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ABSTRACT

Auditory conceptualization as an important factor in literacy development is investigated in this study. Earlier research with the Lindamood Auditory Conceptualization (LAC) Test identified this factor at each grade level, kindergarten through grade twelve, and delineated a LAC Test breakpoint score which was sharply discriminative of reading performance as measured by the individually administered Wide Range Achievement Test. In this study, over 1520 third grade students were tested on their ability to perceive number, identity, and sequence of phonemes in both isolated and syllabic relationship and to conceptualize the auditory stimulus with a sequence of colored blocks, as measured by the LAC Test. Performance was correlated with reading performance as measured by the Cooperative Primary Reading Test (CPRT). The earlier findings were replicated. A comparable breakpoint score was sharply discriminative of reading performance, and a positive correlation was found between CPRT scores and LAC Test scores. This suggests that elemental phonemic analysis skills account for a significant proportion of the variability in measure of the most advanced skills in reading. (Author/TO)

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One of the basic questions in reading research is whether the problem of acquiring reading competency is at the level of reading connected text or is instead at the more elemental level of handling words and their components. This unresolved question has generated controversy in relation to both measurement of reading competency and methods of reading instruction (Shankwiler and Liberman, 1972). Another basic question is whether problems in word perception are primarily visual, auditory, or linguistic/semantic processing difficulties, or combinations of these. The importance of studying these subsystems of cognitive process in isolation is suggested as an aid to diagnosing their separate contributions to total reading performance (Calfee, Chapman et al, 1970)(Posner, Lewis et al, 1972). The factor of auditory conceptualization investigated in this paper gives promise of providing information relative to the above questions. Earlier research with the Lindamood Auditory Conceptualization (LAC) Test identified auditory conceptualization as an important factor in literacy development at each grade level, K - 12 (Lindamood and Lindamood, 1971). In that research a LAC Test breakpoint score was delineated which was sharply discriminative of reading performance as measured by the individually administered Wide Range Achievement Test (Calfee, Lindamood et al, 1973). This paper investigates this same factor of auditory conceptualization and its

relationship to literacy development, but in a larger population, at a single grade level, and in predictive relation to performance on a group reading test.

Auditory Conceptualization

In most research on the auditory components of speech and reading the term auditory discrimination is found. This term usually denotes tasks involving the gross judgment of sameness vs difference for isolated sounds, contrasting syllable or word pairs, or other auditory stimuli involving a stimulus/response within the auditory-vocal modality. Reading, however, is an intersensory or transcoding process involving integration of visual and auditory-vocal modalities. Attention is called to the fact that this transmodal type of processing is required in the LAC Test, and therefore the term auditory conceptualization is used. In addition to discrimination, the tasks involve conceptualization of the phonemic contrast between two spoken patterns, and representation of the contrast in a visual medium.

RESEARCH DESIGN

Subjects

At the end of third grade, every third grade child in each of twenty-one schools geographically spaced throughout Santa Barbara County, California, was tested with the individually administered LAC Test. The schools were those in which a fourth grade teacher had volunteered to participate in a follow-up research project. Of the 1,521 students tested, 765 were girls and 755 boys. This was almost 1/3 of the total county population of third graders. The population represented the full range of socio-economic variation, and the linguistic composition was slightly over 5% bilingual, and almost 95% English speaking only.

Materials and Procedure

The LAC Test measures an individual's ability to perceive and indicate variations in phonemic number, identity, and sequence as phonemes are presented in both isolated and syllabic relationship. A sequence of colored blocks is the visual medium used to represent number, sameness or difference, and order within the auditory stimulus. Any color can represent any sound. No constant relation is maintained between a specific color and a specific sound except to indicate repetition of a sound within a pattern.

In the form used in this study, the test consisted of two categories. In Category I the Subject was presented a spoken sequence of two or three isolated phonemes which he conceptualized with a sequence of colored blocks. For example, the sequence /k,t,k/ would be represented with the block sequence blue-yellow-blue, or any other three block sequence with the first and last block the same color. In Category II the Subject was presented a minimally contrasting chain of syllables. He placed and manipulated a colored block sequence to conceptualize the contrast generated by a phoneme addition, substitution, repetition, omission, or shift within a syllable pattern. Only short vowels were used, to minimize ambiguity from association to spelling principles. No pattern contained more than four sounds, to minimize the auditory memory component, and there were a total of twelve patterns. A particularly interesting feature of the test design is that a procedure was used to tap comparator function, in the belief that this function is related to self-corrective activity in the reading process. The procedure involved an Examiner presentation as follows: "Show me /i/; if that says /i/, show me /ip/; if that says /ip/, show me /pi/; if that says /pi/, show me /pip/;" and so on, culminating in more complex patterns like "If that says /aps/, show me /asp/; if that says /asp/, show me /sasp/." A precheck established the Subject's understanding of the basic

concepts of number, same/different, and left to right ordering. Demonstrations were given of the coding task for both Category I and Category II. The maximum score was 100 points. Testing required about 15 minutes per child. At the same time the LAC Testing was being accomplished, data were gathered on the results of the state mandated, group administered, Cooperative Primary Reading Test performance of each child.

Training of Testers

Testing was done by trained personnel, primarily university students and individuals randomly selected from the county substitute teacher list. One interesting aspect of the selection of testing personnel was that approximately 1/3 of the individuals who had arranged to be trained in the testing were unable to be used. Dysfunction in auditory conceptualization ranging from moderate to severe interfered with their being able to become competent in handling the stimulus items and the scoring judgments within the time available for training. This would indicate that researchers gathering data which include LAC Test performance would be well advised to plan for particularly careful procedures in selecting and training test personnel. Probably the most effective screening procedure would be to administer the LAC Test to prospective testing personnel.

RESULTS AND DISCUSSION

Correlation

The correlation between LAC Test weighted raw scores and grade scores on the Cooperative Primary Reading Test, Form 23B, ran about 0.44. This means that approximately 20% of the variance in the grade score distribution is accounted for by LAC Test performance. Such a finding would not be significant if the relationship existed between two reading tests purporting to measure much the same thing. The significance of this relationship lies in the fact that the focus of the CPRT measure

is on comprehension skills while the LAC Test focuses simply on the most elemental phonemic analysis skills. In other words, this often overlooked elemental cluster of skills accounts for a significant proportion of the variability in measure of the most advanced skills in reading.

Breakpoint Score

A breakpoint at a LAC Test score of 80 was sharply discriminative of reading performance on the CPRT. If a child scores poorly on the LAC Test it is highly probable that he will be experiencing difficulties in mastering fundamental reading skills. The data indicate that over 76% of the third grade children who score below 80 on the LAC Test also score four months or more below grade level norms on the CPRT; while 78% of those who score above 80 on the LAC Test score at or above grade level on the CPRT. This is directly comparable with the breakpoint score of 43 on an earlier form of the LAC Test with a maximum score of 60 points, in the Monterey, California study (Calfee, Lindamood et al, 1973). In that study students who scored above the breakpoint had an 85% probability of reading at or above grade level on the WRAT; those scoring below the breakpoint had a 71% probability of performing below grade level. The breakpoint score of 80 is also compatible with the clinically established LAC Test cut-off score of 81 for a child completing third grade, as indicated in the LAC Test Manual (Lindamood and Lindamood, 1971).

General LAC Test Performance

Scores ranged from zero to 100, the entire range of the test. It is significant to note that over 1/2 of the 1,521 children tested scored below the clinically established LAC Test cut-off score of 81 for a child completing third grade. Furthermore, over 25% of those scoring 80 or below scored significantly below, with scores of 55 or lower. This is less than is recommended for a child completing first grade.

Another very interesting aspect of this data is the wide variation from school site to school site in the percentage of students who fell at or below this score of 55. At some school sites as many as 50% of the population fell below this score, while at other sites, only 5% or 6% fell below it. (The reasons for these variations are presently under examination. At this point it does not appear that some simple hypothesis like the socio-cultural background of the population will provide an adequate explanation.)

There was no indication of differential performance in males versus females.

There was, however, a significant difference in performance of speakers of English only, versus bilingual students. The mean score for speakers of English only was 73, for the bilingual group it was 59. It is highly unlikely that the observed difference in performance between these two groups is the result of chance factors in this particular population.

Effect of Training

Savin (1972) comments that at present there is no plausible answer to the question of why some children are unable to segment syllables into phonemes, and that no training program is known to help these children. While it is true that there is currently no answer to why some children are unable to segment syllables into phonemes, experience with the A.D.D. Program (Lindamood and Lindamood, 1969) provides evidence that such judgment can be stimulated both developmentally and remedially. For example: Yates (1972) reports that 49 first graders who had a mean LAC Test score of 17 in September showed a gain of 32 points for a mean score of 49 in January after four months of A.D.D. Program training. This contrasts with the findings of Varner (1973) where 20 first graders in three different reading programs who had a mean LAC Test score of 22 in September showed a gain of only 20 points for a mean score of 41 in May. This means that the students who received A.D.D. Program training made greater

gains in ability to segment syllables into phonemes in four months than did students without A.D.D. training in a full school year. In a controlled study by Rose (1971) 36 students in grades 1 - 8 received 30 hours of A.D.D. training in a four month period. The average gain in LAC Test score was 28 points. In a control group of 16 students the average gain in LAC Test score was zero. In another controlled study, (Dall 'Armi, 1973) 72 fourth graders received the A.D.D. Program for auditory conceptual training versus other training for a group of 54 fourth graders. Mid-year analysis of LAC Test score variances indicated a significant mean difference for the experimental group receiving the auditory conceptual training.

SUMMARY AND IMPLICATIONS

The earlier findings of a significant relationship between auditory conceptualization and reading ability in the K - 12 population of the Monterey study were essentially replicated in this third grade study. A comparable breakpoint score was sharply discriminative of reading performance, and a positive correlation was found between the group administered CPRT scores and LAC Test scores. The correlation was not as high as between LAC Test scores and the individually administered word recognition task of the WRAT, as would be expected, but the data suggest that even when the focus of the reading test is on the most advanced reading skill of comprehension, elemental phonemic analysis skills account for a significant proportion of the variability in reading performance. These findings, plus initial research findings on the effect of training in auditory conceptualization, suggest the validity of setting specific levels of phonemic analysis competency as a basic minimal educational goal.

Cross Tabulation of Cooperative Primary Reading Test Grade Equivalent Score by Weighted Raw Score on the LAC Test

CPRT Grade Equiv. Score & Level		0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	7	8
Below grade 1.0 - 3.5	1.	8	7	25	96	43	77	111	81	100	37	585	
	2.	1.4	1.2	4.3	16.4	7.4	13.2	19.0	13.8	17.1	6.3		
	3.	66.7	87.5	83.3	66.2	63.2	56.6	49.8	39.1	28.6	14.1		
	4.	0.6	0.5	1.7	6.7	3.0	5.3	7.7	5.6	6.9	2.6		40.6
At grade 3.6 - 4.0	1.	3	0	2	26	16	31	46	43	73	54	294	
	2.	1.0	0.0	0.7	8.8	5.4	10.5	15.6	14.6	24.8	18.4		
	3.	25.0	0.0	6.7	17.9	23.5	22.8	20.6	20.8	20.9	20.5		
	4.	0.2	0.0	0.1	1.8	1.1	2.1	3.2	3.0	5.1	3.7		20.4
Above grade 4.1 - 5.0	1.	1	1	3	23	9	28	66	83	177	172	563	
	2.	0.2	0.2	0.5	4.1	1.6	5.0	11.7	14.7	31.4	30.6		
	3.	8.3	12.5	10.0	15.9	13.2	20.6	29.6	40.1	50.6	65.4		
	4.	0.1	0.1	0.2	1.6	0.6	1.9	4.6	5.8	12.3	11.9		39.0
TOTAL	5.	12	8	30	145	68	136	223	207	350	263	1442	
	6.	0.8	0.6	2.1	10.1	4.7	9.4	15.5	14.4	24.3	18.2		100.0

LAC Test weighted raw score

Legend:
1. Number of pupils at each LAC level scoring at each CPRT level.
2. Percent of pupils at each CPRT level scoring at each LAC level.
3. Percent of pupils at each LAC level scoring at each CPRT level.
4. Percent of total test population scoring at CPRT level and LAC level.
5. Total number scoring at each LAC level.
6. Percent of total test population scoring at each LAC level.
7. Total number scoring at each CPRT level.
8. Percent of total test population scoring at each CPRT level.

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