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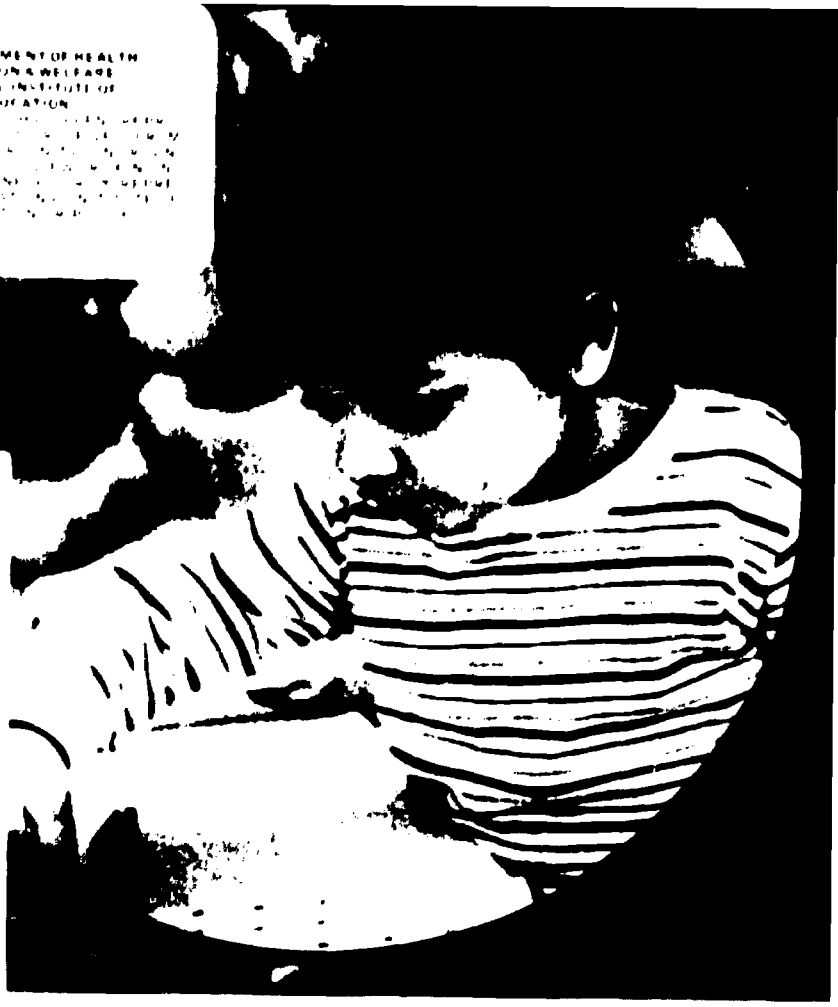
ABSTRACT

This paper is an empirical statistical analysis and interpretation of data relating to school readiness previously examined and reported on a theoretical basis. A total of 118 white, middle class children from six consecutive kindergarten groups in Dearborn, Michigan were tested with seven instruments, evaluated in terms of achievement, ability, and overall maturity by their teachers, and physically examined and x-rayed. In comparing these diversified bodies of information, which also included sex and chronological age, 69 independent variables related to school readiness were counted which represented the range of phenomena to be factor analyzed. Performance of the analysis permitted the synthesis of new entities, or factors, which were far fewer in number than the initial raw variables. Analysis findings revealed seven facets of readiness which together are basic determinants of overall school readiness. They include cognitive readiness, chronological age, reading readiness, body of knowledge, perceptual differentiation, physical development status, and biochemical maturity factor. In the interpretation of each factor, the most highly loaded variables are listed and examined. Discussion focuses on the changed readiness concept, sex differences, chronological age, the importance of knowledge, and the accomplishments, limitations, and implications of this factor analysis. (SDH)



SCHOOL READINESS FACTOR ANALYZED

by

anton brenner AND leland h. stott

the merrill-palmer institute

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CONTENTS

School Readiness Factor Analyzed

Anton Brenner and Leland H. Stott*

The study reported here is part of a long-range research project on children's readiness for school which originated in 1953 and was carried on through 1968. It was conducted by the Merrill-Palmer Institute, Detroit, with the cooperation of Henry Ford Hospital, Detroit; the Greenfield Village Schools, Dearborn; the Detroit Public Schools; and many schools in and out of Michigan. The project was designed to develop a comprehensive concept of school readiness, to further our understanding of the characteristics of children indicative of their degrees of readiness, and to learn about the kinds of demands which schools set up for children. The development of methods of measuring readiness was another major objective.

The earlier phase of the project was exploratory in nature, to be followed by a program testing the findings, first on a smaller and then on a larger scale. All studies, including the factor analysis presented here, were carried out in such a way that they were consistent with our concept of readiness. They must be understood within this frame of reference. It will therefore be helpful first to give a selected exposé of our ideas on readiness published in detail elsewhere.

DESCRIPTION AND DEVELOPMENT OF PROJECT

Our Concept of Readiness

Readiness, like life, is being and becoming. It is process and the result of process. "At the beginning of the life cycle the organism is weakly developed in structure and function; is inexperienced with nurture and environment and has little learning [Hughes, 1958]." Structure, function, affectivity, cognition, personality, and readiness are parts and results of on-going developmental processes and changes. Growth, development, and learning take place through constant interaction between an individual and his environment. This leads to a gradually increasing accumulation and differentiation in the individual organism with an increase in his ability to perceive, to analyze, and to synthesize experience both from within and beyond himself. The more developmentally advanced the person is, the more he is able to act effectively in pursuing and controlling his developmental tasks. Translated into readiness for school this means that the more a child is able to perceive, to incorporate experience into developing behavior, and finally to analyze and synthesize it, the more he is ready for school. Readiness then can be considered a continuing function of perceptual-conceptual and personal development.

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Readiness for school is the result of past development and learning. It is the basis, the prerequisite, for further learning. It is always a state of development produced by hereditary factors which are transacted and transformed through nurture and an individual's life experiences to a unique organic system that allows functioning and performance of specific tasks.

Readiness is seen as the pupil's multidimensional functional potentiality in relation to the multidimensional task requirements in school. To understand the full complexity and meaning of readiness, we must see the individual and task aspects together in each and all of the subject-object dimensions and in their multifaceted relatedness and interwovenness. Where individual volume (the child's abilities, knowledge, and experiences) is commensurate with or surpasses task volume (school demands), there is readiness. Where task volume surpasses individual volume, there is unreadiness.

There is no single road to readiness.

Each individual is different from every other one in his genetic makeup and with regard to the nurture affecting him. The transactions that occur between the developing organism and the field forces impinging upon him create for each child a different pattern of growth, maturation, learning, and readiness. Readiness is the result of the constant interaction between the child's physical, mental, emotional, and social personality and these field forces.

Readiness for certain school demands occurs in each child in a different way and at a different time. Each individual is different in his functional potentiality and biopsychic readiness for school expectations and demands which vary in themselves according to culture, social stratum, locale, administration, teacher and parent personalities, and philosophies. There is great variability among pupils and school demands and therefore also in the various dimensions and patterns of readiness.

The Need for a Factor Analysis Study

Prior to our factor analysis, a series of studies had been carried out over the years with the number of subjects varying from 18 to over 1,000. These studies were designed to approach the problem of readiness from various angles and to shed some light on different aspects of readiness. From the very outset readiness was conceived of as a complex phenomenon of multidimensional individual-task relationships. The time came when it was felt that tentative formulations from earlier studies had to be put on a more solid basis: (a) by increasing the research population of the study; (b) by adding varied and multidimensional content of information; and (c) by studying the interrelatedness and underlying commonalities of the various aspects of this complexity which we call readiness. Only then would we come closer to a total understanding of readiness and get results which have both more definition and extensive meaning than single separate studies. There [illegible] a need for unification in analysis to give related or seemingly [illegible]pendent elements coherence and meaning in the whole. Such

thinking obviously pointed to the need for a factor analysis study on a broad scale. Of this factor analysis study, computed in 1962 from data collected during the preceding nine years, we are reporting here.

Hypotheses To Be Tested

The first hypotheses or problems investigated have led to first findings and tentative formulations about readiness. These earlier findings and tentative generalizations derived from them were used as new hypotheses to be tested again through our factor analysis study. The new hypotheses purposely include also some of our conceptualizations about readiness which we now wanted to have checked through this study. The thus compiled hypotheses read as follows:

Readiness is a multidimensional, individual-task relationship with multiple demands on many facets of the child's personality.

The more differentiated a child is in his personality structure and function, the better he is prepared for school.

Readiness is present when there is a good fit between individual volume and task volume. Individual volume is understood as quantity and quality of preparedness. Task volume refers to the number and magnitude of school demands.

There is no single road to readiness. Different children will arrive at readiness through different combinations of abilities, knowledge, and responses to school tasks and expectations.

A ready child has considerable knowledge and comprehension of the world in which he lives.

He has enough skills to communicate many of his experiences, feelings, and thoughts, verbally, projectively, or representationally (such as in drawings).

He recognizes similarities and differences among persons, objects, colors, forms, sounds, numbers, and symbols.

Perceptual-conceptual discrimination ability is a major agent in personality development, learning, and readiness for school.

Cognitive skills such as perceptual-conceptual ability to see relationships, to analyze and to synthesize, to see commonalities, to classify, to abstract and generalize, and to work with symbols are among the best indicators of readiness.

A ready child has at least a fair amount of intelligence.

He has a good vocabulary and number comprehension.

He draws general conclusions from what he sees going on around him and he forms ideas on the basis of his conclusions.

He has imagination to use his intelligence and past experiences in attacking new problems.

It is possible to assess readiness quite accurately through focusing in a test on the most determining factors in readiness.

It is possible to assess readiness and predict success in kindergarten or first grade with a high degree of certainty using the Anton Brenner Developmental Gestalt Test of School Readiness.

Judgment of children by an experienced and sensitive teacher relates well to children's performances on standardized tests.

There are no big sex differences in school readiness.

Research Population and Raw Data

For the purposes of our factor analysis we selected six consecutive kindergarten groups from the Greenfield Village schools in Dearborn, Michigan, a total of 118 children. Taking the position that readiness is a multidimensional complex phenomenon, result, and expression of a whole person — of his language, perception, and motor skills; of his physical, mental, emotional, and social development in their relationship to multidimentional tasks; we collected and used diversified bodies of data.

Each child was given a complete annual physical examination at Henry Ford Hospital which included height, weight, vision, teeth eruption, x-rays of hand and wrist bones to determine skeletal age, and hormonal studies through the analysis of two twenty-four hour samples of urine of the children in 1960 and 1961 when they had become 7 to 13 years old. The urinary hormone studies included: 17-ketosteroids, 17-hydroxycorticosteroids, and gonadotropins. Urinary creatinine was determined to gauge the completeness of the 24-hour urine collection. The assay provided a useful index of lean body mass.

Teachers evaluated the children in terms of achievement, ability, and overall maturity. Tests were given: the Sangren Information Test, the

Pintner-Cunningham Primary Test, the Metropolitan Readiness Test, the Monroe Reading Aptitude Test, the Monroe New Basic Reading Test, the Stanford-Binet Test, and the Anton Brenner Developmental Gestalt Test of School Readiness. Two administrations of the Brenner test were included, an earlier and a later one, and so were two readings of skeletal age, one made at the time of the physical examination in kindergarten and another at the time when the hormone studies were made.

Sex was a variable and so was chronological age at entrance of a child to kindergarten and at the time of administration of each test, teacher judgment, or physical examination. By considering each subtest of the tests given as a variable (surface variable) and adding all variables up, we arrived at a total of 69 variables. For each child, then, we have 69 variables to measure readiness. The 69 variables represent the range of phenomena analyzed in the factor analysis, or to use Thurstone's term, they are our "domain" of readiness studied from 118 children.

Although the children were selected for admission to kindergarten, 10 boys and 10 girls in each group, they are an unselected research population in the sense that we did not divide them into experimental and control groups. The six kindergarten groups were used in their natural composition. No child was left out. The children are representative of American middle-class white population.

Table 1 illustrates how raw data were coded and prepared for IBM computation.

Readiness Factor Analyzed

The nature, function, and methodology of factor analysis has been clearly described by Cattell (1952, 1957), Harman (1960), Guilford (1968), and others. In one of our earlier publications (Brenner, 1962) we examined on a more theoretical basis the contribution of factor analysis to the study of readiness for school. The present paper is an empirical statistical analysis and interpretation of our data. In essence we are looking for the truly determining readiness factors which underlie the bewildering multiplicity of 69 surface variables presumably related in one way or another to the child's readiness to learn. Factor analysis helps us "in that it constructs from a host of variables the important wholes which need to be taken into account when seeking laws of interpretation [Cattell, 1957]." It "aims to discover and deal with the more massive, functional, and organic wholes instead of losing research perspective in a mass of atomistically conceived variables [Cattell, 1957]." Factor analysis "analyzes out the distinct factors at work among the variables; it also groups the variables together in ways which permit one to synthesize new entities far fewer than the initial raw variables. These new entities are our 'factors' [Thurstone, 1961]."

Seven factors were extracted. The unrotated axes are given in Table 2. They were rotated by computer to the Verimax criterion of simple structure. Table 3 presents the rotated factors. They are the "result" of factor analysis which we have now to analyze and to interpret.

TABLE 1

ILLUSTRATION OF RAW DATA AS PREPARED FOR IBM COMPUTATION

	VARIABLES	MALE	FEMALE	SANGREN INFORMATION TEST												PINTNER-CUNNINGHAM PRIMARY TEST														
				C A AT ENTRY TO KG.		C A AT ADMINIST.		NATURE STUDY		NUMBERS		VOCABULARY		SOCIAL INFORMATION		HOUSEHOLD INFORMATION		LANGUAGE & LITERATURE		C A AT ADMINIST.		COMMON OBSERVAT.		AESTHETIC DIFFER.	ASSOC. OBJECTS	DISCRIM. OF SIZE	PICTURE		PARTS		
CODE#		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	
CASE NUMBERS	1.		2	6	6	7	1	2	0	2	1	3	2	2	1	1	9	2	2	7	4	5	0	6	4	3	1	0	5	
	2.		1	6	1	6	6	2	0	1	2	3	3	2	5	2	1	2	1	7	0	6	0	6	6	4	0	6	5	
	3.		2	6	7	7	2	1	4	0	8	2	4	1	7	1	3	0	3	7	5	6	0	5	4	2	0	3	5	
	4.		2	6	9	7	4	2	6	2	4	3	5	2	7	2	0	2	6	7	7	5	0	6	4	4	1	3	5	
	5.		1	6	7	7	2	2	3	1	4	3	4	2	6	1	6	2	1	7	5	4	0	6	6	2	0	3	5	
	6.		1	6	3	6	8	1	4	0	5	1	9	1	6	1	7	1	6	7	1	6	0	6	3	1	0	1	5	
	7.		1	6	4	6	9	2	2	1	0	2	6	1	7	1	4	1	4	7	0	4	5	5	4	3	0	3	0	
	8.		2	6	9	7	4	2	9	1	9	3	5	3	0	2	1	2	7	7	7	8	0	6	6	4	1	4	5	
	9.		2	6	4	6	9	2	5	2	0	1	7	2	4	1	9	2	4	7	3	6	5	5	5	4	1	3	0	
	10.		2	5	9	6	4	2	8	2	0	2	8	2	7	1	8	1	7	6	8	7	5	6	6	4	0	8	0	
	11.		2	5	9	6	4	2	3	0	7	2	7	2	1	1	6	1	5	6	8	4	5	6	4	2	0	7	5	
	12.		2	6	3	6	8	2	3	1	5	3	3	2	4	2	0	2	4	7	2	7	0	5	6	4	1	4	5	
	13.		1	5	8	6	3	2	5	1	4	3	3	2	6	2	0	2	1	6	5	7	5	6	6	4	1	1	0	
	14.		2	6	7	7	2	2	1	1	5	3	5	2	2	1	8	1	9	7	6	4	0	6	6	4	0	8	0	
	15.		1	6	5	7	0	2	5	2	2	3	0	2	6	1	9	2	2	7	4	7	5	6	5	2	0	9	0	

FINDINGS

The Result: Seven Readiness Factors to be Interpreted

The seven factors extracted portray seven different facets of readiness which in their togetherness are also the basic determinants of overall readiness. In each factor the variables with the highest loadings gave the factor its specific characterization. Therefore, the interpretation of the factors was made by checking the variables with the highest factor loadings. Then each significant variable was examined as to the nature of the task presented to the child, the meaning the item may have for him, or the kind of demand it makes on the child. In most cases the factors were characterized by groupings of significant variables. Analysis of the nature and meaning of these groupings suggested the name given to each factor. The names given are, of course, open to discussion and can be revised because, as Thurstone (1961) points out, "the name for a factor depends on the context of one's philosophical preferences and manner of speech, and of how much one already knows about the domain to be investigated."

INTERPRETATION

FACTOR A: Cognitive Readiness

Factor A is identified as cognitive readiness, the general ability to meet the intellectual demands and perform the tasks of primary school. Nineteen of the 69 variables included in the analysis came out with loadings greater than .50 in this factor. These items listed in the order of magnitude of factor loadings are as follows:

No.	Variable	Factor Loading
63	Teacher Judgment of Ability	.82
64	Teacher Judgment of Maturity	.77
35	Brenner Draw a Man (2nd administration)	.77
36	Brenner Sentence Copying (2nd)	.75
62	Teacher Judgment of Achievement	.72
33	Brenner Number Recognition (2nd)	.66
23	Metropolitan Numbers	.65
30	Brenner Sentence Copying (1st)	.64
32	Brenner Number Producing (2nd)	.63
26	Brenner Number Producing (1st)	.62
24	Metropolitan Copying	.61
27	Brenner Number Recognition (1st)	.60
34	Brenner 10 Dot Gestalt (2nd)	.60
53	IQ Stanford-Binet	.57
22	Metropolitan Matching	.55
17	Pintner-Cunningham Dot Drawing	.54
29	Brenner Draw a Man (1st)	.51
5	Sangren Numbers	.53
28	Brenner 10 Dot Gestalt (1st)	.5[illegible]

TABLE 2

Principal Axis Solution – Total Deck

Factor Var. #	Input Var. #		I	II	III	IV	V	VI	VII
1	1	Sex	171	099	094	010	010	110	373
2	2	CA at Entry to Kindergarten	259	868	351	054	153	035	081
3	3	CA at Sangren Information Test	179	553	173	146	416	047	070
4	4	SA Nature Study	621	049	081	168	185	161	408
5	5	SA Numbers	725	059	015	030	066	049	093
6	6	SA Vocabulary	482	000	072	026	131	204	167
7	7	SA Social Information	549	097	131	188	116	047	433
8	8	SA Household Information	569	136	125	305	024	035	358
9	9	SA Language & Literature	633	042	339	287	223	109	101
10	10	CA at Pintner-Cunningham Test	076	746	326	039	204	255	007
11	11	PC Common Observation	417	027	129	250	294	052	083
12	12	PC Aesthetic Differences	225	079	009	158	159	334	141
13	13	PC Associated Objects	465	218	035	123	033	276	065
14	14	PC Size Discrimination	366	178	135	106	110	402	099
15	15	PC Picture Parts	628	018	013	193	080	249	153
16	16	PC Picture Completion	490	070	222	001	019	139	086
17	17	PC Dot Drawing	618	053	007	087	119	053	001
18	18	CA at Metropolitan Readiness Test	310	851	363	063	088	055	051
19	19	MET Word Meaning	510	113	016	012	126	078	206
20	20	MET Sentences	492	167	055	035	148	009	201
21	21	MET Information	277	076	086	250	249	447	219
22	22	MET Matching	544	195	021	153	072	101	013
23	23	MET Numbers	706	167	096	075	248	116	115
24	24	MET Copying	687	213	012	032	131	010	098
25	25	CA Brenner Gestalt Test (1st Admnns.)	326	856	367	108	068	193	059
26	26	B. Number Producing	637	007	054	161	136	299	663
27	27	B. Number Recognition	626	123	003	020	202	248	076
28	28	B. 10 Dot Gestalt	581	026	165	114	115	096	391
29	29	B. Draw a Man	632	087	090	155	208	004	339
30	30	B. Sentence Copying	602	010	029	008	102	121	332
31	31	CA Brenner Gestalt Test (2nd)	273	732	463	113	179	246	010
32	32	B. Number Producing (2nd)	542	183	090	325	406	268	214
33	33	B. Number Recognition (2nd)	683	281	065	216	136	168	220
34	34	B. 10 Dot Gestalt (2nd)	341	345	146	069	106	077	500
35	35	B. Draw a Man (2nd)	658	168	059	147	172	111	237

TABLE 2 (Cont.)
Principal Axis Solution – Total Deck

actor Var. #	Input Var.#		I	II	III	IV	V	VI	VII
36	36	Sentence Copying (2nd)	.487	.284	-.090	-.345	-.422	.143	-.120
37	37	CA Monroe Reading Aptitude Test	.315	.860	.330	.099	-.119	.038	-.036
38	38	MO Visual Perception	.603	-.033	-.075	-.050	.149	.206	.105
39	39	MO Auditory Perception	.402	.026	-.293	.159	.014	.323	.128
40	40	MO Motor Perception	.435	.173	.034	-.016	.013	.019	-.087
41	41	MO Articulation	.588	.007	.032	.185	.169	-.130	-.074
42	42	MO Language	.397	-.043	.197	.257	.009	-.059	.175
43	43	CA Monroe New Basic Reading Test	.233	-.871	.260	.007	.145	.136	-.046
44	44	NBR Sentence Meaning	.323	.095	.061	.088	-.212	-.329	.038
45	45	NBR Sensory Imagery	.386	.319	.62[illegible]	.012	.361	-.042	-.077
46	46	NBR Relationships	.349	.265	.617	-.050	.369	.077	-.136
47	47	NBR Emotional Reaction & Motives	.290	.270	.581	-.129	.377	.077	.027
48	48	NBR Visual Scrutiny	.349	.397	673	.042	.302	-.023	.032
49	49	NBR Phonetic Analysis	.468	.319	.221	-.270	.069	.290	.091
50	50	NBR Structural Analysis	.410	.345	.419	-.220	.139	-.090	.089
51	51	CA Stanford-Binet	.176	-.624	-.308	.209	.010	.133	-.103
52	52	MA Stanford-Binet	.582	-.213	-.412	.215	-.064	.050	039
53	53	IQ Stanford-Binet	.620	.292	-.274	.084	-.097	.171	.149
54	54	CA Physical Examination	.252	-.738	.341	-.051	-.181	-.020	-.045
55	55	Skeletal Age	.175	-.464	-.156	.386	.117	-.347	-.056
56	56	Height	.180	-.336	.035	-.583	.189	-.298	.043
57	57	Weight	.200	-.357	-.082	-.683	.285	-.278	.072
58	58	Vision	.230	.105	.159	.080	.366	.028	.131
59	59	Number of Permanent Teeth Erupted	.249	-.114	.102	-.142	-.103	-.357	.203
60	60	Developmental Level – Wetzel	.198	-.358	-.051	-.788	.128	-.189	.117
61	61	CA Teacher Judgment	.265	-.848	.117	.153	-.220	-.075	-.115
62	62	TJ of Achievement	.697	.225	-.138	-.010	-.061	-.147	-.248
63	63	TJ of Ability	.776	.261	-.158	-.139	-.132	-.036	-.136
64	64	TJ of Maturity	.765	.200	-.135	-.031	-.108	-.096	-.174
65	65	*Skeletal Age at Hormone Study*	.092	-.486	-.724	-.144	.335	.142	-.233
66	66	Gonadotropins	.107	-.288	.491	-.167	.201	.376	-.036
67	67	17-Ketosteroids	.223	-.514	-.665	-.154	.201	.000	.045
68	68	17-Hydroxycorticosteroids	.166	-.532	-.290	-.223	.125	-.015	.201
69	69	Creatinine	.268	-.427	-.546	-.093	.283	-.020	.036
			14.792	10.037	5.426	3.171	2.620	2.409	2.235

The identification of this factor with the cognitive aspect of school ability is based largely upon its high loadings with the three "teacher judgment" variables of ability, maturity, and achievement – Variables 63, 64, and 62 (loadings of .82, .77, .72 respectively). This may come as a surprise to a good many research people who tend to belittle teacher judgments; yet it must be realized that teachers of young children soon become aware of differences among children with whom they work in daily contact – differences in alertness, in attentiveness, in following directions, in comprehension, and in other indicators of the children's cognitive preparedness for successful school performance.

Another surprise may be the loading of .57 of the Stanford-Binet which is high but moderate when compared with the loadings of teacher judgment and the Brenner Gestalt variables in our factor. It would seem that while the Stanford-Binet intelligence scale is most useful during the school years as a test of "general ability," the composition of Factor A indicates (what other researchers felt for a long time) that the Stanford-Binet test may not be particularly discriminative of the abilities and assets in a child which are most important in meeting the immediate demands of beginning school.

The interpretation of Factor A as a cognitive factor is supported by the fact that 10 of its most highly loaded items come from the two administrations of the Brenner Gestalt Test which was designed to measure readiness for learning.

> The basic assertion is that growth, development, and learning take place through constant interaction between an individual and his environment. This leads to accumulation and differentiation within the person which increase his ability to perceive, to analyze, and to synthesize experiences both from within and from beyond himself. These are the processes which lead to readiness. Our hypothesis is: the more a child is able to perceive, to incorporate experience into developing behavior, and to analyze and synthesize into increased degrees of differentiation and specification, the more is he ready for school.

The five Brenner Gestalt subtests are built on the principle of personality and Gestalt differentiation discussed in detail in "Reality Perception, Perceptual Differentiation and Readiness for School" (Brenner, 1958); in "A New Gestalt Test for Measuring Readiness for School" (Brenner, 1959); and in the test manual (Brenner, 1964). They focus on the conceptual relevance of perceptual development.

> Perception is understood as sensory awareness of stimuli, external or internal, which the mind immediately organizes, interprets, and associates with existing concepts or transforms into new ones. When one level of perception and conception is reached in the transaction between individual and environment, it serves as a new basis for more objective and more discriminating perception and conception, thereby sharpening perception and conception in the on-going process of personality development, learning, and maturation. In development, perception and conception are intimately interrelated [Brenner, 1959, p. 27].

This thinking warranted test information which called for perceptual and conceptual responses in the child. The tasks of the Gestalt test require space and form perception, comparisons of elements and totalities, recognition of similarities and differences, abilities to analyze and synthesize, perceptual motor skills, intellectual visualization, the application of number concepts, and abstraction and generalization abilities.

These are all perceptual and cognitive skills needed for effective functioning in the primary school situation. The Brenner Gestalt Test measures

> the new (intellectual) instruments which enable the child to bring order and meaning into the world which surrounds him through constructive organization of his expanding life experiences. The extent to which a child possesses qualities derived from these classes of developing experience and uses them at any given level in his transaction with reality becomes indicative of his readiness for school [Brenner, 1959, p. 29].

The high factor loadings substantiate the correctness of the basic premises upon which the test has been constructed.

Of the remaining highly loaded items in Factor A, three are subtests of the Metropolitan Readiness Test (Variables 23, 24, 22); one comes from the Pintner-Cunningham Test (Variable 17); and one from the Sangren Test (Variable 5). It is of interest that they all have a strong component of "gestalting" in the double sense of both recognizing and forming Gestalten, an ability which also gave the Brenner Draw a Man subtest its high loading of .77. Because of this all-pervading strong component of gestalting in Factor A, we could very well have called this factor "cognitive gestalting."

Number perception and comprehension and with them abstraction ability run also significantly through more than one half of the variables, thus emphasizing the role of number work in school which all too often falls back behind the emphasis on reading readiness.

We learn from Directions for Administering this test (1949) what the Metropolitan Readiness Test is intended to measure: "Among the chief factors that contribute to readiness for beginning school work are linguistic attainments and aptitudes, visual and auditory perception, muscular coordination and motor skills, number knowledge, and the ability to follow directions and to pay attention."

In terms of the intellectual abilities hypothesized by Guilford (1967), the "operations" required of the child in responding to the test items included in the description of Factor A are cognitive, memorative, and convergently productive in nature. Recognizing numbers and words, remembering, understanding verbal instructions and carrying them out, copying words and designs, following directions, and the like are the traditionally predominant activities in the elementary classroom. These are by and large the abilities that teachers readily observe in the children with whom they work. They are abilities and qualities which have acquired by the child through experience and learning within the set by a child's biologically inherited potentiality in interaction

with his environment. The result of this interaction is each child's unique functional potentiality, his individual readiness.

Summary

Factor A represents the cognitive aspect of readiness, here predominantly seen as an ability factor resulting from the degree of developed personality differentiation and the child's experiences in perceptual-conceptual "gestalting." Having the highest total loadings of all seven readiness factors, Factor A ranks prominently as a readiness factor. Teacher judgment, the Brenner Gestalt Test, and subtests of the Metropolitan Readiness Test make appraising this type of readiness very possible.

FACTOR B: Chronological Age

The second factor is obviously one of age. Among the 69 variables included in the analysis were the chronological ages in months of the children when each test was administered, when physical measures were taken, and when the teachers made their ratings. There were 11 such age values for each child. The conditions of the testing program — the fact that the time intervals between tests tended to be the same or similar for all the children — imposed high degrees of correlation among these age values. Because of the very narrow age range in the children at the time of each test, the correlation between age and test score was low. Thus, the highly intercorrelated age values constituted a "cluster" in the correlation matrix with relatively little relationship with the other variables. Consequently, the age variables were segregated in the factor analysis with one of the rotated axes passing directly through that far-out cluster. All of the factor loadings of the age variables on this factor were very high, most of them above .90 with very low loadings in other variables. (See Table 3.) Hence, the CA factor.

The clustering out of the CA factor is significant. It forces us to reexamine our position with regard to the role of CA, particularly in the light of the academic devaluation of CA as it has developed over the last years because of the emphasis on individual differences. Notwithstanding this emphasis on individual differences, it makes sense to give weight to the role of CA in the readiness of a child. Common sense, observation, and research force upon us the notion that growth, maturation, development, and learning take place through time. The longer a child has lived, the more he has had contact with reality and has accumulated knowledge and experiences. The longer he has lived, the greater are the chances that he has developed or perfected his physical and cognitive skills. The older the child, the more he will have developed emotional security, independence, social responsibility, task orientation, and motivation to learn — at least under normal conditions and when we speak of the population in general. That there are individual differences and that in particular cases a younger child may have developed more of these personality characteristics than an individual older child is well known. But this fact is not incommensurable with the of the general statement. More experiences; more knowledge; skills; more emotional security, independence, and social respon-

TABLE 3
Rotated Factors – Verimax Solution

Factor Var. #	Input Var. #		A	B	C	D	E	F	G
1	1	Sex	.287	.058	.025	-.205	.124	.020	.236
2	2	CA at Entry to Kindergarten	.015	-.988	.017	.018	.013	.077	.026
3	3	CA at Sangren Information Test	.229	.553	.247	.189	.347	.079	.294
4	4	SA Nature Study	.305	.053	.212	.692	.147	.024	.089
5	5	SA Numbers	.533	.128	.258	.408	.091	.046	-.038
6	6	SA Vocabulary	.313	-.074	.166	.363	.193	.052	.147
7	7	SA Social Information	.221	-.142	.062	.692	.116	.028	.006
8	8	SA Household Information	.257	-.209	-.001	.669	.069	.058	.123
9	9	SA Language & Literature	.383	-.058	.050	.554	.427	.110	.136
10	10	CA at Pintner-Cunningham Test	-.135	-.801	-.115	-.017	-.186	-.171	.200
11	11	PC Common Observation	.145	-.101	.366	.327	.127	.095	-.216
12	12	PC Aesthetic Differences	.086	-.093	.105	.083	.085	.052	-.442
13	13	PC Associated Objects	.367	.065	.157	.292	.156	-.018	.298
14	14	PC Size Discrimination	.373	.110	-.040	.138	-.101	-.052	-.440
15	15	PC Picture Parts	.453	-.176	.204	.241	.092	.005	-.424
16	16	PC Picture Completion	.329	-.129	.298	.244	-.147	-.090	-.132
17	17	PC Dot Drawing	.538	-.148	.116	.279	.006	.067	-.048
18	18	CA at Metropolitan Readiness Test	.015	-.978	.044	.050	.050	.074	.022
19	19	MET Word Meaning	.389	-.023	.066	.375	-.213	.142	-.188
20	20	MET Sentences	.425	-.009	.114	.326	.177	.053	.045
21	21	MET Information	.155	-.114	-.223	.373	.270	-.032	.401
22	22	MET Matching	.553	.032	.162	.162	.015	.082	.089
23	23	MET Numbers	.651	-.089	.138	.319	.246	.111	.062
24	24	MET Copying	.612	.005	.350	.154	.175	.028	-.176
25	25	CA Brenner Gestalt Test (1st Adminis.)	-.027	-.979	.154	.087	.198	-.010	.045
26	26	B. Number Producing	.622	-.225	.163	.133	.086	-.028	.236
27	27	B. Number Recognition	.603	-.103	.095	.299	-.016	.107	.179
28	28	B. 10 Dot Gestalt	.527	-.119	.125	.039	.338	.032	-.361
29	29	B. Draw a Man	.537	-.057	.277	.111	.343	.102	-.295
30	30	B. Sentence Copying	.644	-.157	.178	.023	.128	.104	-.069
31	31	CA 2nd Brenner Gestalt Test	.072	.916	.103	-.036	-.051	-.090	.252
32	32	B. Number Producing (2nd)	.634	-.057	.035	.201	-.269	-.127	.433
33	33	B. Number Recognition (2nd)	.660	.095	.145	.380	-.061	-.142	.240
34	34	B. 10 Dot Gestalt (2nd)	.597	.211	.076	-.269	.155	.125	-.102
35	35	B. Draw a Man (2nd)	.768	-.046	.121	-.020	.094	-.016	-.002

TABLE 3 (Cont.)
Rotated Factors – Verimax Solution

Factor Var. #	Input Var. #		A	B	C	D	E	F	G
36	36	B. Sentence Copying (2nd)	.745	.098	.066	.060	.147	.114	.225
37	37	CA Monroe Reading Aptitude Test	.021	.980	-.003	.079	.043	.055	-.044
38	38	MO Visual Perception	.418	.131	.205	.363	.250	-.081	.119
39	39	MO Auditory Perception	.311	.042	.081	.379	.303	.160	.166
40	40	MO Motor Perception	.422	.016	.191	.104	.014	.013	-.051
41	41	MO Articulation	.378	.141	.271	.289	.140	.026	.304
42	42	MO Language	.231	-.070	-.075	.440	.094	.082	-.160
43	43	CA Monroe New Basic Reading Test	-.007	-.943	-.081	.005	.091	.082	.080
44	44	NBR Sentence Meaning	.314	.010	-.091	.190	-.207	.051	-.303
45	45	NBR Sensory Imagery	.180	-.020	.862	.035	-.173	.016	-.096
46	46	NBR Relationships	.175	-.053	.833	-.036	.077	.034	.004
47	47	NBR Emotional Reaction & Motives	.094	.003	.790	.049	.118	.063	.086
48	48	NBR Visual Scrutiny	.164	.048	.846	.079	-.275	.010	-.013
49	49	NBR Phonetic Analysis	.441	.090	.439	.139	-.048	.088	.338
50	50	NBR Structural Analysis	.304	.089	.574	.115	-.260	.187	.018
51	51	CA Stanford-Binet	.025	-.497	-.323	.135	.454	.063	-.080
52	52	MA Stanford-Binet	.435	-.195	-.240	.434	.294	.013	-.219
53	53	IQ Stanford-Binet	.567	.200	-.026	.456	-.017	-.043	-.199
54	54	CA Physical Examination	.049	-.855	-.012	-.019	-.064	-.155	-.012
55	55	Skeletal Age	.045	-.296	-.126	-.027	.187	-.608	.216
56	56	Height	.045	-.198	.043	-.029	.107	-.744	-.061
57	57	Weight	.035	-.176	.073	-.008	.193	-.854	.016
58	58	Vision	-.005	.031	.410	.258	.103	.005	.035
59	59	Number of Permanent Teeth Erupted	.120	-.157	.003	.202	-.256	-.328	-.179
60	60	Developmental Level – Wetzel	.101	-.209	.007	-.044	.093	-.879	.142
61	61	CA Teacher Judgment	.059	-.893	-.225	.040	.079	.036	.181
62	62	TJ of Achievement	.720	.054	.128	.124	.093	-.042	-.280
63	63	TJ of Ability	.820	.073	.111	.191	.058	-.113	-.098
64	64	TJ of Maturity	.770	.010	.113	.196	.070	-.057	.208
65	65	Skeletal Age at Hormone Study	.031	-.115	-.366	.003	.870	-.264	.041
66	66	Gonadotropins	.077	-.065	-.223	.079	.624	-.135	.270
67	67	17-Ketosteroids	.072	-.183	-.413	.251	.636	-.376	.053
68	68	17-Hydroxycorticosteroids	-.040	-.323	-.234	.244	.320	-.417	.063
69	69	Creatinine	.072	-.158	-.250	.273	.601	-.323	.103
			10.811	9.255	5.409	4.907	4.131	3.436	2.742

sibility; more task orientation and greater motivation to learn – these all contribute to the child's ability to cope with the reality of school *demands. These all mean more readiness for school.*

We will further elaborate and critically examine this problem in the "Discussion" section of this analysis. Our attempt here was to emphasize the fact that our factor analysis has revealed an Age Factor significant in readiness; and to discuss briefly the significance of this fact.

FACTOR C: Reading Readiness

Factor C has its highest loadings in a cluster of variables which are subtests of the Monroe New Basic Reading Test. This cluster gives the factor its basic character. The total series of Monroe Basic Reading Tests has been designed to measure the extent to which pupils in the early stages of learning to read have progressed in various aspects of reading from prereading skills through a readiness and basic reading program. In keeping with the intent behind the new basic reading tests, we shall call Factor C our reading readiness factor. Already a look at the relevant variables and their loadings should justify this designation.

No.	Variable	Factor Loading
45	sensory imagery	.86
48	visual scrutiny	.85
46	perceiving relationships	.83
47	recognizing emotional reactions and motives	.79
50	structural analysis	.57
49	phonetic analysis	.44

Moving on to an interpretive analysis we will draw heavily, but not exclusively, on Monroe herself and her own interpretation of the ideas measured in these tests.

As Monroe points out in her manual (no date), each item stresses and therefore tests the child's ability in an important aspect of reading. Above all, a child must be able to "live the story." In order to be able to live the story, he needs to create the vivid sensory imagery that transports him mentally into the setting (Variable 45). The more he can project himself into the text and can form mental images of sight, sound, touch, smell, and taste of the persons, objects, and actions described in reading matters; the more meaningful the text becomes and the more it will help him in linking events and remembering them. It is this ability to form mental images while reading that makes reading a living experience. The high factor loadings of this aspect of readiness should therefore not come as too great a surprise.

Equally important for the understanding of a text is the ability to perceive relationships (Variable 46). As things happen in time and space, meaningful reading requires that the child see ideas and events in their relatedness to other ideas and events; that he link time in [illegible]er sequence; that he be perceptive of chronology – of events, [illegible]ns, and characters as they relate to the present, the past, and the [illegible]e. The child must be able to associate time with the right persons

and places, see the logic or its absence in what happens. In short, the child must be able to see things in their functional, logical time space, and cause and effect relationship. The more he can perceive concrete and abstract relationships and can organize his thinking in terms of the above categories, the better will he understand and the more will his new reading become associated with and incorporated into his past and present thinking.

No proper interpretation and no understanding is possible if we are not able to feel what other people feel and if we do not understand the drives and motives behind their actions. Thus, recognizing emotional reactions, inner drives, and motives (Variable 47) becomes the third basic interpretative ability and skill in reading readiness that is needed for making reading a living experience. To quote Monroe herself: "When pupils identify themselves with a character in the story — feel the character's gladness or sadness, understand what kind of person he is and why he reacts as he does in a given situation — they are really living the story."

So far, we have emphasized the need for and the value in reading readiness of three interpretative skills: the child's ability to form sensory images, to perceive relationships, and to recognize emotional reactions and motives behind people's behavior. These interpretative skills, however, cannot function unless the child has developed word perception skills. In order to comprehend and interpret the printed message the child must have first learned to perceive the printed symbol accurately. Visual scrutiny, Variable 48, is the prerequisite for any interpretation and understanding. The child must be able to differentiate between words that look alike and yet are different; for instance, hand-hard; word-would. He must be able to see similarities and differences in form and Gestalt of letters and words; only then will he be able to differentiate their meaning.

Unless the child can accurately scrutinize the printed word he will also have difficulties associating each printed word with its particular sound and meaning. In reading, correct phonetic analysis, Variable 49, depends first of all on correct visual perception and analysis; but then the sound of printed words, pronunciation, and phonetic analysis may help the child in cases where his visual memory defaulted him or when he encounters an unknown word which represents a spoken word that is familiar to him. We also know that people differ in their learning styles. Some learn predominantly through visual, other through auditory pathways of perception. Thus, apart from deriving pronunciation from it, phonetic analysis becomes especially important for an auditory learning type, an idea which has never been mentioned by Monroe.

There is another kind of perception and analysis which is essential to meaning and understanding, and that is structural analysis, Variable 50. Monroe says: "Structural analysis is essentially a visual process that involves the scrutiny of words for root, ending, prefix or suffix." Structural analysis is a highly complex process as is suggested in part by another statement by Monroe: "Basic to this ability to scrutinize a given form is a sensitivity for the sound, meaning and usage of inflected and compounded forms in total language [Manual]."

Phonetic and structural analysis are of great help when the child encounters unknown words. Much of the success, enjoyment, and challenge in reading can come from an enjoyment and skill in phonetic and especially structural analysis.

We cannot close this section without mentioning the extremely low factor loading of Variable 44, "sentence meaning." It is the first subtest in Monroe's New Basic Reading Test and represents according to Monroe another interpretative skill. We do not know why this variable, so essential in reading, came out with an insignificant loading. Our data do not allow a satisfactory answer.

Summary

Factor C is our reading readiness factor. It deals with three (four) abilities of the child that are most needed for interpretation and understanding of reading material and it also includes the three word perception skills that are prerequisite for meaning and understanding in the reading and listening process.

FACTOR D: Body of Knowledge

Factor D represents another aspect of readiness which is the product of past experience and learning. It is the child's accumulation and organization of knowledge. It represents the "cognitive structure" with which the child begins his school experience and which grows with further experience through the constant process of "subsumption" (Ausubel, 1965).

The 14 test items whose intercorrelations brought them together as a factor are given below. As one can readily see, this is a "Sangren Factor;" that is, the Sangren Information Test supported by related dimensions gives this factor its "Gepraege." In other words, it gives it definition and its specific character.

No.	Variable	Factor Loading
4	Sangren — nature study	.69
7	Sangren — social information	.69
8	Sangren — household knowledge	.67
9	Sangren — language and literature	.55
53	Stanford-Binet IQ	.46
42	Monroe — language	.44
52	Stanford-Binet — mental age	.43
5	Sangren — number comprehension	.41
33	Brenner — number recognition	.38
19	Metropolitan — word meaning	.38
39	Monroe — auditory perception	.38
21	Metropolitan — information	.37
38	Monroe — visual perception	.36
6	Sangren — vocabulary	.36

Additionally, children go to school to learn, to acquire knowledge skills and thus develop their intellect. From the point of view of

the cognitive learning theorist, this development (learning) comes about through the assimilation of new information, knowledge, and skills into the existing "cognitive structure," the organized backlog of already acquired knowledge, concepts, and skills. In the words of Bruner (1968):

> Growth depends upon internalizing events into a "storage system" that corresponds to the environment. It is this system that makes possible the child's increasing ability to go beyond the information encountered on a single occasion. He does this by making predictions and extrapolations from his stored model of the world [p. 5].

Inspection of the 14 highest loaded component items of Factor D shows that they are either subtests of information indicating the amount and diversity of knowledge and concepts acquired by the child — his information about nature, social information, household knowledge, language and literature, general vocabulary, his understanding of the meaning of words; or, they give evidence of the child's mastery of the most important instruments needed for the acquisition of this knowledge and thus the mastery of the world around him — auditory perception skills, visual perception, number comprehension, intelligence, and the ability to abstract and to generalize.

The accumulation of such a large and diversified body of knowledge and the availability of such powerful instruments with which information is pursued, processed, and organized do, indeed, in their combination represent readiness as a state of being and as potentiality for future successful learning in school.

A close relative to Factor D, if not a family member, is Factor G which we will therefore discuss next, to be followed by Factors F and E which represent biophysical and biochemical aspects of readiness.

FACTOR G: Perceptual Differentiation

Perceptual differentiation is suggested as a label for this aspect of school readiness. The following tabulation shows the nine variables with significant loadings.

No.	Variable	Factor Loading
12	P-C — Aesthetic Differences	.44
14	P-C — Size Discrimination	.44
32	Brenner — Number Producing	.43
15	P-C — Picture Parts	.42
21	Metropolitan — Information	.40
28	Brenner — 10 Dot Gestalt	.36
49	Monroe — Phonetic Analysis	.34
41	Monroe — Articulation	.30
44	Monroe — Sentence Meaning	.30

essence, content and meaning of this factor are intimately related
hat has been said in the discussion of Factors A, C, and D. We deal
again with perceptual-conceptual skills and the child's knowledge,

with his abilities to analyze and synthesize, his ability to perceive size and form in space, to differentiate among visual and auditory elements, to associate objects, and to find meaning in what he perceives. All these are faculties upon which much of the child's success in kindergarten and first grade depends, particularly in reading, spelling, and in working with numbers.

None of the component variables in Factor G has a loading sufficiently high to be clearly definitive of factor meaning by itself; however, all of the items with loadings of .30 and above are congruent with and contribute to the idea of perceptual-conceptual differentiation. The fact that these variables have been sifted out again, apart from their role in Factors A, C, and D, gives added emphasis to the importance of perceptual-cognitive skills and the role of Gestalt in preschool learning and readiness.

FACTOR F: Physical Development Status[2]

This factor clearly represents physical developmental status in children. We have five variables to support this contention:

No.	Variable	Factor Loading
60	Developmental Level (Wetzel)	.88
57	Weight	.85
56	Height	.74
55	Skeletal Age	.61
59	Number of Permanent Teeth	.33

It is a belief of old standing that the child's physical status is important in readiness to enter school and to meet the demands of school. The common man, especially in farming areas, paid this factor always his particular attention. To be big, strong, and physically well developed was often times taken as the sole criterion of readiness, thus giving physique an undue weight over the importance of other factors in readiness. The medical profession, of course, including the pediatrician, the school physician, the endocrinologist, the ophthalmologist, the orthodontist, is primarily concerned with the child's physical developmental status, and psychologists would be well advised to heed psychosomatic relatedness of structure and function. Factor F may serve as a reminder of this need.

The above five variables are indexes of physical growth status. "Developmental level" is a measure of physique which is determined by plotting height against weight on the Wetzel Grid (Wetzel, 1941). Skeletal age as assessed from x-ray plates of the hand and wrist bones is by many people considered to be the most reliable single index of general physical maturation, but it should be used only in conjunction with chronological age as should also "developmental level." The

[2]Special thanks are due to Dr. R. Mellinger for his assistance in the preparation of sections Factor F and Factor E. For a more detailed and specific analysis of our endocrinological material we refer to his article. "Correlations between Endocrine and Physical Measures of Maturity during Childhood" in Pyle, Waterhouse, and Greulich (1970). This same Standard of Reference book brings Dr. J. A. Johnston's and Dr. Gordon Manson's views on development and readiness research from a pediatrician's point of view.

importance of this developmental status factor as an aspect of school readiness inheres in its relation to health. A child who is not up to par in developmental status is not likely to be a healthy child, and without good physical health he is likely to fall short in meeting the demands of school. Concerning this relationship between growth status and health, Wetzel (1941) says:

> "From the clinical point of view it is axiomatic that a child who fails to grow properly is not healthly and that such a child accordingly should become subject to medical examination . . . The main objective of all organized health work is to facilitate growth and development whether this is specifically stated or not. There is in each of these endeavors an unmistakable implication that deviations in growth and development are connected with changes in health, and that they constitute initial signs of an otherwise unsuspected disease [p. 1188]."

Wetzel points out that "development level" along with chronological age in the child can approximately be regarded as an indicator of growth status and of "physical fitness." Physical fitness most surely plays an important role in readiness for school entrance and successful learning in school. Large differences in developmental levels — deviations from proper channels on the Wetzel Grid — may legitimately be regarded as representing differences if not problems in physical fitness, for instance the obese or the overly thin, undernourished child.

Apart from its significance from the standpoint of physical fitness, this factor of physical status may also be a factor of advantage from a psychosocial point of view. A child large of structure and with the attributes of good health and physique is likely to be reacted to by adults and his peers alike in ways which will give him personal status in the classroom. This would constitute an immediate advantage in relating and adjusting to the new school situation and in functioning in it adequately.

It is interesting, though somewhat to be expected, that the number of permanent teeth erupted became a variable in this factor of physical status. Some students of anatomy consider teeth as part of the cutaneous system; others are of the opinion that they can be properly considered part of the skeletal system. Thus teething would be also an expression of skeletal maturation. As the senior author of this study observed in his professional contacts with the Waldorf Schools years ago, the eruption of permanent teeth — mostly around the age of six — was used as a basic criterion for total school readiness. This notion is part of their particular theosophical beliefs. It is thinking in terms of psychosomatics, of the interrelatedness of body and mind.

Three other variables in Factor F deserve our attention. They are related to the endoctrine system and thus to the biochemistry of the body. The three items listed below have loadings which, though relatively low compared with other factor loadings, are of sufficient magnitude to be included in this discussion along with the five aforementioned physical variables.

No.	Variable	Factor Loading
68	17-Hydroxycorticosteroids	.42
67	17-Ketosteroids	.38
69	Creatinine	.32

The 17-hydroxycorticosteroids and the 17-ketosteroids are metabolites of secreted adrenal hormones. These hormones are major factors controlling anabolism and catabolism; accordingly, they are significant in growth and development of body mass. Creatinine is an index of lean body mass, that is, fat-free tissues. It may be expected to correlate with the adrenal steroids which significantly affect physical growth and development and probably also mental development in the process of maturation.

Other endocrine factors could well have been included in our study. Thyroid and pituitary secretions merit attention. However, adrenocortical functions undergo qualitative modifications during preschool and school years, whereas the other endocrine functions are stable and relatively unchanging in this age group. In the older child the gonadotropic secretion and resulting gonadal function assume importance. For our research population the changing adrenal secretion is considered to be the most likely significant variable. Herein lies a justification for the inclusion of these steroid analyses in our study.

Summary

Surveying all of the eight variables which characterize our growth status factor, we find it constituted by five biophysical determinants and three biochemical determinants. Although the loadings of the latter are lower than those of the first group, they are significant. Their significance is further demonstrated in their loadings in Factor E which we designate as our biochemical factor. We are giving them a second look in the following discussion of Factor E.

FACTOR E: Biochemical Maturity Factor

The factors of functional readiness so far discussed refer mostly to the beginnings and early periods of school adjustment and learning. Factor E relates to processes of development and function which are associated with and are aspects of the pervasive complex of physical, physiological, and psychological changes which characterize child development and, in the case of the gonadotropins, the puberal period. The items which constitute the core of this factor are biochemical in nature. They represent some of the changes in physiological functioning which promote body growth and maturation and thus prepare the individual for higher level personal functioning physically and cognitively. The highly loaded factor variables are:

No.	Variable	Factor Loading
65	Skeletal age at time of hormone study	.87
67	17-Ketosteroids	.64
66	Gonadotropins	.62
69	Creatinine	.60
9	Sangren Language Subtest	.43

The time urine specimens were taken, the children's skeletal maturstatus was assessed. As stated earlier, skeletal maturity level, as a

single measure, is perhaps the best indicator of the developmental status of the organism as a whole. There is an especially close relationship between skeletal maturation and the development of the reproductive system. Note the very high loading of skeletal age, .87 in this factor. "So intimate is the correspondence between the maturational changes in the reproductive and in the skeletal systems that it is possible to predict when the menarche will occur from the assessment of a radiogram of the hand and wrist during the prepuberal period [Greulich & Pyle, 1959]." Thus, the degree of development of the skeletal system in its tie-up with sexual development becomes a reliable indicator of the level of general body development which would include the brain and the nervous system.

Since metabolism generally is controlled by the endocrine glandular system, hormone levels correlate with growth, development, and the functional state of the body. Puberal sexual changes and the associated spurt of growth are set in motion by release of pituitary gonadotropic hormones which stimulate secretion of estrogens and androgens from the gonads. In the prepuberal years, the anabolic steroids are contributed by the adrenal cortex which is under the control of pituitary adrenocorticotropin. Throughout childhood, adrenal androgens are secreted in gradually increasing quantity. At puberty, testicular androgen greatly augments this secretion and produces the male secondary sex characteristics. It is likely that in females the adrenal androgens rather than gonadal secretion produce the adolescent growth spurt, while estrogens account for sex characteristics.

All androgens are excreted as 17-ketosteroids. Thus, growth and maturational effects of the anabolic hormones can be estimated from the 17-ketosteroid assay. This determinant has a loading of .64 in Factor E. The gonadotropic hormone factor which augments anabolic hormone secretion and sparks the physical changes of puberty is loaded .62. Creatinine, a by-product of creatine metabolism in muscle tissues, is an indicator of total lean body mass which obviously depends on physical growth, proceeding under the controlling influence of the hormones. Creatinine is loaded .60.

During the period of puberal changes organismic development generally is rapid and pervasive. Psychological correlates of the structural changes have also been noted. According to Piaget (Inhelder, 1958), for example, it is approximately the age of 11 years, the time of the onset of puberty, which marks the beginning of the "formal operations" in the child's cognitive development. It is during this period that he can begin to think in purely abstract terms, conceptualize, and reason logically. The intellectual skills involved in inductive and deductive reasoning and in handling the calculus of proportions become available to him. In general, the child at this time becomes able to function mentally in terms of symbolic representations and abstractions at levels previously impossible to him.

Thus the measured levels and changes in the biochemical products of metabolism (Variables 65, 66, 67, and 69) signal changes in patterns of physiological functioning and in rate of organismic maturation. In view

of the observed changes in levels of cognitive functioning which are presumed to accompany the stepped-up biological maturation of the puberal period, this factor may tentatively be regarded as representing the structure and the processes which make the child ready for higher levels of academic learning than he is capable of as a prepuberal child.

The loadings of .43 for the Sangren language subtest and lesser loadings in other tests of mental functioning that were fed into Factor E reflect to some degree the assumed relationship between structure and function.

DISCUSSION

The Changed Readiness Concept

The burning questions have always been: How does a child arrive at readiness? Can readiness be produced? Or is readiness the result of maturational factors which by definition must follow their own intrinsic laws of growth and cannot be speeded up?

Scientifically the concept of readiness is intimately related to the old nature-nurture issue. The thinking on readiness will depend on the stand which one takes in this controversy. The final practical question that arises here for parents and teachers is whether or not intervention is possible, and if it is possible, whether or not it is desirable.

Around 1950 and in the early '50's when our research project was started, the position generally taken was that school readiness is a matter of maturation. Readiness cannot be produced. The development of readiness follows an organismic law of growth which you cannot repeal, get around, overlook, or cheat on. Lack of recognition of this law means that the youngster is doomed to fail. Children inherit their rate of growth. The speed at which they may mature is bred into them. "The way you treat a child may lower his capabilities; you can make him function on only three of his four cylinders or on seven of his eight, but you cannot build an extra cylinder into him," said James L. Hymes, Jr. (1955) whose words became the education bible for nursery school-kindergarten teachers as much as Dr. Spock's advice about infant care and child-rearing became the bible for young parents. No effort must be made to intervene. "The time will come when a child is ready." "When you high-pressure a child . . . you hurt the child." Growth is the boss. Time is its worker. You have to be patient. You have to wait until the child is ready. We can be sure that his inner wheels are turning even if we don't see them: his intellectual wheels, social, emotional, memory, reasoning, and attention span wheels. We must hold our horses. We must have faith in this law of maturation. "Remember," says Hymes, "growth builds readiness . . . you don't [p. 88]."

Times have changed. The Zeitgeist has changed and with it the readiness concept has changed (Brenner, 1966, 1967). In the sixties it is believed that readiness can be produced. Present-day thinking takes [illegible]ain ideas which began to take shape in the 1930's when the Iowa Welfare Research Station published its findings about the [illegible]nce of various environmental settings on the child (Wellman,

1934, 1937; Wellman & Coffey, 1936; Skeels et al., 1937; Skodak, 1939). The contentions of these various researchers were far from universally accepted. Out of the nature-nurture controversy which followed (Goodenough, 1940) emerged two lines of thought: one continued to emphasize the effect of environment on child development, and another emphasized maturation. The latter movement became by far the more dominant and in educational-psychological practice the prevailing movement stressing the idea that school readiness is a matter of maturation with which one should not "tamper" (Hymes, 1955, 1958; Jersild, 1946).

For some years now there has developed an upsurge of new interest in the facts of stimulation appropriate to the child's age, particularly research in sensory and cultural deprivation and in cognition and perception of children in very early years. New research into the structure of the intellect, into stages of human development and learning, has further contributed to the new enthusiasm about the possibilities of environmental stimulation, be it through general enrichment or specific stimulation and tutoring of the child.

This research was bound to lead to a "new"concept of readiness, to a rather extreme environmentalist point of view. The tendency now is to neglect the maturational factor in readiness. It is now argued that children can learn earlier, faster, and more than we used to think. Readiness is not a matter of maturation, time, and patient waiting (Tyler, no date). It can and must be produced. This is the duty of the parent, the teacher, the school administration, the community, the nation. The pressure is on. If a child is not ready for school, it is rarely, if ever, the "fault" of the child, but rather of the parent, the teacher, and all those who are responsible for the child's early development of his potential and skills (Deutsch, 1963, 1964; Gordon, 1946).

The senior author's conceptual model of school readiness provides for both points of view and allows for a proper balance between an exclusive biological-maturational and an exclusive environmentalist position. The research reported in this study indicates that certain facets of readiness for school are largely "biological" in nature, and these presumably follow a biological time table. On the other hand, certain other aspects of general readiness are more clearly products of earlier learning from experience. There is no aspect of readiness, though, which would not be the result of the interaction of an individual's hereditary potential with environmental forces.

We want to address ourselves, therefore, to the need for a balanced view of the role of the genetic makeup of a child and the ensuing maturational factors on the one hand, and the need for environmental stimulation and earlier life experiences on the other hand. Neglect of or overemphasis on either the "nature" or "nurture" part of readiness is unrealistic and must lead to false hopes on the part of adults and to less than optimal readiness in the individual child. A "wait and be [illegible]nt" maturational attitude tends to underestimate a child's potential [illegible]apacities for early learning. It does not utilize enough new dis[illegible]ies in research and the possibilities which lie in environmental

stimulation for inducing readiness. The belief that readiness can and must be produced, almost under any circumstance, through environmental stimulation overlooks the fact that low genetic potential sets limits to the effectiveness of environmental manipulation. It also tends to ignore differential maturational forces at work in various individuals, thus perhaps pushing a child too hard and demanding too much at an inappropriate time, which in the long run may create more unreadiness than readiness. More points of discussion and critical evaluation can be found in "Readiness for School and Today's Pressures" (Brenner,).

Sex Differences

In 1965, Ilg and Ames published their book on "School Readiness." They report that . . . "regardless of test used and regardless of age of subjects, for nearly every test at every age, it is the scores of girls which are superior and which show greater maturity of response [35, p. 364]."

Much of the research literature and most textbooks in child development and learning favor girls over boys. It has become a stereotype repeated over and over again that girls mature earlier and are clearly ahead of boys in readiness and achievements of all sorts before school, at entrance to school, and in subsequent years. Teachers in general believe it and many researchers tell them that this is so. Such thinking has led to the suggestion that girls should enter school a year or at least half a year earlier than boys because of their advanced maturity and accomplishments, or boys should enter later. Our factor analysis does not bear out these claims and conclusions. Our Variable 1 is the sex variable. Table 3 shows that in none of the seven Factors has the sex variable a high or even moderate loading. The highest is one of .29 in Factor A which is lower than any other coefficient used in our study. In preparing the data for computer card punching, sex was coded 1 for boys and 2 for girls. The positive factor loading .29 thus reflects a slight overall superiority of girls in "cognitive readiness."

If we move away from this global result to a breakdown of sex differences in mean scores on the various subtests among the 69 variables, we find:

At Kindergarten Level

No significant difference in all six subtests of the Sangren Information Test.

No significant difference in all six subtests of the Metropolitan Readiness Test.

No significant difference in five subtests: 1, 2, 3, 6, 7, of the Pintner-Cunningham Test.

No significant difference in number producing and number recognition on the Brenner Gestalt Test, first administration.

No significant difference in number producing, number recognition, and sentence copying on the Brenner Gestalt Test, second administration.

At First Grade Level

No significant difference in four subtests: 1, 2, 4, 5, of the Monroe Reading Aptitude Test.

No signicant difference in six subtests: 1, 3, 4, 5, 6, 7, of the Monroe New Basic Reading Test.

To sum up: 32 variables show no significant sex differences; 22 at kindergarten level and 10 at first grade level.

Analysis of other variables reveals a consistent trend of superiority of girls over boys. The variables and their levels of significance of differences favoring the girls are:

Variable No.	Variable Name	Level of Significance (p=value)
	At Kindergarten Level	
14	Pintner-Cunningham — Discrimination of Size	.01
15	Pintner-Cunningham — Picture Parts	.02
28	Brenner — 10 Dot Gestalt, 1st administration	.05
34	Brenner — 10 Dot Gestalt, 2nd administration	.05
29	Brenner — Draw a Man, 1st administration	.01
35	Brenner — Draw a Man, 2nd administration	.001
30	Brenner — Sentence Copying	.05
62	Teacher Judgment — Achievement	.001
63	Teacher Judgment — Ability	.01
64	Teacher Judgment — Maturity	.01
	At First Grade Level	
40	Monroe Reading Apt. — Motor perception	.01
45	Monroe New Basic Reading — Sensory imagery	.05

All in all: 12 variables, namely nine subtests and three teacher judgments of achievement, ability, and maturity show statistically significant differences in favor of the girls. Seven of the nine subtests favoring girls over boys were kindergarten level achievements, while only two refer to first grade achievement.

Evaluating now the total result of our analysis of sex differences: 32 variables showing no significant difference versus 12 variables showing significant differences, we come to the conclusion that in our research population there is indeed a consistent trend of superiority of girls over boys in about ⅓ of the specified measured abilities and performances; there was also a statistically insignificant difference in mean Stanford-Binet IQ of 3 points (117.42 for girls, 114.56 for boys) in favor of the girls. But in ⅔ of the specified measured abilities and performances there was no significant sex difference.

Our data then do not confirm the generalized findings about the scholastic superiority of girls as pointed out so often, in particular by F. R. Pauley (1951) who studied sex differences in the Tulsa schools way back in the thirties and forties, and by Ilg and Ames in the 1965 Gesell Institute studies of school readiness. It is of interest to note that the above quoted findings from Ilg and Ames are hard to reconcile with their many differing findings in their own tables and specifically with their own observations in a most important area of readiness and learning, namely number readiness. They found that "the manual execution of numbers is better in girls, but the concept of numbers . . . is higher in boys [p. 59]." We believe that the latter accomplishment is by far the more relevant one. If true, it would speak clearly for greater cognitive maturity of boys rather than girls in the field of number work and thus contradict the authors' claim for greater overall maturity response in girls.

It is generally agreed that girls are usually advanced in the maturation of the skeletal-muscular system and therefore in various kinds of manipulatory and visual skills. It is also generally agreed that more

girls learn earlier to read than boys. That boys may do better in number work has not found enough attention. It is of crucial importance in the study of sex differences to move away from large statistical averages and similarities and to specify sex differences with regard to specific task performances as we have done it in this section. This enables us to be particular about tasks in which boys are superior and about other tasks in which girls are superior. Both Pauley and the Gesell Institute report such specific research findings, yet it seems to us that they did not avoid the danger of falsifying the correct specific findings through the very process of broad and thus faulty generalizations. But we have to go still further in specifications.

Differences in responsiveness and action patterns between boys and girls may vary with regard to age, interest, initiation, involvement, motivation, social class, cultural dispositions, sex appropriateness of tasks, and styles of categorization (Bruner, 1966). There seem to be sex differences with regard to anxiety. Teaching methods can make a difference: Is the method one of problem solving and risk taking? Then boys may do better than girls who seem to achieve better where traditional learing-obeying-conforming attitudes are required. There seem to be sex differences in teacher-planned activities vs. teacher-pupil-planned activities and even within these two approaches there may be differences if it comes to various subjects, meanings, skills, and drills (Shab, 1967). Permissiveness or authoritarian teaching styles can make a difference. Then there is the problem of identification, of "masculinity" or "femininity" in the classroom. Boys find it often difficult to identify with the female teachers who so greatly outnumber the male teachers; there may be outright resentment or rejection with subsequent lack of contact and performance, if not discipline problems — dynamic interaction patterns which tend to produce lower ratings by the teacher and thus mask actual abilities in boys.

On the basis of the findings of our factor analysis and considerations like these we would not be able to support the idea that girls should begin school a year or half a year earlier than boys. There is too much variance in sex differences, explored, and not yet sufficiently explored, to warrant the global assumptions underlying such a recommendation. Refering to Oetzel's bibliography on sex differences, Sigel (1963) reports that "findings of approximately one hundred ninety-six studies show that boys and girls differ consistently from each other in relatively few areas."

Much more, and more refined, psychological as well as statistical research is needed to settle the problem of sex difference in readiness and learning.

The Role of Chronological Age

We know from observation and research that five- or six-year-old children may show a range of 3 to 5 years in mental age; that is, some [illegible] six-year-old children may have a mental age of 4 or only 3; [illegible] may have a mental age of 7 or 8. We have found the same range [illegible]erences in skeletal age among our five- or six-year-olds. Seen

from this point of view, chronological age is not a good indicator of school readiness. Yet our factor analysis has turned out chronological age as one of the 7 Factors in readiness. Is there then a rationale for defending chronological age as a factor in readiness? Yes, there is.

The importance of chronological age as a basic factor contributing to readiness must be emphasized because psychological literature with its constant emphasis on individual differences and different rates of growth and development traditionally tends to devalue chronological age. In fact, psychological academia has been fighting chronological age as the universal indicator of developmental status for years, feeling quite superior to the "laymanish" administrative practice of admitting children to school on the basis of chronologicial age. There can be no doubt, though, that this practice has developed not only as an administrative convenience but because it is based on common observation and experience on a very large scale which tells us that by and large the five-year-old is ready for kindergarten and the six-year-old is ready for first grade in the United States as well as in other parts of the world. These biological-psychological generalities do not only exist as realities which we have to face, but they have been given scientific value in the construction of intelligence tests where individual differences are measured against the general intellectual levels of expected performance in the testing of two-year-olds, three-year-olds, four-year-olds, and all the way up to adult levels. Well-known achievement tests also assign scientific and practical value to chronological age; for instance, the Stanford Achievement Tests developed by Kelley, Ruch, and Terman. These tests use "Age and Grade Norms" and "Age Equivalents;" they associate low chronological age with a given grade placement, etc. These facts have been tacitly overlooked in discussions of the importance of chronological age in readiness for school.

Our factor analysis suggests now very strongly that psychological academia better re-assess their position regarding chronological age. The emphasis on individual differences and individual rates of growth, development, and learning was necessary and meritorious in the face of the complete disregard of these differences at the time of the exclusive reign of chronological age as criterion for school readiness, school entrance, and promotion. Insofar as this emphasis on individual differences in turn has led to an almost complete disregard of the importance of chronological age, it has become a one-sided emphasis, although it was an important new insight into individual development and learning. Our factor analysis tells us now that the time has come to restore the balance on a higher level of thought with implications for subsequent practice. The two positions are not mutually exclusive. Chronological age is definitely important and meaningful for growth, development, preschool learning, and readiness. The older the child is, generally, the more he has grown in structure and function, has accumulated life experiences, knowledge, concepts, and understanding of the world around him. Common observation, research, and our factor analysis [illegible] it. It be herewith re-emphasized. Equally, recognition of individual differences in personality, ability, and experience at the same [illegible]nological age, and the recognition of differences in rates of growth,

development, learning, and readiness must be maintained. Their importance is not devalued by our factor analysis. Consideratiion of both, a higher synthesis, is necessary from a scientific as well as a practical viewpoint.

The Importance of Knowledge

The emphasis in Factor D on the importance of knowledge in readiness prompts us to take issue with a widespread tendency in educational circles to de-emphasize the value of knowledge. Such an attitude must be examined carefully before it can be accepted or rejected. We agree with it when it means that there is no value in "deadwood knowledge" or in "inert" knowledge, as Alfred North Whitehead speaks of it. Much of the learning in school is of this sort. For instance, learning historical dates or any other facts just to be able to pass a "test" of knowledge, or cramming knowledge into the mind to pass an exam after which the students want to forget what they have learned as fast as possible. This is a waste of time and energy in the light of knowledge which is educative. We must disagree, however, with an attitude which says: "It is not important for a child to know facts; it is much more important to know where to get information, for instance, from an encyclopedia or from a library." This attitude overlooks the importance of knowledge that is alive, that is ever present and available when needed, and upon which future experiences will have to

build. There will be many occasions in life where we cannot say, "Wait a minute, I have to get an encyclopedia; I have to go first to the library to find out." Or, the anti-knowledge man will say: "The child does not have to know facts. The important thing is that he can think. We must develop his thinking." True enough. The development of a child's thinking ability is one of the major tasks of education and of growing up, but thinking does not occur in a vacuum. Thinking requires substances to think about and with; it requires knowledge of facts, comparisons with other facts, ideas, other concepts. It requires skill and schooled memory for stored knowledge. Or, there is the modern argument that times change so fast that what we know today is worthless tomorrow. Here again, the knowledge of tomorrow grows out of the knowledge of today. If what was taken as a fact today will be disproven tomorrow, replaced by a new "fact," it is still true that the new knowledge and thinking is based on the present one. New ideas and creativitiy have their best chance to be born out of a rich body of knowledge and flexible, imaginative thought that has been constantly disciplined in examining facts, events, contradictions, deviations from engraved traces of knowledge, and so forth.

Thus, the anti-knowledge attitude is wrong in underestimating the power of knowledge. "Knowledge is one chief aim of intellectual education," says Whitehead (1958, p. 41); "the ordered acquirement of knowledge is the natural food for a developing intelligence." We can reformulate this idea and say: Intelligence, in order to develop, requires ordered knowledge as its natural food.

If we are willing to accept this as a general truth, it becomes specifically important for children entering school. The more knowledge the child brings to school, the more he will have "apperceptive masses" to help him understand and integrate new knowledge in school. The more knowledge he brings to school the more concepts he will have available for understanding oral and written language. The more knowledge and concepts he has the more he will sharpen his perceptions in transactions with his environment. If we know more, we see more and hear more. We have better all-around antennas for new intake, for new assimilations of the old and the new. These are the ways a child grows intellectually, expands his horizon, and deepens his understanding. The greater his body of knowledge of concepts and perceptual skills, all intimately related, the more successful a child will be in his beginning and subsequent school years. The less knowledge, fewer concepts and perceptual skills he has, the less is he ready for school and subsequent learning.

These are no longer hypotheses or constructs. Their validity and their contribution to readiness in children has been clearly evidenced and re-affirmed in our earlier reports (Brenner & Morse, 1965; Hofmann & Brenner, 1960, 1961). In all these studies, which included a pilot group and 5 research groups tested both in kindergarten and first grade, to ess the role of knowledge and information in readiness and achievent prior to kindergarten, in kindergarten, and in first grade, the gren Information Test yielded consistently the best diagnostic and

predictive result, statistically significant above the 1% level. Teacher judgment and other test results were the validating criteria.

It is Factor D with its high loadings in the Sangren subtests which forcefully points to the role in readiness of knowledge, percepts and concepts, and the accompanying skills of analysis and synthesis, of abstraction and generalization ability.

And what about so-called "enrichment programs," Head Start, preschool programs? Are they not intended to give the child more background experiences in educationally needed knowledge, to develop perceptual and conceptual skills, to offer more opportunities for growing a vocabulary and developing cognitive thinking? And are these not achievements which an environment poor in nurture did not produce or allow to develop?

Once the child is in school it is the task of the school to keep knowledge alive, to prevent it from becoming inert knowledge, to use it, to clarify it, to channel it into new directions, to build on it. The body of knowledge, the life experiences which the child brings to school upon entering, and his perceptual-conceptual skills are the stock-in-trade for the teacher's work with the child. The more the child shows readiness in these respects, the more the teacher can help the child to grow further in readiness and personality development.

An anti-knowledge attitude is undefendable when applied to readiness for learning and growth of personality.

Accomplishments and Limitations of our Factor Analysis

Generally speaking, factor analysis is a mathematical-statistical procedure for organizing and categorizing in terms of their interrelationship a set of measured or otherwise observed behaviors, events, conditions, or attributes. It can therefore not "reveal" anything that is not inherent in the relationship which exists among the variables as measured or quantified. Thus, one limitation of our factor analysis lies in the selection of the measurable, indeed of the 69 measured, variables. A selection of other variables or a still larger number might have changed the outcome, although we do not think it would have changed it significantly. 69 variables derived from and related to 118 children furnish a respectable matrix of intercorrelations and thus provide a solid foundation for a factor analysis. Herein lies its strength and what is accomplished for us. A second limitation stems from the fact that in readiness there are many intangibles which escape direct measurement, but enter into behavior and performance. They can only be implied from the quality of performance or must be otherwise observed.

We shall first summarize the accomplishments of our factor analysis and then speak about its limitations in assessing total readiness.

1. Our factor analysis has confirmed earlier findings and new hypotheses.

It has upheld our multidimensional concept of readiness and its

value in assessing readiness because its conceptual framework is broad and flexible enough to allow for consistency and change in emphasis when new discoveries or changed beliefs come up.

3. It has sifted out seven basic Factors in readiness, separate and yet also related among each other.

4. Within each Factor it has shown the variables which contribute most to readiness, both on the task and the individual sides.

5. It puts before us a panorama of the demanding structure on the task side and the required bio-psychic structure in the pupil which enables him to fulfill the task.

6. As a consequence we are a better position to diagnose readiness for school through relating individual structure to task structure.

7. As a further consequence we have now clear directions as to what to focus on in improving measurement instruments.

8. Teacher judgment has been found to be very reliable in assessing readiness by judging a child's ability, maturity, and achievement. Experienced and sensitive teachers can do it.

9. The new insights gained from the recognition of the need for adequate subject-object or pupil-task relationships should enable more teachers to improve their methods in fitting the task requirements to the abilities and functional potential of individual children — especially important for the disadvantaged and gifted child — as brought to mind by Brenner (1957, 1959), Bruner (1960, 1966), Skinner (1965), M. Deutsch (1963, 1964), Passow (1963), Ira Gordon (1966), and others. The time should definitely be over when teachers, completely misunderstanding John Dewey, would say: "We teach children, not subject matter [Hofmann & Brenner, 1963]." A kindred mind and friend of John Dewey, the famous school superintendent of school in Munich, Georg Kerschensteiner, has as early as 1917 clearly spelled out this need for subject-object adequacy and the consideration of personality structure and developmental level of pupils in devising appropriate curricula and teaching methods.

10. On a broader scale, our factor analysis is a long overdue step toward a psychology of the structure of subject matter as discussed by J. Bruner (1960). It should also help as a stimulus toward bridging the gap between psychology and education, again a matter of concern to Bruner and recently to the APA as expressed by John Feldhusen (1966) in "Focus on Educational Psychology." The concern is that psychologists spent half a century measuring results of teaching while neglecting teaching itself. Psychologists must "re-enter the field of education." Bruner believes we are at a major point where psychology will once again concern itself with the design of methods of assessing cognitive growth. It is our belief that the implementation of our factor analysis can in some measure contribute to such a design.

The limitations of our study must be pointed out with equal force. By its very nature, our factor analysis, of advantage in finding commonalities of task and individual requirements, conceals in its final results differences among the six groups of children used and further individual differences within each group, each time in regard to levels of achievement and differences of personality structure and ability. Thus, in the actual practice of diagnosing and predicting readiness, the psychologist and the teacher must find out where each individual pupil stands on the continuum of each Factor or each variable commonality, both on the task and the individual side of readiness. Expressed in a different way: factor analysis reveals the demands, the abilities, and the skills needed in general, abstracted from and disregarding individual differences. How much mastery of abilities and skills in meeting the demands of school a child has mustered depends on the individual, his high or low potential, his past learing experiences, the tutoring from parents, the quality of teaching, and a host of other factors influencing individual child performance. To these qualities in a child the teacher must be sensitive in assessing readiness, in placing the individual in the continua of our Factors and variables, and in matching his teaching methods with the child's developmental level and personality structure.

There are ways, however, of utilizing the result of factor analysis for the assessment of individual differences in readiness. For this purpose a further step, not carried out in this study, is required. A score must be derived for each child on each aspect of readiness as represented by the seven Factors. Each of the seven Factors thus becomes a dimension in terms of which the child is measured and placed in the distribution from highest to lowest score. To obtain such individual scores in the most rigorous way requires further computer operations. However, it can be done in a less rigorous manner by simply marking the child's rating or score on each of the original variables which have high loading in a particular Factor. The sum, or some kind of average of these variable scores, could be used to place the child on the factor continuum. Such raw factor scores could then be converted to standard scores and a plotted "profile" of these scores for each child would present a qualitative picture of the pattern of measurable aspects of his total readiness.

Among the host of other factors influencing total readiness are many criteria and patterns of personality and behavior which we have established and discussed in our earlier research (Brenner, 1957, 1964, 1965, 1967a, 1967b; Brenner & Samelson, 1959). They are not in the immediate grasp of our factor analysis.

To illustrate: Factor analysis cannot directly measure motivations of the child, ability to pay attention, to concentrate, to follow directions, to be self-directing; it measures these only indirectly in so far as the abilities enter performance. It cannot measure in any direct way the impact of love, trust, belonging, and security on the child or the effect of being accepted or rejected at home or in school. It cannot measure ...us tensions, fears, anxieties, or the kind of self image a child has. ...not measure his restlessness or his tendency toward temporary or

permanent tiredness. Health and absenteeism are excluded from our factor analysis.

Similarly, it does not measure the child's striving to emulate significant adults, to pattern his life according to those who become a model for him or whose expectations he enjoys or hates to meet. Interpersonal skills are excluded from this type of factor analysis as are measures of the child's skill in finding a balance between freedom of expression and necessary restrictions in school. All these are important criteria of readines which are beyond the reach of our factor analysis. Their significance has been shown in our previous research.

There are still other limitations. Our factor analysis does not measure the effectiveness of the teacher: the effect of his personality on the child, his personal tempo (Yando & Kagan, 1968), his pedagogical art and craft. It does not measure peer group and community influences on the child.

Total readiness is contingent on the seven Factors plus all the just mentioned factors which are often intangible and elusive. For a full understanding and a proper diagnosis of school readiness we must keep this in mind. We are speaking here from the standpoint of an ideal comprehensive assessment of readiness. In actual diagnostic practice more or less limited approaches will have to suffice.

SUMMARY AND IMPLICATIONS

As part of a long-term comprehensive research project on school readiness, this study deals with information on 118 middle-class children in kindergarten and first grade. Sixty-nine variables consisting of the age of the children at the time of school entrance and of testing; of subtests of well known standardized tests; teacher judgment of ability, maturity, and achievement; and a number of physical examination data have been selected for each of the 118 children. This information has been factor-analyzed. As a frame of reference and to provide the necessary contextual background, our concept of readiness has been outlined first, then the development of the project and the hypotheses to be tested. The research population and raw data have been described. Table 1 illustrates the way that raw data were prepared for IBM computation. Table 2 gives the principal axis solution; Table 3 the rotated factors, verimax solution. The computer analysis resulted in seven readiness Factors which were identified as Factor A: Cognitive readiness; B: Chronological age; C: Reading readiness; D: Body of knowledge; E: Biochemical (maturity) factor; F: Physical developmental status; G: Perceptual differentiation. Thereafter we discussed the changed concept of readiness, sex differences, the role of chronological age, the importance of knowledge in readiness, and, finally, accomplishments and limitations of our factor analysis.

The implications of our study may be formulated as follows:

1. The huge body of intercorrelations which led to the final seven factors allows for many specific studies in the future which can shed increasing light on the complex problem of school readiness.

2. With these research results we have the knowledge necessary to construct a test of readiness which focuses on the most salient ingredients of readiness and achievement (apart from not directly measured emotional and social personality factors).

3. In teaching, the classroom teacher should now know better than before which aspects of readiness should be emphasized on the individual and on the task side. This has further implications for curriculum construction and development of teaching methods, to fit content and method to the developmental level and understanding of individual students so as to assure maximum success in teaching and learning.

4. Our findings should caution research people not to devaluate too quickly the teacher's ability to judge children.

5. From our study teachers can draw confidence in their judgment of their students' abilities, maturity, and achievement, provided that the teacher is observant and sensitive to the multidimensional aspects of individual-task relationships.

6. With the recognition that a child's life experiences, his body of knowledge, and his perceptual-cognitive skills are so vital to readiness, parents, teachers, and communities should find themselves advised to provide early, many, and variegated opportunities for the child to acquire those experiences, if possible, in preschool years. This should be done without undue pressure.

7. While chronological age is not a good indicator for the diagnosis of individual readiness because of the wide ranges of individual developmental physical and mental status at a given chronological age, it deserves to be emphasized as a natural basis for developing organismic structures and for increasing the child's life experiences. The older child is generally more ready for school than the younger child of equal potential.

8. Our findings should be apt to encourage parents, teachers, pediatricians, endocrinologists, ophthalmologists, and orthodontists to cooperate in providing physical fitness for the child in all its various aspects.

9. There is still no conclusive evidence as to the superiority of girls over boys in readiness and learning at these early age levels. The examination of sex differences needs to be continued. It will make progress only once we move away from widely accepted generalizations and study specific differences among boys and girls in regard to specific tasks and accomplishments.

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