.20*
28. H_0: $\alpha_3 - \alpha_7$	= 0	2	521	1.07
29. H_0: $\alpha_3 - \alpha_8$	= 0	2	521	1.66
30. H_0: $\alpha_4 - \alpha_5$	= 0	2	521	2.22
31. H_0: $\alpha_4 - \alpha_6$	= 0	2	521	1.41
32. H_0: $\alpha_4 - \alpha_7$	= 0	2	521	5.11**
33. H_0: $\alpha_4 - \alpha_8$	= 0	2	521	6.58**
34. H_0: $\alpha_5 - \alpha_6$	= 0	could not be tested because H_0 9 could not be rejected		
35. H_0: $\alpha_5 - \alpha_7$	= 0			
36. H_0: $\alpha_5 - \alpha_8$	= 0			
37. H_0: $\alpha_6 - \alpha_7$	= 0	could not be tested because H_0 10 could not be rejected		
38. H_0: $\alpha_6 - \alpha_8$	= 0			

* significant at .05 level
** significant at .01 level