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ABSTRACT

The purpose of this investigation was to test whether the assembly or system model was more adequate to account for the relationships among subskills in normal and disabled readers. Thirty-eight subjects were divided into three groups. There were 19 disabled subjects with a mean chronological age of 9.17, a mean IQ of 104.84, and a mean reading level of 1.80. Ten normal-old subjects were matched to the disabled group on chronological age, 8.61, and IQ, 106.00, and the reading level of the group was 4.20. Nineteen normal-young subjects, with a mean age of 7.00, an IQ of 105.36, and a reading grade level of 1.91, (were matched with the disabled on chronological age and IQ. Criterion referenced tests of phoneme-grapheme association skills were constructed and administered to both disabled and normal readers. The strength of subskills in the disabled group was virtually identical to the comparable subskills in the normals similar in reading level. Both of these groups were inferior to normals matched on age who had completely mastered each of these skills. Intercorrelations among subskills were high positive for the normals and were largely insignificant for the disabled. (Author/WR)

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MODELS OF READING AND READING DISABILITY

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Objectives

It is suggested in this paper that models of reading may be divided into two classes on the basis of the relationships among the components in the models. These two classes may be subdivided further into two classes on the basis of the characteristics of the individual components in each model. Specifically, there are models which assert that reading requires an assembly of skills which are acquired autonomously and which function independently (assembly model). Other models contend that components of reading are heavily dependent on each other and are acquired simultaneously (system model). The components for either of these models may consist of basic cognitive processes such as auditory memory and visual discrimination or reading subskills such as the ability to emit the phoenemes of a consonant cluster (bl) when the child is presented with the graphemes. Four types of models result: (1) assembly - cognitive processes, (2) assembly-subskills, (3) system - cognitive processes and (4) system - subskills.

Many studies of reading disability (Bateman, Myklebust and Johnson, Deutsch and Katz) assume that reading is accounted for by an assembly model. The studies typically examine cognitive processes rather than subskills. The purpose of this investigation was to test whether the assembly or system model was more adequate to account for the relationships among subskills in normal and disabled readers. It was anticipated that if the subskills for normal readers were highly intercorrelated that the system model would be supported and the assembly model would be questioned. If the system model was supported for normals, it was expected that disabled readers would be deficient on a large majority of subskills; however if the assembly model was supported for normals, the disabled readers were expected to be deficient on a small minority of subskills.

Method and Data Source

The subjects consisted of 38 Ss, who were divided into three groups: disabled, normal-old and normal-young. There were 19 disabled Ss with a mean chronological age of 9.17, a mean IQ (WISC) of 104.84, and a mean reading grade level on the Gates-MacGinitie Comprehension of 1.80. The 10 normal-old Ss were matched to the disabled group on chronological age, 8.61, and IQ of 106.00, and the reading level of this group was 4.20. The 19 normal-young Ss had a mean age of 7.00, an IQ of 105.36, and a reading grade level of 1.91. They were matched with the disabled on chronological age and IQ.

A criterion-referenced test of subskills was constructed. It included 15 subtests each of which contained 20 items. One group of subtests was referred to as a production set. In these tasks, graphemes were presented to the S and the S was required to say the sounds orally which were represented by the graphemes. The subtests in this group included: words in context, sight words timed (.5 second) sight words untimed, nonsense words, long vowel words, short vowel words, consonant clusters, single letter sounds and letter naming. A second group of subtests required the Ss to circle one of four or five alternatives presented visually when the items were spoken aloud by the test administrator. This group included: nonsense words, consonant clusters, final letter sounds and initial letter sounds. Also included were tests of auditory blending and syllabication.

The recognition section was administered to groups of 5 Ss simultaneously. The remainder was administered to all Ss individually. The normals were tested in the school they attended. The disabled were tested in the Kennedy Institute where they attended a remediation program. The disabled Ss were tested to be normal on auditory acuity, visual acuity and emotional adjustment.

Results

First the validity and reliability of the criterion-referenced test were examined. The nonsense word production subtest was judged to require the highest degree of integration of subskills and was expected to be most highly related to sight vocabulary. The correlation between this subtest and the Gates-MacGinitie Vocabulary Score was .83. It was concluded that the nonsense word reading subtest was valid since it correlated highly with the standardized test vocabulary score. The validity of the other subtests was not evaluated. It was found that the subtests which had decreasing similarity to the nonsense word production test had decreasing correlations with that subtest: short vowel-nonsense word = .78, consonant cluster-nonsense word = .76, single letter sound-nonsense word = .50.

Reliabilities of the subtests were computed with the KR 21 formula. All 15 subtests exceeded .80 except two. Letter naming on which a ceiling effect appeared and syllabication on which scorer reliability was low were excluded from further analyses.

Intercorrelations among the subtests for normal-young children were high positive. Of the intercorrelations among the production subtests, 9 out of 10 correlations exceeded the .01 level of significance. Of the intercorrelations among the recognition subtests 3 out of 3 exceeded the .01 level. The normal-old subjects were excluded from this analysis since they scored beyond 90 percent correct on all subtests and thus manifested little variance within which to observe correlation. Contrary to the normals, the correlation among the production of subtests for disabled subjects was low. On only a minority of 4 out of 10 possible correlation was a significant relationship observed at the .01 level. Furthermore the nonchance correlations which occurred for this group were significantly lower ($p < .05$) than the comparable correlations for 10 normal-young subjects in 3 correlations out of 4. The intercorrelation on recognition subtests was as high for disabled as for normals.

The level of performance of these three groups on the tests were compared. The old-normal group mastered all of the subtests at beyond 90 percent correct and were significantly higher than the young-normal group ($t = 2.43$, $df = 28$ $p < .05$). The other groups were compared with a 2 (groups) x 8 (tests) repeated measures analysis of variance. A significant main effect was observed for tests ($F = 94.05$, $df = 7/252$, $p < .05$), and the groups did not differ significantly from each other. There was no significant interaction. The performance of the disabled group, in terms of percent correct was: nonsense words = 30, long vowel words = 17, short vowel words = 30, consonant clusters = 50, letter sounds = 85, nonsense word recognition = 50, consonant cluster recognition = 72, initial letter sound recognition = 85.

Discussion

Since the intercorrelations among the subtests for normal readers were high, the system model is supported and the assembly model is questioned. The system model contends that reading requires a system of subskills which are dependent on each other and which facilitate one another during the process of acquisition. Since the system model was confirmed for normals, it was expected that disabled readers would be deficient on a large majority of subskills. The mean percent correct scores on the subtests and the failure to obtain a testxgroup interaction in the analysis of the variance confirm this expectation. Thus the system model is supported both by the correlation data for normals and by the level of performance data for disabled readers.

The relatively low intercorrelation among production subtests for disabled readers suggests a possible source of the disability of poor readers. The system model suggests that the normal acquisition of reading requires that the subskills facilitate each other and progress at similar levels of strength. It is possible that poor readers have one subskill which has not been learned and which prevents the others from being learned. An alternative is that the necessary interfacilitation among subskills does not take place. The low intercorrelation provides evidence in favor of the latter alternative. Additional, experimental evidence on the positive transfer among subskills is needed to investigate that hypothesis.

Significance

Many investigators have found the use of models fruitful in the study of educational and psychological problems. This paper clarifies the characteristics of four types of reading models: assembly-cognitive process, assembly-subskill, system-cognitive process, system-subskill. Examination of the fruitfulness and accuracy of these models will enable researchers to place their studies in the meaningful context of a model and help avoid research on irrelevant issues. In particular, the relationships among subskills of normal and disabled readers were found to be accommodated more adequately by the system than the assembly model. The disabilities of poor readers may be at least partially attributable to a lack of interfacilitation among subskills which is required by the system model. The implications of the system model for the acquisition of reading in normal and disabled readers merits further study.

MODELS OF READING

AND

READING DISABILITY

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TABLE 1

AGE, IQ AND READING LEVEL OF SUBJECTS

	Disabled	Normal Young	Normal Old
Boys	17	10	5
Girls	2	9	5
Chronological Age			
$\bar{X}$	9.17	7.00	8.61
SD	1.24	.48	.32
Intelligence Quotient			
$\bar{X}$	104.84	105.36	106.00
SD	12.53	11.14	7.66
Reading Comprehension			
$\bar{X}$	1.80*	1.91*	4.20**
SD	.52	.57	.77
Reading Vocabulary			
$\bar{X}$	2.07*	2.21*	
SD	.73	.83	

* Grade equivalent of the Gates-MacGinitie, Primary A, Form 1.

** Grade equivalent of the Gates-MacGinitie, Primary C, Form 1.

SUBTESTS OF KENNEDY INSTITUTE PHONICS TEST

Subtest	Examiner	Examinee Responds			
1. Words in Context	"The boy rode the" bike	"bike"			
2. Words Flashed	corner	"corner"			
3. Words Untimed	corner	"corner"			
4. Nonsense Words	cled	"cled"			
5. Long Vowel Words	bait	"bait"			
6. Short Vowel Words	hat	"hat"			
7. Consonant Cluster Production	bl	"bl"			
8. Letter Sound Production	k	"k"			
9. Letter Naming	f	"f"			
10. Nonsense Word Recognition	"cled"	clad	(cled)	pred	sug
11. Consonant Cluster Recognition	"bl"	(bl)	dr	bn	sl
12. Initial Letter Recognition	"prick"	v	f	(p)	k
13. Final Letter Recognition	"flatter"	b	s	h	(r)
14. Auditory Blendings	c-arp-et	"carpet"			
15. Syllabication	calendar	cal/en/dar			

Table 2

Reliability and Validity of KIPT

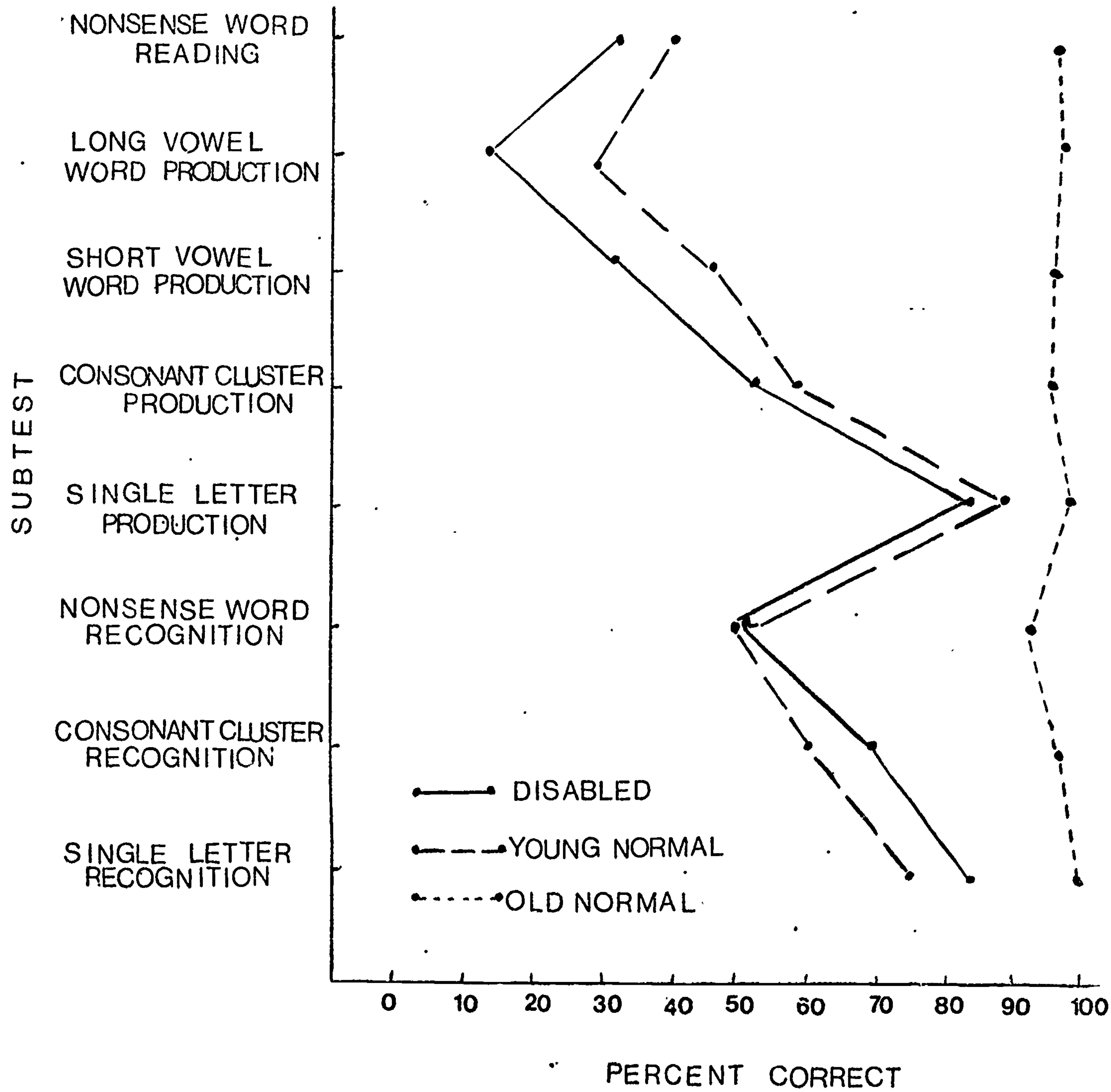
Reliability				Validity	
Subtest	r	Subtest	r	Measures	r
1. WC	.91	10,NR	.83		
2. WF	.86	11,CCR	.81	KIPT Nonsense Wd P. Gates-MacG. Vocab.	.83
3. WU	.88	12,ILR	.88		
4. NP	.86	13,FLR	.83	KIPT Nonsense Wd P. Gates-Mac G. Comp.	.79
5. LVP	.91	14,AB	.90		
6. SVP	.90	15,S	.20	KIPT Short Vowel Wds Gates-MacG. V	.81
7. CCP	.95	Total KIPT	.98		
8. LSP	.85	Gates MacGinitie Comp.	.91	KIPT Consonant Cluster Gates-MacG. V	.71
9. LN	.22	Gates MacGinitie Vocab.	.94	KIPT Letter Sounds Gates-MacG. V	.37

TABLE 4

CORRELATIONS AMONG EIGHT SUBTESTS
OF THE KIPT FOR YOUNG NORMAL READERS

Subtests	NP	LVP	SVP	CCP	SLP	NR	CCR	ILR
Nonsense Word Production (NP)		.78*	.87*	.94*	.53*	.84*	.72*	.66*
Long Vowel Production (LVP)			.94*	.83*	.47	.85*	.48	.45
Short Vowel Production (SVP)				.90*	.56*	.91*	.57*	.44
Consonant Cluster Production (CCP)					.60*	.83*	.69*	.57*
Single Letter Production (SLP)						.56*	.59*	.57*
Nonsense Word Recognition (NR)							.62*	.55*
Consonant Cluster Recognition (CCR)								.82*
Initial Letter Recognition (ILR)								-

* Indicates $p < .01$.



SUBTEST
NONSENSE WORD READING
LONG VOWEL WORD PRODUCTION
SHORT VOWEL WORD PRODUCTION
CONSONANT CLUSTER PRODUCTION
SINGLE LETTER PRODUCTION
NONSENSE WORD RECOGNITION
CONSONANT CLUSTER RECOGNITION
SINGLE LETTER RECOGNITION
DISABLED
YOUNG NORMAL
OLD NORMAL
0 10 20 30 40 50 60 70 80 90 100
PERCENT CORRECT

TABLE 5

CORRELATIONS AMONG EIGHT SUBTESTS
OF THE KIPT FOR DISABLED READERS

Subtests	NP	LVP	SVP	CCP	SLP	NR	CCR	ILR
Nonsense Word Production (NP)		.50	.85*	.69*	.37	.68*	.55*	.52*
Long Vowel Production (LVP)			.52*	.34	.18	.24	.24	.26
Short Vowel Production (SVP)				.66*	.40	.60*	.52*	.45
Consonant Cluster Production (CCP)					.49	.66*	.63*	.74*
Single Letter Production (SLP)						.45*	.67*	.81*
Nonsense Word Recognition (NR)							.69*	.66*
Consonant Cluster Recognition (CCR)								.79*
Initial Letter Recognition (ILR)								

* Indicates $p < .01$.

11.

NPD
CS

Models Of Reading And Reading Dis bility

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Criterion referenced tests of phoneme-grapheme association skills were constructed and administered to disabled and normal readers. The strength of subskills in the disabled group was virtually identical to the comparable subskills in the normals similar in reading level. Both of these groups were inferior to normals matched on age who had completely mastered each of these skills. Intercorrelations among subskills were high positive for the normals and were largely insignificant for the disabled. A model is forwarded which suggests that interfacilitation among subskills is necessary for normal reading.