DEVELOPMENTAL ANALYSIS OF THE VON RESTORFF EFFECT

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ABSTRACT

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by Sue A. Wisenberg

The present study was concerned with the possibility that the effects of isolation within a serial list are related to the developmental level of the Ss.

Second, fourth and sixth grade children were randomly selected and administered the same practice list of four 100% association value CVC syllables typed in black capital letters. All Ss received the same test list of ten 33% association value CVC syllables under two conditions. The test list was typed in black capital letters for half of the Ss at each grade level. The other half of the Ss received an identical test list with the one exception that the sixth CVC syllable was typed in red capital letters. All lists were presented on a memory drum with a four second inter-stimulus interval and an eight second inter-trial interval. The criterion for all Ss on the practice and test lists was one perfect recitation of the list by means of the anticipation method.

The results of the present study indicated that the effects of isolation within a serial list were related to the developmental level

of the Ss. Five dependent variables were used in order to assess the effects of isolation; they were errors at the isolated item position, errors at positions adjacent to the isolated item position, total errors and trials to criterion. Significant differences between experimental and control groups at the same grade level were found for the sixth grade only. These findings were obtained for all five dependent variables. The sixth grade also performed significantly better than the second grade but not significantly better than the fourth grade in respect to all dependent variables. In addition, the sixth grade experimental group performed significantly better than the second or fourth grade experimental group in respect to errors at the isolated item position and trials to criterion.

The facilitative effect of isolation upon the learning of a serial list at the sixth grade level only was attributed to the fact that the isolated syllable was a salient cue only for Ss in the sixth grade. For these Ss the isolated syllable served as a strong stimulus and response to which correct responses could be attached and allowed for the reorganization of the list.

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OF THE VON RESTORFF EFFECT

By

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CHAPTER I

INTRODUCTION

The learning of a serial list is typified by the familiar serial position curve. This bow shaped curve illustrates the fact that the first and last positions are the easiest to learn and the most difficult position is immediately beyond the middle of the list. Spelling may be considered a serial learning task in that adjacent letters serve as both a stimulus and a response with the exception of the first letter which only serves as a stimulus and the last letter which only serves as a response. Support for this contention comes from recent investigations which have indicated that the error curves for spelling words of various lengths closely resemble the typical serial position curve.

The serial position curve is not invariant in serial learning tasks. The use of isolation in the learning of a serial list has resulted in a reduction of errors at the isolated position. This is evidenced by a decided dip in the serial position curve at the isolated position.

If spelling is a serial learning task and isolation facilitates learning of the isolated item, one might propose that isolation within a spelling word would facilitate learning of the isolated letter. However, this has not been the case. This may be due to the fact that young children have served as subjects in studies of this type.

It may be that the effect of isolation in a serial list is dependent upon the age of the subject. Interestingly enough, all of the past studies investigating the Von Restorff phenomenon have used adult subject, generally college sophomores. It may well be that the young child does not benefit from perceptual isolation within a serial list while the older child or adult does. The purpose of the present study is to investigate the relationship between isolation effects and the developmental level of the child.

The specific effects of isolation within a serial list were first investigated by Von Restorff. She typically employed a ten item serial list consisting of nine nonsense syllables with the second or third member of the series being a two-digit number (Kohler, 1938). Von Restorff found that the isolated item was recalled a greater per cent of the time than the other items in the serial list.

The fact that isolation facilitates learning of the isolated item as compared to its nonisolated counterpart, known as the Von Restorff phenomenon, has been a consistent finding in the literature. Isolation effects have also been found in studies concerned with immediate recall following one presentation of the serial list (Smith, 1949; Saltz and Newman, 1959; Siegel, 1943).

One might assume that isolation would also be effective in reducing total list learning due to the facilitative effect of isolation on the isolated item. However, most investigators have found that isolation does not facilitate learning of the serial list as measured by total list errors or trials to criterion (Newman and Saltz, 1958; Jones and Jones, 1942; Jensen, 1962; Smith, 1948; Roberts, 1962). Smith and

Stearns (1949) have offered as an explanation of this general finding the fact that learning of the isolated item is at the expense of other list items and have noted that an increase in the recall of the isolated item is accompanied by a decrease in the recall of the rest of the list. It is interesting to note that even in an experiment designed to investigate the effect of isolation upon immediate memory, Smith (1949) found no difference in the over-all recall or recognition of a 13 item list which had isolation at the eighth position and the same list which did not contain an isolated member.

Practically all studies have shown that isolation has little if any effect upon trials to criterion of the entire list. However, one exception is a study by Smith and Stearns (1949). These investigators had subjects learn both an isolated (eighth position) and homogeneous list of 13 two-syllable adjectives for five days; two new lists each day. Half of the subjects learned the homogeneous list first and half of the subjects learned the isolated list first. They found that the isolated list was learned in fewer trials than the non-isolated list when both lists were presented first. However, whole list facilitation by means of isolation did not occur when both lists were presented second.

The third effect of isolation within a serial list concerns the 'spread of effect'. This term refers to the facilitation of the isolated item on the learning of adjacent items. Jones and Jones (1942) both found a slight but insignificant advantage for the item which preceded and followed the isolated item. Smith (1948) also confirmed this finding. However, Smith (1949) was unable to confirm his results of the previous study. Jenkins and Postman (1948) and Jensen (1962) also

offer evidence in support of the fact that neither of the adjacent items is facilitated by isolation of the isolated item. In spite of the above results, there is some evidence to indicate that isolation facilitates learning of the item which follows the isolated item (Smith and Stearns, 1949; Newman and Saltz, 1958). Although Roberts (1962) disagrees with the latter finding, he does present evidence which indicates that isolation facilitates learning of the item which precedes the isolated item. In a single presentation of a serial list, Saltz and Newman (1959) also obtained evidence which indicated that isolation facilitates learning of the item preceding the isolated item.

In recent years, spelling has been studied from the standpoint of a serial learning task. Jensen (1962) was the first to publish research concerning this topic. He supplied junior high, senior high and college students with boxed answer sheets and counted as an error any space which did not contain the correct letter. Jensen found that the distribution of errors for all three grade levels approximated the serial position curve. Kooi, Schutz and Baker (1965) used ninth grade students as subjects and counted as correct all letters in the correct sequence. They found essentially the same result as did Jensen --- the errors in spelling words of equal length closely approximated the familiar, bow-shaped, serial position curve. In 1966, Guinaugh, B., Hedgebeth, J., Lange, A., Loupe, M., Mondol, M., Piper, R., Ten Brink, T., Wisenberg, S., and Wong, M. investigated spelling as a serial learning task with second, third, fourth and fifth grade students. They also found the typical serial position curve for the distribution of errors in spelling words.

If spelling is a serial learning task, as it appears to be, one might propose that isolation would produce facilitative effects on the learning of spelling words. However, Horn (1960) states that, "Calling attention to difficult parts of words in presenting the words of a lesson is a doubtful practice." He briefly mentions a 1930 study by Tireman which found that "stressing hard spots by underlining, writing in capitals, or using bold-faced type was of little or no value" in the learning of spelling words.

Nevertheless, in the spring of 1966 the present author undertook an investigation of the Von Restorff technique applied to spelling words given to third grade children. The results showed that isolation did not significantly facilitate learning of the isolated letter-position, adjacent letter-positions or the whole word during either original learning or during retention. However, the distribution of errors within the words did approximate the typical bow-shaped serial position curve.

The above results suggested the hypothesis that the non-facilitative effect of isolation in spelling words may be a function of the developmental level of the child. More generally, the facilitative effects of isolation within a serial list may be due to the fact that traditional serial learning studies have employed adult Ss.

The present study was designed and conducted in order to determine the functional relationship between the effects of isolation within a serial list and the developmental level of the child. The specific research problems to be investigated were:

1) When presented with a 10 item serial list in which the sixth item is isolated, does isolation facilitate learning of the isolated item for second, fourth and sixth grade children?

2) When presented with a 10 item serial list in which the sixth item is isolated, does isolation facilitate learning of the item preceding the isolated item for second, fourth and sixth grade children?

3) When presented with a 10 item serial list in which the sixth item is isolated, does isolation facilitate learning of the item following the isolated item for second, fourth and sixth grade children?

4) When presented with a 10 item serial list in which the sixth item is isolated, does isolation facilitate whole list learning as measured by trials to criterion and total errors for second, fourth and sixth grade children?

CHAPTER II

METHOD

A. Subjects

A total of 120 Ss attending regular public school classes in grades two, four and six were tested in this study. Twenty males and twenty females were randomly selected from each of the three grades.

B. Materials

The same practice list was used for all 120 Ss. The practice list consisted of four 100% association value (Hilgard, 1951) CVC syllables. The practice list was typed in black capital letters.

The test list consisted of ten 33% association value (Hilgard, 1951) CVC syllables. All items in the test for the control groups were typed in black capital letters. The test list for the experimental groups was identical to that of the control groups with the exception that the CVC syllable in the sixth serial position was typed in red capital letters.

All lists contained four black asterisks preceding the first syllable. A Lafayette memory drum was used for presentation of all lists.

C. Procedure

At each grade level, Ss were randomly assigned to either an experimental or a control group. The experimental groups consisted of 20 Ss each and were administered the test list containing the red

syllable in the sixth position. The control groups consisted of 20 Ss each and were administered the test list typed entirely in black.

Each S was tested individually. The following instructions were read to the S prior to administration of the practice list. The practice list was administered in order to familiarize the S with the learning task.

> I'm going to show you a list of syllables that I want you to learn. Learn the list as fast as you can. When I turn on this machine, syllables will appear in the window one at a time. Your job is to tell me each syllable just before you see it. The first time you see the syllables I will say them out loud with you. The machine will repeat the list until you can tell me each syllable just before you see it in the window. When you can tell me each syllable just before you see it in the window, you will have learned the entire list. Remember to say each syllable out loud----just before you see it in the window. Are there any questions?

Each item in the practice list was presented at a four second rate. An eight second inter-trial interval was employed for both the practice and test lists. The E and S pronounced the syllables of the practice list during the first presentation of the list. The criterion for the practice and test lists was one perfect recitation of the entire list. As soon as the S had reached criterion on the practice list, the test list was presented. Once again the E and S pronounced the syllables during the first presentation of the test list. The items in the test list were also presented at a four second presentation rate.

The order of presentation of the test lists was counterbalanced throughout the experimental sessions. Whenever possible, the testing of grade levels was also counterbalanced throughout the experimental sessions.

Ss responses were scored correct if they were correctly anticipated. Mispronounced responses were scored correct if the pronounciation was consistent. All intra and extra list intrusions were recorded by E.

CHAPTER III

RESULTS

In order to determine the effect of isolation on the isolated syllable the number of errors at the isolated item position (6th) was computed for all Ss. Table 1 presents the means and standard deviations of errors at the isolated item position (6th) for the experimental and control groups. The means are depicted graphically in Figure 1.

Table 1: Mean Number of Errors at the Isolated Item-Position for Experimental and Control Groups at Each Grade Level.

Grade	Exp.*	σ	Control*	σ
2	17.55	(6.79)	19.70	(9.36)
4	11.85	(6.02)	12.95	(5.35)
6	6.95	(3.39)	15.40	(8.59)

*N = 20 at each grade level

In order to test the assumption of homogeneity of variance, the data in Table 1 were analyzed by an F max test. The F test was significant (F max = 7.65, 6/19, $p < .01$). Therefore, the original data were subjected to a square root transformation which was the square root of errors at the isolated position plus .5 (Winer, 1962). A 3 x 2 analysis of variance of errors at the isolated position was then performed on the transformed data. Table 2 presents the results of this analysis.

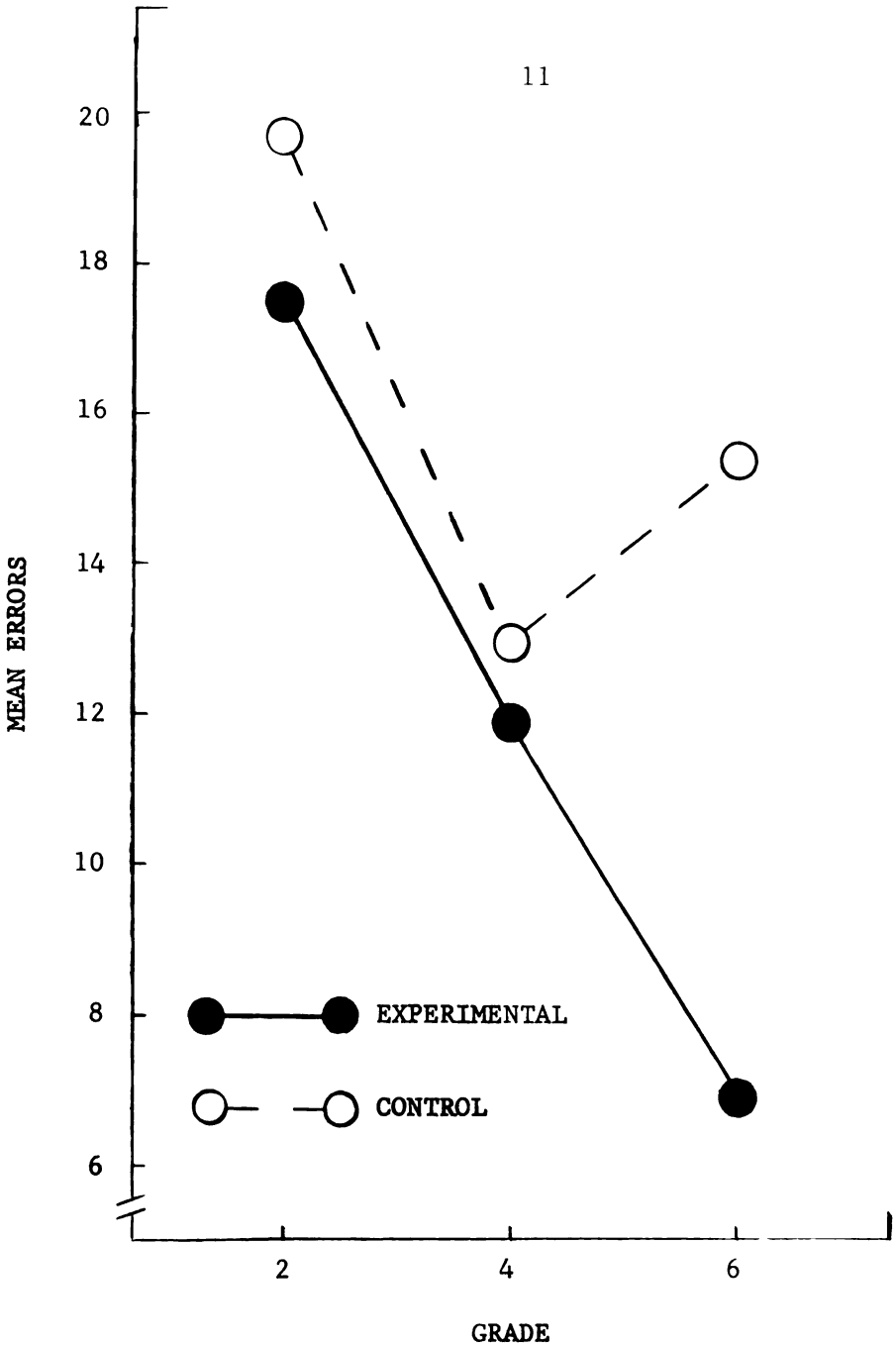

Fig. 1 Mean number of errors at the isolated position for the experimental and control groups in the second, fourth, and sixth grades.

Table 2: Three by Two Analysis of Variance Summary Table of Errors at Isolated Position for Transformed Data

Source	SS	df	MS	F
Grades	22.3673	2	11.1836	15.0824***
Treatment	8.3635	1	8.3635	11.2791***
AB	6.9710	2	3.4855	4.7006**
Within	84.5346	114	.7415	
Total	122.2364	119		

***F.99 (2,114) = 4.79
***F.99 (1,114) = 6.85
**F.975 (2,114) = 3.80

The significant Grades x Treatment interaction was investigated by means of two 1 x 3 analyses of variance and Tukey (a) tests of individual comparisons (Winer, 1962).

The F for a one-way analysis of variance of errors at the isolated position for the control groups was significant ($F = 3.60$, $2/57$, $p < .05$). A Tukey (a) test of individual comparisons was used to identify control groups which differed significantly from each other. Total errors at the isolated position (transformed data) for the second, fourth and sixth grade control groups were 87.55 ($\bar{x} = 4.38$), 71.76 ($\bar{x} = 3.59$), and 77.41 ($\bar{x} = 3.87$), respectively. The Tukey (a) test revealed that the fourth grade control group (C-4) made significantly fewer errors at the isolated item position than the second grade control group (C-2). This result is shown in Table 3.

Table 3: Matrix of Differences in Errors at the Isolated Item Position for Control Groups Using Transformed Data

	C-4	C-6	C-2
C-4		5.65	15.79*
C-6			10.14
C-2			

Critical value at .05 level (3,57) = 14.33

The F for a one-way analysis of variance of isolated position errors for the experimental groups was also significant ($F = 19.30$, $2/57$, $p < .01$). Total errors at the isolated position (transformed data) for the second, fourth and sixth grade experimental groups were 83.51 ($\bar{x} = 4.18$), 68.31 ($\bar{x} = 3.42$), and 53.22 ($\bar{x} = 2.66$), respectively. A Tukey (a) test of individual comparisons revealed that the sixth grade experimental group (E-6) made significantly fewer errors at the isolated position than the fourth grade experimental group (E-4) and the second grade experimental group (E-2). The test also showed that the fourth grade experimental group (E-4) made significantly fewer errors at the isolated position than the second grade experimental group (E-2). These results are shown in Table 4.

Table 4: Matrix of Differences in Errors at the Isolated Item Position for Experimental Groups Using Transformed Data

	E-6	E-4	E-2
E-6		15.09*	30.29*
E-4			15.20*
E-2			

Critical value at .01 level (3,57) = 14.75

In order to test differences between the experimental and control groups at each grade level for errors at the isolated position item, individual t tests were computed. No significant differences were found for the second grade ($t = .6838$, 38df, $p > .05$) or for the fourth grade ($t = .682$, 38df, $p > .05$). However, the sixth grade experimental group made significantly fewer errors than the sixth grade control group at the isolated position ($t = 4.6195$, 38df, $p < .001$). These results indicate that isolation facilitates learning of the isolated item only at the sixth grade level.

The significant main effect of grades (Table 2) was investigated by means of a Tukey (a) individual comparison test of errors at the isolated position by grades. Total errors at the isolated position (transformed data) for the second, fourth and sixth grades were 171.06 ($\bar{x} = 4.28$), 140.07 ($\bar{x} = 3.5$), and 130.63 ($\bar{x} = 3.27$), respectively. The Tukey (a) test revealed that the sixth grade made significantly fewer errors than the second as did the fourth grade. Table 5 presents these results.

Table 5: Matrix of Differences in Errors at the Isolated Item Position for Grades Using Transformed Data

	6	4	2
6		9.44	40.43*
4			30.99*
2			

Critical value at .01 level (3,117) = 17.35

The first measure analyzed to determine the effect of isolation on whole-list learning was trials to criterion. Trials to criterion were computed for all Ss. The mean number of trials to criterion and the standard deviations are presented in Table 6 and depicted graphically in Figure 2.

Table 6: Mean Number of Trials to Criterion for Experimental and Control Groups at Each Grade Level

Grade	Exp.*	σ	Control*	σ
2	24.05	(8.68)	25.30	(10.24)
4	22.05	(9.29)	20.35	(5.82)
6	15.45	(5.91)	23.20	(9.79)

*N = 20 at each grade level

In order to test the assumption of homogeneity of variance, the data in Table 6 were analyzed by an F max test. The F test was not significant (F max - 3.098, 6/19, $p > .05$). A 3 x 2 analysis of variance was used to evaluate the data in Table 6 and the results are presented in Table 7.

Table 7: Three by Two Analysis of Variance Summary Table of Trials to Criterion

Source	SS	df	MS	F
A (grade)	589.52	2	294.76	3.89**
B (treatment)	177.64	1	177.64	2.35
AB	467.51	2	233.75	3.09*
Within	8620.80	114	75.62	
Total	9855.47	119		

*F.95 (2,114) = 3.07
**F.975 (2,114) = 3.80

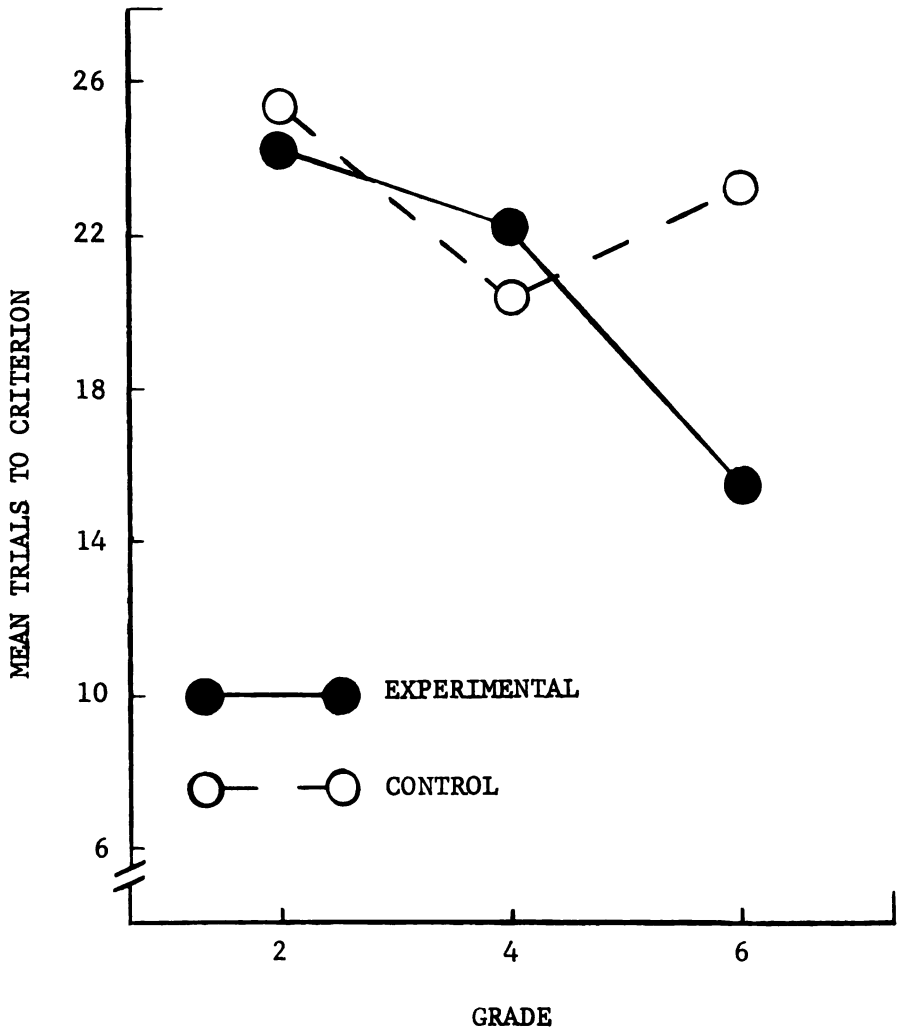

Fig. 2 Mean number trials to criterion for second, fourth, and sixth grade control and experimental groups.

The significant Grades X Treatment interaction (See Fig. 3) was investigated by means of two 1 x 3 analyses of variance and a Tukey (a) test of individual comparisons. The F for a 1 x 3 analysis of variance of trials to criterion for control groups was not significant ($F = 1.5$, $2/57$, $p > .05$). However, the same statistical analysis revealed a significant F for the experimental groups ($F = 5.87$, $2/57$, $p < .01$). A Tukey (a) test of individual comparisons was used to identify experimental groups which differed significantly from each other. Total trials to criterion for the second, fourth and sixth grade experimental groups were 481 ($\bar{x} = 24.05$), 441 ($\bar{x} = 22.05$), and 309 ($\bar{x} = 15.45$) respectively. The Tukey (a) test revealed that the sixth grade experimental group (E-6) required significantly fewer trials to reach criterion than the fourth (E-4) or second (E-2) experimental groups. These results are shown in Table 8.

Table 8: Matrix of Differences in Trials to Criterion for Experimental Groups

	E-6	E-4	E-2
E-6		132*	172*
E-4			40
E-2			

Critical value at .05 level (3,57) = 126
Critical value at .01 level (3,57) = 158

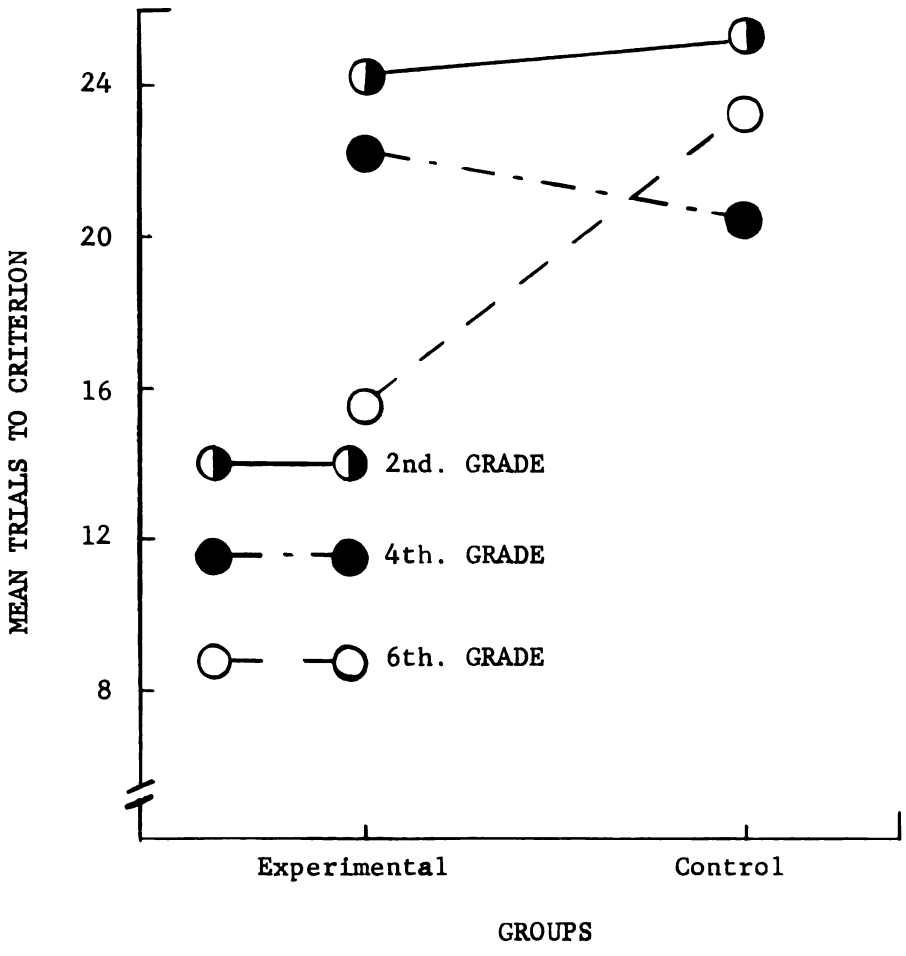

Fig. 3 Mean number of trials to criterion for the three grades and the experimental and control conditions.

In order to test differences between the experimental and control groups at each grade level for trials to criterion, individual t tests were computed. Both the second and the fourth grades evidenced t values <1. However, the sixth grade experimental groups took significantly fewer trials to reach criterion than the sixth grade control group ($t = 3.20$, 38df, $p < .005$). This result indicates that isolation significantly facilitates whole-list learning at the sixth grade only.

The significant main effect of grades (Table 7) was investigated by means of a Tukey (a) individual comparison test of trials to criterion by grades. Total trials to criterion for the second, fourth and sixth grades were 987 ($\bar{x} = 24.68$), 848 ($\bar{x} = 21.2$) and 773 ($\bar{x} = 19.33$), respectively. The results of the Tukey (a) test, presented in Table 9, revealed that the sixth grade took significantly fewer trials to reach criterion than the second grade.

Table 9: Matrix of Differences in Trials to Criterion for Grades

	6	4	2
6		75	214*
4			139
2			

Critical value at .05 level (3,117) = 189

The second measure used to determine the effect of isolation on whole-list learning was total errors. Table 10 presents the means and standard deviations of total errors for the experimental and control groups. A graphic portrayal of the mean number of total errors is presented in Figure 4.

Table 10: Mean Number of Total Errors for Experimental and Control Groups at Each Grade Level

Grade	Exp.*	6	Control*	6
2	130.50	(43.79)	144.85	(63.50)
4	114.85	(49.09)	109.95	(32.82)
6	80.60	(33.61)	119.20	(53.69)

*N = 20 at each grade level

In order to test the assumption of homogeneity of variance, the data in Table 10 were analyzed by an F max test. The F test was not significant (F max = 3.74, 6/19, $p > .05$). A 3 x 2 analysis of variance was used to evaluate the data in Table 10 and the results are presented in Table 11. Only the main effect of grades was significant ($F = 6.278$, 2/114, $p < .01$).

Table 11: Three by Two Analysis of Variance Summary Table of Total Errors

Source	SS	df	MS	F
A (grade)	29627.02	2	14813.51	6.278***
B (treatment)	7696.01	1	7696.01	3.261
AB	9502.91	2	4751.46	2.013
Within	268987.05	114	2359.54	
Total	315812.99	119		

***F.99 (2,114) = 4.79

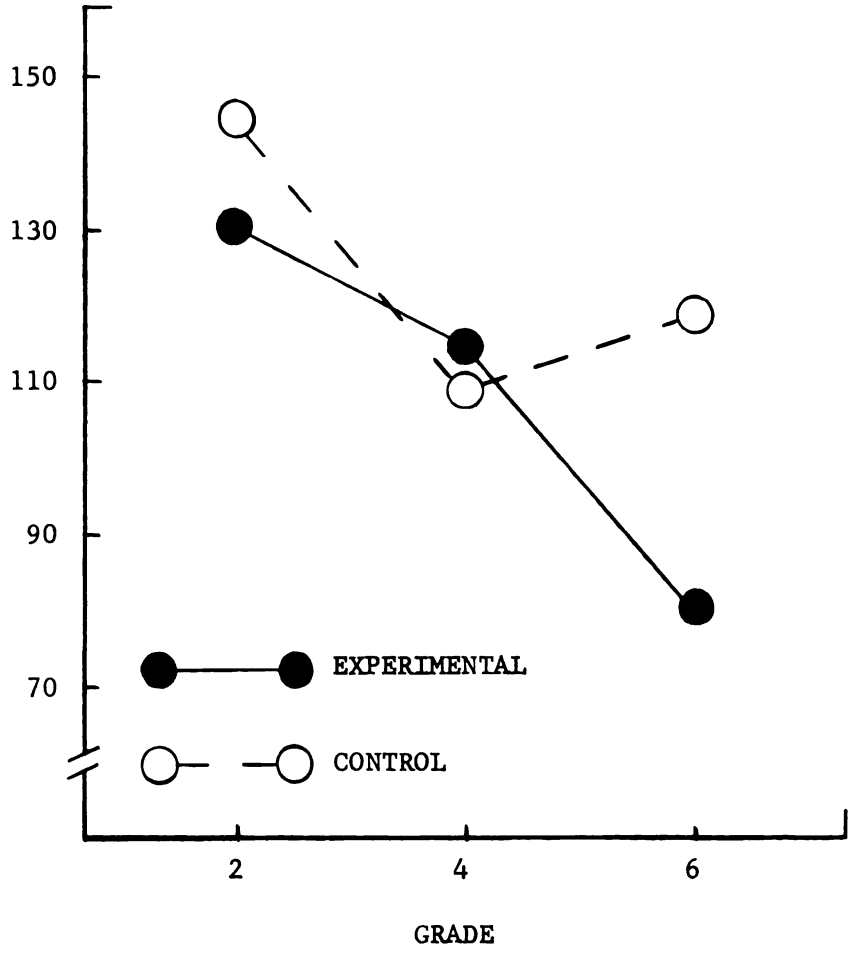

Fig. 4 Mean number of total errors by experimental and control groups in the second, fourth, and sixth grades.

The significant main effect of grades was investigated by means of a Tukey (a) individual comparison test of total errors by grades. Total errors for the second, fourth and sixth grades were 5507 ($\bar{x}$ = 137.68), 4496 ($\bar{x}$ = 112.4), and 3996 ($\bar{x}$ = 99.9), respectively. The Tukey (a) test revealed that the sixth grade made significantly fewer total errors than the second grade, as can be seen in Table 12.

Table 12: Matrix of Differences in Total Errors for Grades

	6	4	2
6		500	1511*
4			1011
2			

Critical value at .01 level (3,117) = 1313

In order to test total error differences between the experimental and control groups at each grade level, individual t tests were computed. The t values for both the second and fourth grade were < 1. However, the sixth grade experimental group made significantly fewer total errors than the sixth grade control group ($t = 2.656$, 38df, $p < .01$). It would once again appear that isolation significantly facilitated whole list learning for the sixth grade.

In order to determine the effect of isolation on the nonsense syllable preceding the isolated syllable, the number of errors at the fifth position were computed for all Ss. The means and standard deviations of errors at the fifth position for experimental and control groups are given in Table 13 and presented graphically in Figure 5.

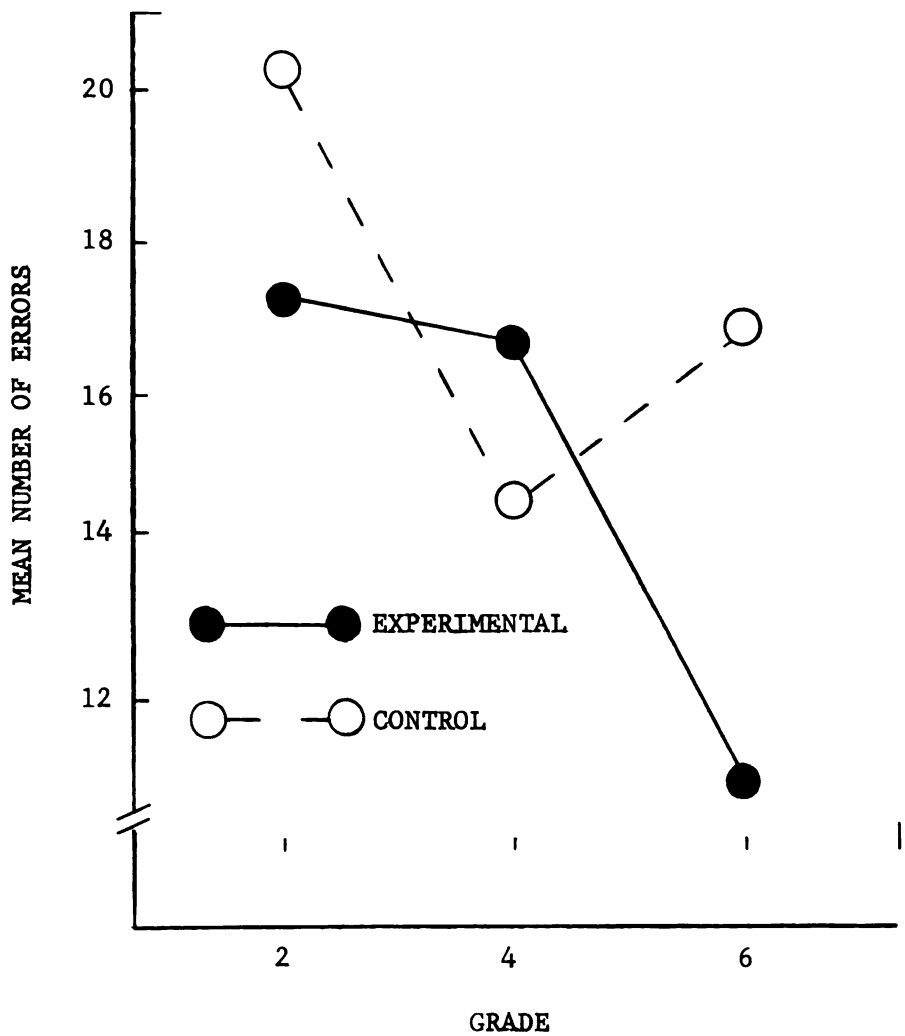

Fig. 5 Mean number of errors for the item preceding the isolated item by experimental and control groups in the second, fourth, and sixth grades.

Table 13: Mean Number of Errors for the Fifth Item

Grade	Exp.*	δ	Control*	δ
2	17.30	(5.89)	20.25	(9.57)
4	16.75	(8.45)	14.60	(5.55)
6	10.95	(4.91)	16.85	(8.94)

*N = 20 at each grade level

In order to test the assumption of homogeneity of variance, the data in Table 13 were analyzed by an F max test. The F test was significant (F max = 3.796, 6/19, p < .05). Therefore, the original error scores for the fifth position were transformed by taking the square root of the original error score plus .5 (Winer, 1962).

A 3 x 2 analysis of variance of the transformed fifth position errors showed that the grades differed significantly from each other. The results of this analysis can be seen in Table 14.

Table 14: Three by Two Analysis of Variance Summary Table for Errors at Fifth Position for Transformed Data

Source	SS	df	MS	F
A (grade)	7.9950	2	3.9975	4.7966***
B (treatment)	2.0099	1	2.0099	2.4116
AB	4.3251	2	2.1625	2.5947
Within	95.0183	114	.8334	
Total	109.3483	119		

***F.99 (2,114) = 4.79

The significant main effect of grades was investigated by means of a Tukey (a) individual comparison test of fifth position errors by grades. Total errors at the fifth position (transformed data) for the second, fourth and sixth grades were 171.85 ($\bar{x}$ = 4.3), 157.05 ($\bar{x}$ = 3.93),

and 146.69 ($\bar{x}$ = 3.67), respectively. The results of the Tukey (a) test, presented in Table 15, revealed that the sixth grade made significantly fewer errors at the fifth position than the second grade.

Table 15: Matrix of Differences for Errors at the Fifth Position by Grades Using Transformed Data

	6	4	2
6		10.36	25.16*
4			14.80
2			

Critical value at .01 level (3,117) = 24.72

In order to test differences between the experimental and control group at each grade level for errors at the fifth position, individual t tests were computed. No significant differences were found at the second grade and fourth grade level (both t values < 1). However, the sixth grade experimental group made significantly fewer errors at the fifth position than the sixth grade control group ($t = 2.446$, 38df, $p < .01$). It would appear that isolation facilitated learning of the nonsense syllable preceding the isolated syllable for the sixth grade only.

In order to determine the effect of isolation on the nonsense syllable following the isolated syllable, the number of errors at the seventh position were computed for all Ss. Table 16 presents the means and standard deviations of errors at the seventh position for all experimental and control groups. The mean number of errors at the seventh position are depicted graphically in Figure 6.

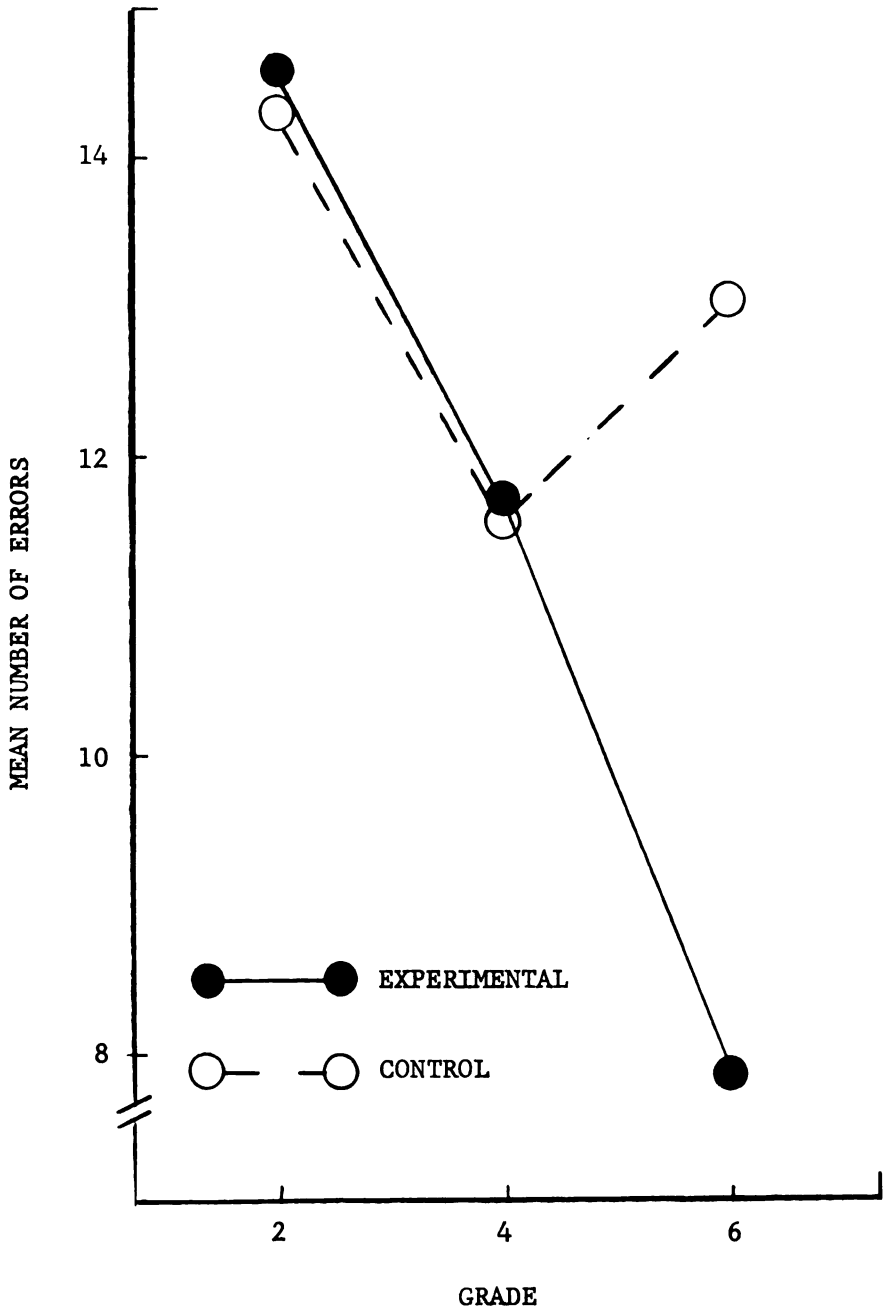

Fig. 6 Mean number of errors for the item following the isolated item for the experimental and control groups in the second, fourth, and sixth grades.

Table 16: Mean Number of Errors for the Seventh Item

Grade	Exp.*	6	Control*	6
2	14.60	(8.31)	14.30	(6.21)
4	11.70	(7.93)	11.55	(4.68)
6	7.85	(4.09)	13.05	(9.75)

*N = 20 at each grade level

In order to test the assumption of homogeneity of variance, the data in Table 16 were analyzed by an F max test. The F test was significant (F max = 4.12, 6/19, $p < .05$). Therefore, the original error scores for the seventh position were transformed by taking the square root of the original error score plus .5 (Winer, 1962).

A 3 x 2 analysis of variance of the transformed seventh position errors showed that the grades differed significantly from each other. The results of this analysis can be seen in Table 17.

Table 17: Three by Two Analysis of Variance Summary Table of Errors at Seventh Position for Transformed Data

Source	SS	df	MS	F
Grades	6.3407	2	3.1703	4.0577**
Treatment	2.8152	1	2.8152	3.6032
AB	3.7996	2	1.8998	2.4315
Within	89.0759	114	.7813	
Total	102.0314	119		

**F.975 (2,114) = 3.80

The significant main effect of grades was investigated by means of a Tukey (a) individual comparison test of seventh position errors by grades. Total errors at the seventh position (transformed data) for the second, fourth and sixth grades were 150.21 ($\bar{x}$ = 3.76), 133.91

($\bar{x}$ = 3.35), and 128.60 ($\bar{x}$ = 3.22), respectively. The results of the Tukey (a) test, presented in Table 18, revealed that the sixth grade made significantly fewer errors on the seventh item than the second grade.

Table 18: Matrix of Differences for Errors at the Seventh Position by Grades Using Transformed Data

	6	4	2
6		5.31	21.61*
4			16.30
2			

Critical value at .05 level (3,117) = 19.21

In order to test differences between the experimental and control groups at each grade level for errors made at the seventh position, individual t tests were computed. No significant differences were found for experimental and control groups at the second and fourth level (both t values < 1). However, the sixth grade experimental group made significantly fewer errors at the seventh position than the sixth grade control group ($t = 23.72$, 38df, $p < .001$). It would appear that isolation facilitated learning of the nonsense syllable following the isolated syllable for the sixth grade only.

All three grades evidenced serial position curves as can be observed in Figures 7, 8, and 9.

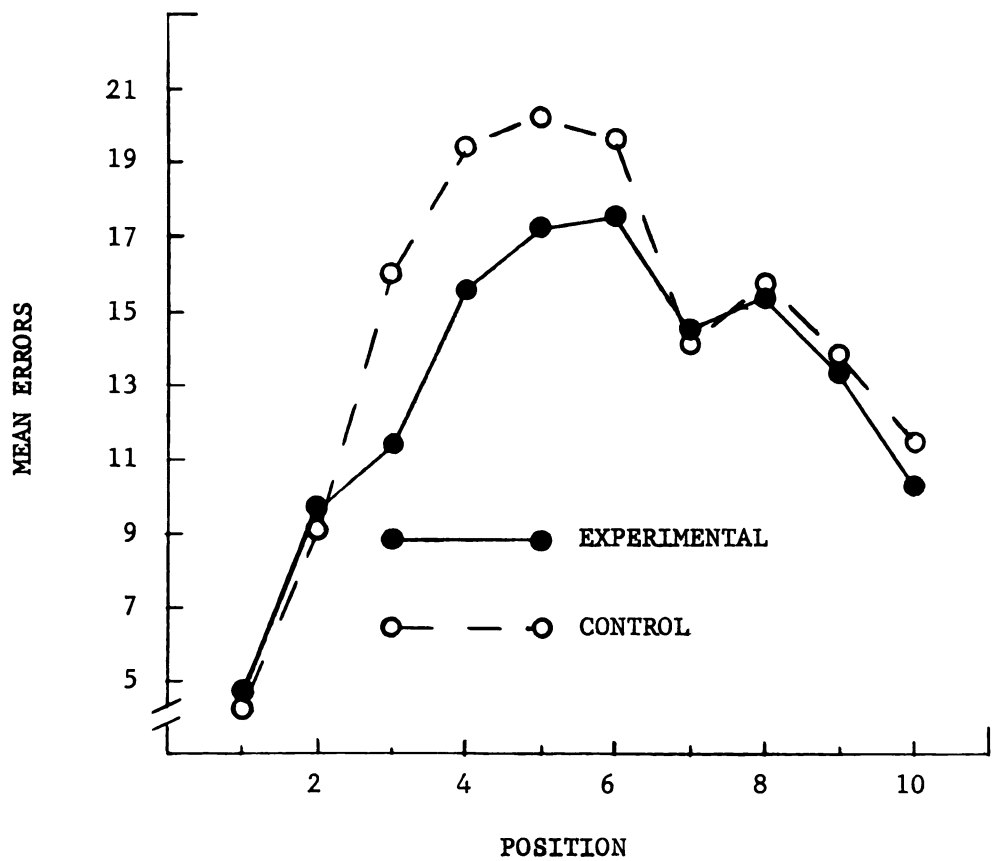

Fig. 7 Mean number of errors at each position for the experimental and control groups in the second grade.

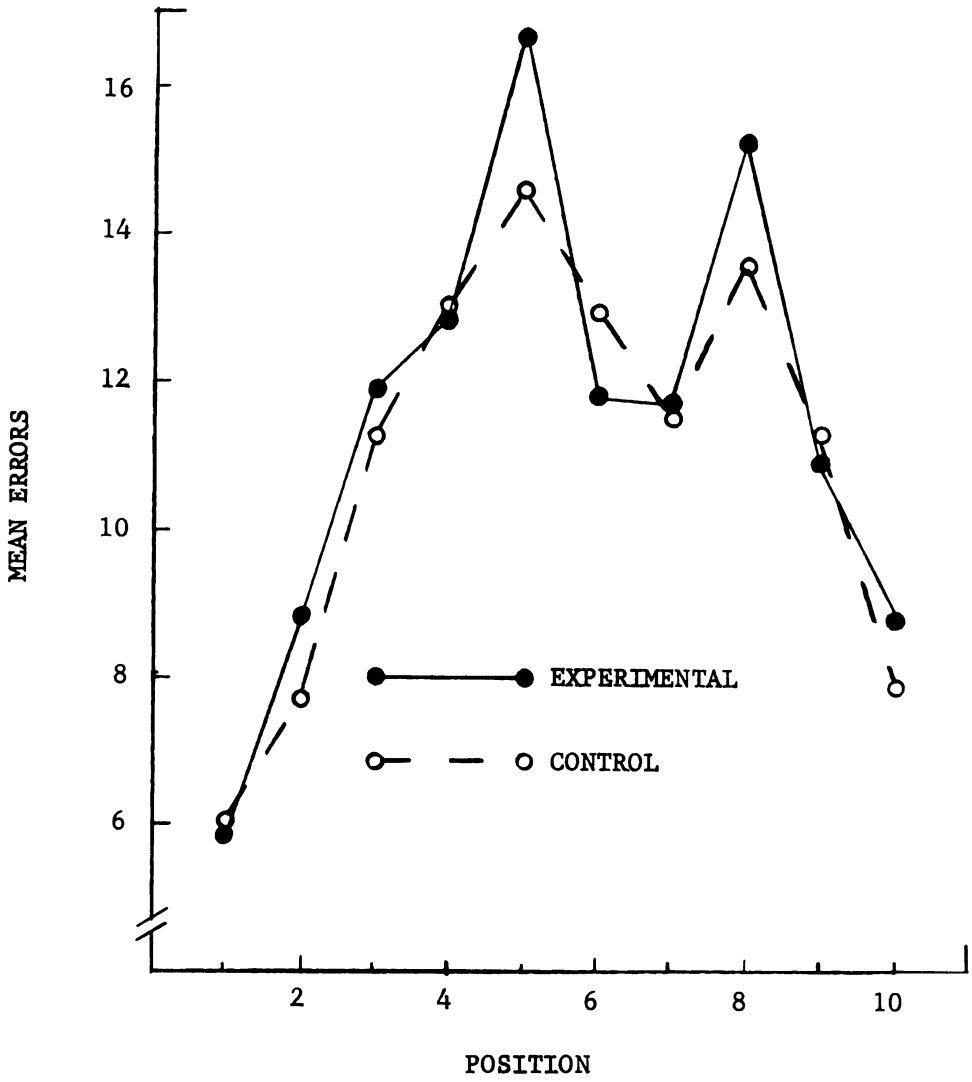

Fig. 8 Mean number of errors at each position for the experimental and control groups in the fourth grade.

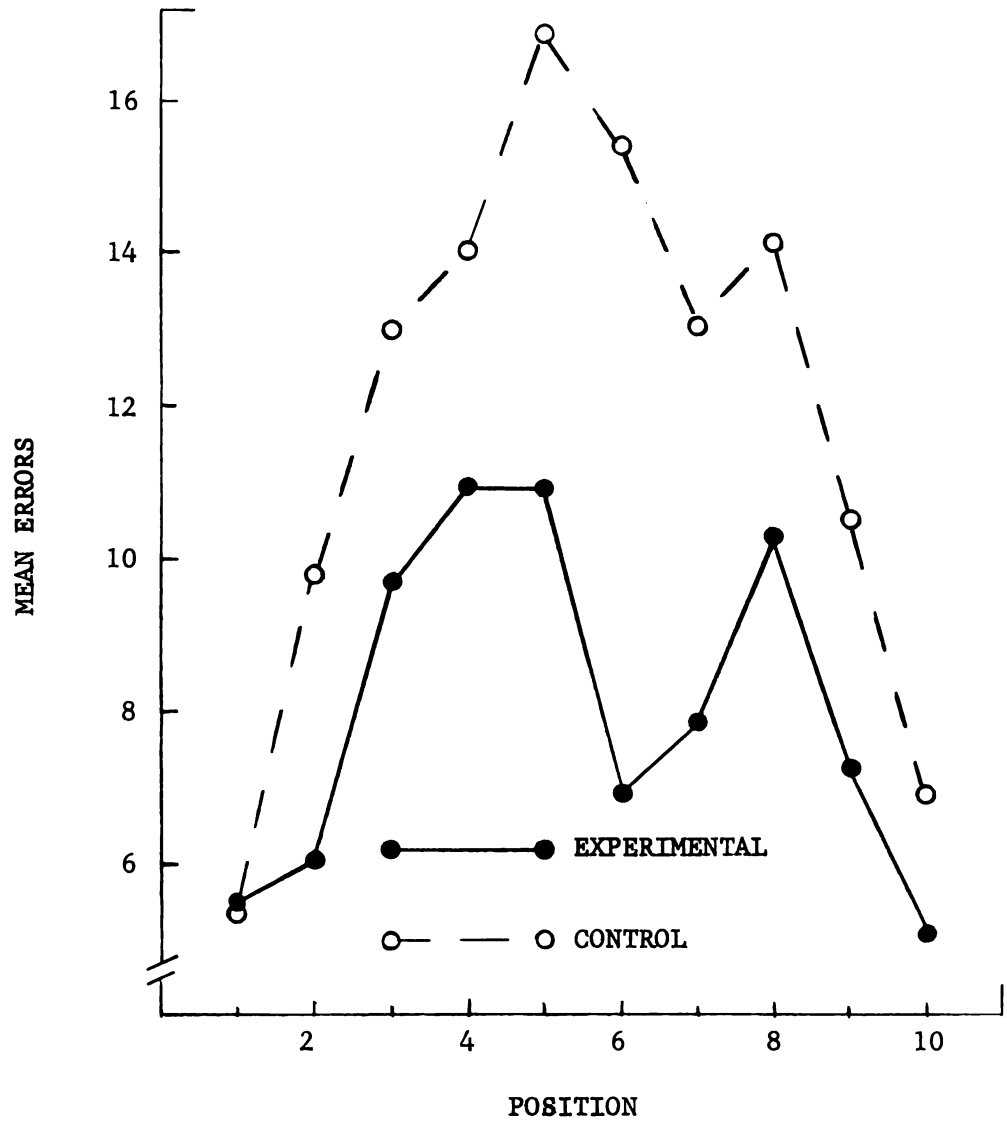

Fig. 9 Mean number of errors at each position for the experimental and control groups in the sixth grade.

CHAPTER IV

DISCUSSION

The results of the present study indicated that the facilitative effect of isolation in a serial learning task was related to the developmental level of the S. The results have consistantly shown that the sixth grade (both experimental and control groups) performed significantly better than the second grade but not significantly better than the fourth grade. This was found for the isolated item, adjacent items, total errors and trials to criterion. However, analyses of the errors at the isolated item position and trials to criterion have shown that the sixth grade experimental group performed significantly better than either the fourth grade experimental group or the second grade experimental group. Furthermore, the sixth grade was the only age level at which significant differences were obtained between the experimental and control groups at the same level. This was found for all dependent variables.

Contrary to practically all existing literature (Newman and Saltz, 1958; Jones and Jones, 1942; Jensen, 1962; Smith, 1948; Roberts, 1962) was the finding of a facilitative effect of isolation for whole list learning at the sixth grade level. This result was evidenced by the fact that the sixth grade experimental group (6-E) took significantly fewer trials to criterion and made significantly fewer total errors than the sixth grade control group (6-C). Neither of these results was

found for the second or fourth grades. Thus, a facilitative effect of isolation for whole list learning was found in the present study and appears to be related to the developmental level of the S.

The present finding that isolation facilitated the learning of items adjacent to the isolated item for the sixth grade is also contrary to the general findings (Jenkins and Postman, 1948; Jensen, 1962). However, the present finding is in agreement with those who offer evidence for the facilitative effect of isolation upon the item which follows the isolated item (Smith and Stearns, 1949; Newman and Saltz, 1958) and the item which precedes the isolated item (Roberts, 1962; Saltz and Newman, 1959). However, the interesting aspect of this finding in reference to the specific purpose of this study is that the facilitative effect of isolation on the learning of the response and stimulus terms of the isolated item position was only found at the sixth grade level. It would appear as though this lends further support to the conclusion that the effect of isolation is dependent upon grade level.

This finding relates to general cueing effects obtained in the sixth grade. The isolated item served as a strong stimulus and a strong response to which correct responses were readily attached. It is felt that this cueing effect of the isolated item for the sixth grade was instrumental in the significant reduction of trials to criterion for the sixth grade experimental group.

The most general and consistent finding in the literature ---- that isolation facilitates learning of the isolated item ---- was evidenced only at the sixth grade level in the present study. Although

all three of the experimental groups fell below their own control group in errors at the isolated position (See Fig. 1), only at the sixth grade level did the experimental group perform significantly better than the control group. This result is clearly indicative of the fact that only the sixth grade is significantly benefited by isolation. Or to put it another way, isolation is only beneficial in reducing errors for the isolated position at the sixth grade level.

There appears to be some indication for the belief that the influence of isolation at the isolated position is at the expense of other items in the list (Smith and Stearns, 1949), especially at the fourth grade level. Inspection of Figures 7, 8, and 9 reveals that the experimental group curves rise above the control group curves at various positions and various times dependent upon grade level. It appears as if the fourth grade is the grade which is most influenced by this phenomenon, then the second grade and finally, the sixth grade.

However, this result must be viewed in recognition of the curious performance of the fourth grade control group. The fourth grade control group consistently fell below the sixth grade control group but the difference was never a reliable one. This was true for errors at the isolated position (See Fig. 1); errors on the preceding syllable (See Fig. 5) and the syllable following the isolated position (See Fig. 6); total errors (See Fig. 4); and trials to criterion (See Figures 2 and 3). The consistency and unreliability of this result leads the present author to attribute its occurence to the random sampling procedure. Meaningful differences between the sixth grade and the fourth grade in regard to all five dependent variables might have occurred if the fourth grade control group had not consistently fallwn below the sixth grade control group.

Inspection of the serial position curves for the control groups at all three grade levels reveals that the sixth grade evidenced a more typical serial position curve than the fourth or second grade. For the sixth grade the first and last positions were the least difficult to learn. Whereas, the first and second positions were the least difficult to learn for the second and fourth grades. All three grades found the first item in the serial list to be the easiest to learn. However, the most difficult item to learn was not the item just past the middle of the list (Bugelski, 1950; Jensen and Roden, 1963) but the middle item itself. These figures also show that the sixth and fourth grade control group serial position curves are quite similar yet different from the second grade curve.

In general, the present study has indicated that the effect of isolation is dependent upon grade level and that the sixth grade was the only grade which significantly benefited from an isolation technique in a serial learning task. Isolation produced a facilitative effect on the learning of the isolated item, adjacent items and whole list learning for the sixth grade subjects. The findings of the present study, therefore, suggest that the previous study by Wisenberg (1966) resulted in a non-facilitative effect of isolation within spelling words because of the developmental level of the subjects. To the extent that serial learning and spelling involve the same basic processes, then one would be inclined to predict that isolation of a middle-positioned letter within spelling words would produce facilitative effects upon the learning of spelling words for sixth grade children.

In conclusion, it is felt that isolation was only effective at the sixth grade level due to the fact that the isolated syllable was a salient cue only for Ss in the sixth grade. Second grade Ss, in particular, were overly concerned with correct pronunciation of the nonsense syllables. Therefore, their attention was diverted and the isolated syllable did not function as a salient cue. Furthermore, the isolated syllable served as an anchor point at the sixth grade level due to the saliency of the cue and produced reorganization of the list which resulted in a facilitative effect upon learning of the entire list.

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