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Catherine Morsink
University of Kentucky

Donald P. Cross
University of Kentucky

Jane Strickler
University of Kentucky

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HOW DISABLED READERS TRY TO REMEMBER WORDS

Catherine Morsink

UNIVERSITY OF KENTUCKY FACULTY

Donald P. Cross

UNIVERSITY OF KENTUCKY FACULTY

Jane Strickler

GRADUATE ASSISTANT, UNIVERSITY OF KENTUCKY

Disabled readers seem to have great difficulty with associative learning tasks which involve word-like stimuli. Sometimes this difficulty appears so severe that it is called "word blindness." Early summaries of the ITPA suggest that disabled readers might have deficits in auditory and visual sequential memory (Seivers, et al, 1963), although these subtests may have little diagnostic or predictive value for reading (Hammill & Newcomer, 1976). Studies of memory tasks with normal learners, involving letters and word-like patterns, indicate that recall is easier when stimuli present familiar patterns, either as pronounceable syllables (Gibson, 1965) or as contextual dependencies (Miller & Selfridge, 1950). Blumberg (1968), studying associative learning tasks, found brain injured children to have the least difficulty in making associations between visual non-wordlike stimuli and spoken words, while having greatest difficulty with visual word-like associations. Bakker (1967) reports that severely disabled readers were significantly poorer than better readers in the recall of meaningful, but not meaningless, sequences.

It might be concluded from these studies that disabled readers have specific difficulty in the recall of meaningful or word-like letter sequences, rather than general difficulty in letter memory. It might also be concluded that visual word-like sequences are not meaningful to disabled readers because they have not learned to shorten the memory task by grouping letters into pronounceable patterns. They may try instead to memorize words one letter at a time, which means that their performance on the recall task would be more nearly like the normal reader's poor performance on the recall of meaningless sequences.

Purpose. The purpose of this study was to 1) compare the overall performance of disabled and normal readers on recall of letter sequences (meaningful and meaningless combined), and to 2) examine each group's performance on recall of meaningful as opposed to meaningless sequences.

Meaningful letter sequences were defined as those which are recognizable as redundant spelling patterns, such as om, lup, grel Meaningless letter sequences were defined as those which are unrecognizable (they would not appear as patterns in English words); i.e., fh, ndw, wjqs

The research questions were as follows:

- 1) Will disabled readers in classes for the learning disabled (LD) differ from normal readers in regular classes (RC) in their overall ability to recall letter sequences?
- 2) Will the within-group performance of the RC group be markedly superior on meaningful vs meaningless sequences, while the performance of the LD students is more nearly equal on both kinds of tasks?

Design. A two-way univariate analysis of variance was selected as the design for the study, and $. \leq 05$ was selected as the significance level. The interaction between group and type of stimulus was the question of major interest.

Description and selection of subjects. The target population was eight-through-ten-year-old children identified as learning disabled (state guidelines) who were receiving remedial instruction in one of twelve existing LD resource rooms in an urban central Kentucky county. Participating resource room teachers were asked to submit a list of students who were 1) reading two or more years below expectations for grade level, 2) with deficits in word recognition and 3) who could recognize and name letters of the alphabet and read some words by sight.

Using this pool, one child was selected at random from each LD room. The child's sex, chronological age (CA), and socioeconomic status (SES) were recorded. SES was determined by use of an occupational rating scale (Hatt & North, 1964).

Upon completion of the LD subject selection, the regular elementary teacher in whose classroom each LD child was mainstreamed was asked to list students who were reading at or above grade level, not having any difficulty in word recognition, who matched the LD child in sex, CA (within one year), and SES (+ 10 points on the rating scale). In many cases, there was only one child from each regular class who met all of the matching criteria. However, when options were available, the "control" child was selected at random from among the pool.

There were eight boys and four girls in each subgroup. The average SES of each group was lower-middle (range lower to upper-middle). Because LD children were mainstreamed for non-reading subjects with children who approximated their achievement levels, the average CA of the LD group was 9.3, while the average CA of their regular class peers was 8.7. The twelve LD children had an average reading level (basal instructional placement) of 1.1, while the RC students had an average reading level of 4.1.

Selection of stimulus materials. The visual and auditory letter memory subtests from the *Group Diagnostic Reading Aptitude and Achievement Tests* (Monroe & Sherman, 1939) were selected as stimuli for the meaningful sequences. Both subtests present sequences of letters containing recognizable English spelling patterns (bo, fow, grel . . .), increasing in length from two to nine letters. Both auditory and visual stimuli were presented and these scores were combined in order to prevent the task from becoming a modality test.

Stimuli for the meaningless sequences were designed by the experimenter for this investigation. Since it was important that they contain no patterns recognizable as syllables in English words, these sequences were composed entirely of consonants. The consonants were drawn at random in sequences which, like the meaningful stimuli, increased in length from two to nine letters (jg, cxz, tmjd . . .). Again, both auditory and visual stimuli were presented and these scores were combined.

A complete list of test items can be found at the end of the text. It should be noted that neither of these two types of stimuli are "meaningless" in the sense that this term was used by earlier researchers (Bakker, 1967), since both can be verbally mediated. The meaningful stimuli, however, are pronounceable and wordlike, therefore subject to the process which Gibson (1965) calls "chunking," or grouping into units to aid recall.

Presentation of stimulus materials. In the visual subtests, lower case letters printed in black on white flashcards were exposed to students for five seconds with the instructions, "I will show you a card with letters on it. I will show it to you for five seconds, then put it face down on the table. I want you to write down on this paper the letters you saw. OK? Now, the tricky part is you can't write the letters until after I put the card down. Are you ready?"

In the auditory subtests, individual letters were spoken at the rate of two per second, with students observing the examiner as she spoke. Instructions were to listen to the whole sequence, then write down the letters in the same order they were heard.

All testing was done in a uniform manner, in a quiet setting away from the child's classroom. It was anticipated that the order of presentation might affect the results of the study, since students had short attention spans, and also because they might develop a set for the task. To control this factor, the order of the four presentations was determined independently for each subject by a flip of the coin. Testing on each of the four types of stimuli was stopped after the subject made three consecutive errors. One point was given for each "word" written in correct sequence. Due to the age of the subjects, letter reversals (backwards "s," "b" for "d," etc.) were not counted as errors.

Results and discussion. Results of the ANOVA, summarized in Table 1, indicate that there were significant differences between the overall performance of the two groups, and between the two types of stimuli, with the RC group scoring higher overall (12.75) than the LD (8.17), and the performance of both groups combined higher for meaningful (12.50) than meaningless (8.42) material.

Table 1 also indicates that there was a significant interaction between group and type of stimulus material, with the RC group demonstrating better facility with meaningful (15.58) than meaningless (9.92) stimuli, while the LD group's performance was more nearly equal on both types of stimuli (9.42 meaningful, 6.92 meaningless). The nature of this relationship is shown in Figure 1. These results may indicate that the LD students did not perceive frequently-occurring spelling patterns as meaningful material, or that they had not yet developed enough reading

TABLE 1

UNIVARIATE *F* RATIOS FOR TWO-WAY ANOVA:
 TYPE OF STIMULUS (MEANINGFUL/MEANINGLESS)
 BY GROUP (REGULAR CLASS/LEARNING DISABLED)

Source of Variation	df	Ms	F	p
Factor A (stimulus)	1	200.08	32.89	p = < .0001*
Factor B (group)	1	252.08	41.44	p = < .0001*
A x B	1	30.08	4.95	p = < .0313*
Within cells	44	6.08		

*significant at the $\alpha = < .05$ level

skill to distinguish between spelling patterns which could be grouped into pronounceable units and those which represented random jumbles of unrelated symbols.

Since the mean raw scores combined auditory and visual stimuli in increasingly longer sequences, the meaningful score of 9.42 meant that the average LD child could recall a sequence of only three or four letters (range 2-5) in a row. The mean of 15.58 meant that the average RC child, who was nearly a year younger, could recall five or six letters (range 4-8) in a row.

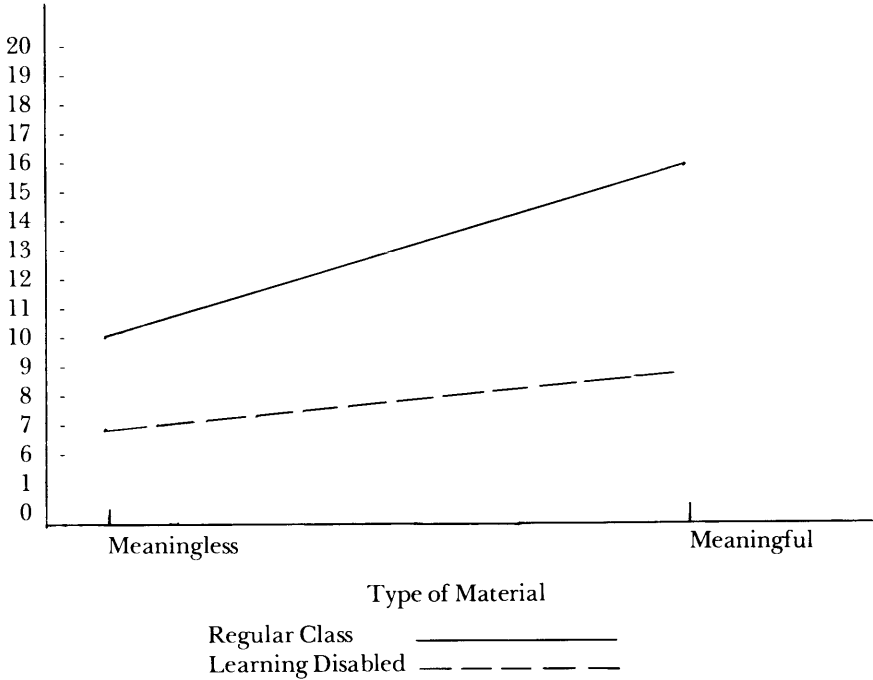
Careful study of individual response sheets indicated three other interesting findings. 1) There was less than expected difference between the groups (RC or LD) in their tendency to reverse letters in writing, with the LD having thirteen such reversals, while the younger RC children had eight. Younger normal learners, then, had nearly as many letter reversals as did this LD sample.

2) The auditory portions were marked by so many confusions in sound discrimination for both groups that the validity of this part of the test might be questioned. In twenty-nine cases the RC, and in thirty-eight cases the LD students wrote down a letter which was incorrect, though auditorially similar to the one pronounced by the examiner (d/e, f/s, j/a, v/b, p/t, c/z, etc.). Although this may reflect a slight variation in regional dialect, it also seems indicative of the need for specific training in auditory discrimination between similar letter sounds. In spite of difficulties with the auditory stimuli, these scores were retained to prevent the test from focusing on a single modality channel. However, if only the visual stimuli had been considered, the RC group's overall mean would still have been 7.05 (8.92 meaningful, 5.17 meaningless), as compared with 4.08 (4.67 meaningful,

FIGURE 1

RELATIONSHIP BETWEEN GROUP MEMBERSHIP AND
ABILITY TO RECALL TWO TYPES OF MATERIAL

Number of "words" Correct

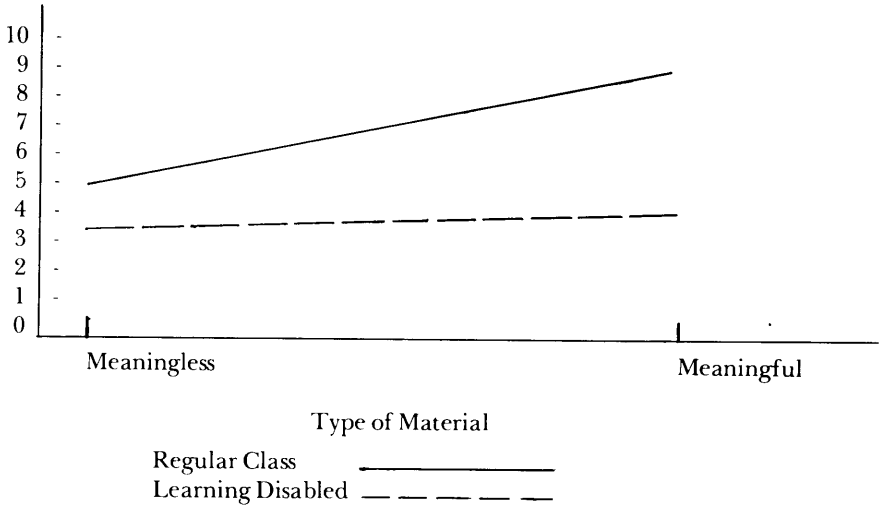


3.50 meaningless) for the LD students, and the similarity between the LD group's performance on meaningful and meaningless material would have been even more pronounced, as shown in Figure 2.

3) Most meaningful recall errors by the RC group tended to resemble word-like sequences ("winry" for "wibry," "kinel" for "kignel," "etoraboka" for "etorakubo," etc.), while many recall errors by the LD group appeared to be random jumbles of letters ("whlb" for "whugg," "afnt" for "afet," "mde" for "malde," etc.), consisting of the first letters or the first and last letters and often lacking vowels. Following the test students were asked to explain their strategy for recalling the sequences. Most LD students who could verbalize what they did reported saying the individual letters to themselves, while the RC students more often said they "tried to make words out of them." Again, this may suggest that even regularly occurring letter sequences are not recognizable as meaningful patterns by LD children.

FIGURE 2

RELATIONSHIP BETWEEN GROUP MEMBERSHIP AND ABILITY TO RECALL TWO TYPES OF MATERIAL WHEN ONLY VISUAL STIMULI ARE CONSIDERED



STIMULI USED IN TESTING

<i>Visual</i>		<i>Auditory</i>	
<i>Meaningful</i>	<i>Meaningless</i>	<i>Meaningful</i>	<i>Meaningless</i>
ag	jg	om	fh
bo	yl	lu	yk
nup	nsw	tas	bzc
fow	cxz	mey	ndw
grel	wjqs	flob	tmjd
afet	hbcm	spag	snwv
malde	kgcj	whugg	rxdq
wibry	xdrqc	trome	jslmt
cunerf	vdlfbj	skenar	nkfygh
kignel	mtslng	grevik	kbfygr
smontir	mjnqrhp	alinnar	vjtspnq
doponas	srhbyfd	yaproif	crgyfbk
rilamperp	xkbvjzfw	mafapase	xtjvmlhd
chiolary	ypxmzhgk	squogelt	kfbgrysc
etorakubo	fcqslvntw	hethoselt	znvglcqsw
snelerith	mjdkqbyp	briagonty	qdskvjrz

Limitations. Results should be interpreted with caution, due to the small number of students available, making precise matching impossible and simple randomization inadvisable. Also, I.Q. was neither measured nor partialled out. And, since the nature of the “meaningful” component of the task was so similar to the reading task itself, poorer performance by LD students on this task may be an artifact, indicating a previously noted relationship with the ability to read rather than an underlying deficit. However, since the findings of previous studies with this population have been similar to those in the present study (Blumberg, 1968; Bakker, 1967), and since children similar to those described continue to have extreme difficulty in learning to read, it seems that the problem is worthy of further exploration.

Conclusions. Results of this pilot study suggest that 8- through 10-year-old disabled readers in LD classes may differ from younger average-to-good readers, both in their ability to recall sequences of letters and in their ability to shorten the recall task by perceiving recognizable spelling patterns as meaningful groups. Further research on visual letter memory, with larger groups of children, is needed. If these results can be replicated, a case might be made for teaching LD children to recognize as meaningful the spelling patterns which occur with highest frequency in the English language. Overlearning of these patterns might then allow LD students to make automatic responses to visual stimuli, circumventing possible difficulties in visual letter memory and/or letter-sound correspondence.

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