The Irish Journal of Education 1973, vii, 2, pp 53 65

A FACTORIAL STUDY OF THE CHARACTERISTICS OF PRESCHOOL DISADVANTAGED CHILDREN*

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For a sample of three year old pre school children twenty four measures were obtained in the following areas cognitive development, pre school achievement, visual perceptual development, auditory perceptual development language personality and home environment An iterative principal factor analysis followed by a varimax orthogonal rotation yielded seven factors three cognitive, three personality and one home background These factors accounted for 57 per cent of the total variance of the variables One cognitive factor (general ability or intelligence) accounted for nearly one third of the common variance and about one fifth of the total variance of the variables

In recent years a large number of tests has become available for use at the pre-school level (8, 11) The production of such tests has been largely influenced by a growing interest in the possibility of providing pre-school educational opportunities for so-called disadvantaged children The multiplicity of tests available forces investigators to choose and the question of basis of choice naturally arises A primary consideration in making a choice is whether or not tests can be demonstrated to measure different things

In the present study, several tests and methods of evaluation were used with a group of three-year old children attending a pre-school in a disadvantaged area The measures selected represented a cross-section of techniques of evaluation in use with pre-school children On the basis of an inspection of their content, twenty-four measures were selected which seemed to cover seven areas cognitive development pre-school achievement visual perceptual development auditory perceptual development, language, personality and home environment Test scores were then factor analysed to determine the extent to which the measures were tapping different aspects of behaviour

*This study was supported by grants from the Van Leer Foundation and the Department of Education of the Irish government
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METHOD

Sample

All children (n 96) attending a pre-school centre in a disadvantaged area in Dublin were selected The children were drawn from an area in which the majority of families were economically poor and in which the local school had a record of high educational failure Because of absences and non-cooperation, complete data were obtained for only 90 children (44 boys and 46 girls) Testing for each child was spread over several weeks The mean age of the group at the time of taking the Stanford-Binet Scale, which was administered half-way through the testing programme, was 44 months (SD 3 7 months) Mean Stanford-Binet IQ was 92 99 (SD 13 10) All children had been in attendance at the pre-school for at least six weeks before they were tested, thus they had some time to adjust to the pre school and the conditions of testing

Variables investigated

Cognitive ability The Stanford-Binet Intelligence Scale (Form L-M) is regarded as a measure of 'general intelligence' (24), and has been used in many studies of disadvantaged children

Pre-school achievement The Pre-school Inventory was developed at the Educational Testing Service, Princeton, New Jersey, 'to give a measure of achievement in areas regarded as necessary for success in school (5)' It has been developed specifically for use with disadvantaged children Before using the test in Ireland, it was necessary to change the vocabulary of some of the items (elevator phonograph gas) One of the 85 questions was omitted altogether (question 29) The test yields four separate scores based on factor analysis as well as a total score The four factors represented are *A* Personal-Social Responsiveness (information about self—name, parts of body, ability to respond to communications of another person) *B* Associative Vocabulary (ability to demonstrate awareness of the connotation of a word to describe the essential characteristics of social roles—policeman, teacher) C_1 Concept Activation, Numerical (ordinal or numerical relations how many eyes, point to last one) C_2 Concept Activation, Sensory (knowledge of sensory attributes—form colour, size)

Visual perceptual ability Visual perceptual ability has been found to be related to school attainment, particularly reading (cf 26, 14) Two

tests of visual perceptual ability were used (i) The Developmental Test of Visual-Motor Integration which is a series of 24 geometric forms to be copied with pencil and paper The test is designed to examine visual perception and motor coordination It also involves the coordination of perceptual and motor abilities (cf 3) (ii) The Visual Discrimination Inventory is one of a battery of tests developed by Dr Carolyn Stern at the University of California at Los Angeles (21, 22) The test assesses the child's ability to discriminate visual stimuli (representational and geometrical) by having the child select from three stimuli the one which matches a standard stimulus The tasks cover four perceptual areas form constancy, figure-ground, closure and position-in-space

Auditory perceptual ability As in the case of visual perceptual ability, auditory perceptual ability is often regarded as an important factor in learning to read The test included in the present study was The Children's Auditory Discrimination Inventory (20, 22) In this test the child is required to discriminate between sounds by pointing to a picture to which a sound label has already been attached

Language Two measures of language development were used, both have been used frequently in studies of the disadvantaged (i) The Illinois Test of Psycholinguistic Abilities—Grammatical Closure subtest in this subtest, the child's ability to make use of redundancies in oral language is assessed (16) (ii) The English Picture Vocabulary Test, this is the British version of the Peabody Picture Vocabulary Test (4) and measures listening vocabulary

Personality Kamii (13) has suggested teacher ratings as being better suited than tests for the assessment of socio-emotional characteristics of young children Young children she argues, are not likely to conceal showing their feelings, besides information based on daily observation is superior to that based on a short test The rating scale used in the present study was the Children's Behavior Rating Scale developed at the Institute for Developmental Studies at New York Medical College The scale contains the name together with a definition of eight traits, each trait is subdivided into five descriptions ranked from high to low ('high' representing a child who possesses the traits to a marked degree) and scaled from 0 to 9 The eight traits are (i) self-determination (extent child takes initiative) (ii) persistence (does not give up easily,

or is not readily bored or distracted), (iii) stimulus-seeking behaviour (curiosity, inquisitiveness), (iv) competitiveness (attempts to excel in competition with other children), (v) response to direction (dutifully executes requests, commands), (vi) dependence (seeks assistance from others) (vii) emotional control in situations of failure or frustration (inhibits expression of emotion), (viii) mood cheerful—depression (merry, happy, pleasant vs morose, unhappy, gloomy) The children were rated by their teachers after the children had been in school for a full term

Home environment The investigations of Davé (7) and Wolf (27) indicate that environmental 'process' variables display substantial relationships with measures of achievement and intelligence These process variables as distinct from status variables, attempt to describe what parents *do* with children in the home The instrument used in the present study was the one developed by Dave, with adaptations for use with younger children Mothers of the pre-school children were interviewed by social workers The home background of each child was assessed in terms of the following variables (i) achievement press—parental aspirations for the education of the child (educational goals), (ii) language model—quality of the language usage of parents (pronunciation, vocabulary), (iii) academic guidance—extent of general supervision and suggestions regarding school work, (iv) family activities—variety, frequency and educational value of the activities of the family, (v) intellectuality of the home—variety and thought-provoking elements in toys and games available to the child, (vi) work habits of the family—degree of structure and routine in home management

RESULTS

Analysis

Means and standard deviations on the cognitive tests are presented in Table 1 Mean scores for the personality and environmental measures are not given, since no useful comparisons between them and any other data can be made

The intercorrelation matrix of the variables is given in Table 2 The hypothesis that the correlation matrix does not differ from the identity matrix was tested during Bartlett's (1950) test of the significance of a correlation matrix The χ^2 value of 79 834 (*df* 310) is significant beyond the 001 level Thus, following Knapp and Swoyer (17) one

TABLE 1

MEANS AND SDs ON COGNITIVE TESTS (N 90)

	Mean	SD
Stanford-Binet IQ*	92 99	13 10
Preschool Inventory-Personal-Social (A)	9 80	2 88
Preschool-Inventory-Associative Vocab (B)	3 07	2 61
Preschool-Inventory Numerical Concepts (C_1)	4 49	2 38
Preschool-Inventory-Sensory Concepts (C_2)	6 20	3 24
Preschool Inventory-Total	23 48	8 66
Developm Test of Visual-Motor Integration Age Equivalent*	38 99	6 00
Visual Discrimination Inventory	17 20	9 69
Auditory Discrimination Inventory	29 01	3 55
ITPA—Grammatical Closure Scaled Score*	35 90	5 65
English Picture Vocab Test Standard Score*	88 98	9 31

*Scores, other than those with an asterisk, are raw scores

TABLE 3

FACTORS OF THE R MATRIX

Variables	Factor Loadings						
	1	2	3	4	5	6	7
1 Binet IQ	—69	01	—42	—08	08	11	—10
2 PS Inv A	—51	—11	—22	24	13	—01	31
3 PS Inv B	—66	—01	—16	02	11	00	12
4 PS Inv C_1	—60	18	—22	03	05	08	—06
5 PS Inv C_2	—68	—14	—28	14	06	—10	10
6 Beery Vis Perc	—59	10	—20	—20	15	—21	—03
7 UCLA Vis Dis	—53	—08	—15	—09	—14	—31	27
8 UCLA Aud Dis	—49	—02	—21	28	—26	52	—03
9 ITPA Gram Clos	—58	—02	—30	08	—07	—08	03
10 Peabody	—62	01	—31	06	18	—07	—18
11 Home-Achieve	—52	—47	38	11	—05	—04	02
12 Home Language	—66	—45	27	15	04	07	06
13 Home-Acad Guid	—63	—32	32	—11	—15	07	00
14 Home-Family Act	—62	—35	36	—11	06	01	02
15 Home-Intell	—48	—32	37	—07	08	—01	—21
16 Home-Work Habits	—15	—23	—07	35	03	—20	—33
17 Pers-Self Deter	—51	54	23	27	—26	—17	—07
18 Pers-Persist	—62	49	23	—14	00	—16	—19
19 Pers Stim Seek	—61	44	12	04	—19	08	06
20 Pers-Compet	—37	—21	—10	—38	—53	—08	04
21 Pers Resp to Dir	—55	27	28	—25	—28	11	04
22 Pers-Dependence	52	—35	—22	—15	23	00	18
23 Pers Emot Cont	—39	27	12	—26	16	25	14
24 Pers-Mood	—22	22	42	28	26	—04	16

TABLE 2

INTERCORRELATION

	1	2	3	4	5	6	7	8	9	10	11
1 Binet IQ											
2 PS Inv A	43										
3 PS Inv B	51	45									
4 PS Inv C_1	51	35	48								
5 PS Inv C_2	49	51	56	42							
6 Beery Vis-Perc	47	30	40	39	47						
7 UCLA Vis Dis	41	39	34	26	40	42					
8 UCLA Aud Dis	44	32	29	35	38	17	14				
9 ITPA Gram Clos	46	36	40	50	54	38	41	34			
10 Peabody	60	24	50	41	58	48	31	34	45		
11 Home-Achieve	21	25	26	11	38	17	28	22	19	18	
12 Home-Language	33	37	42	22	42	25	37	37	31	34	71
13 Home-Acad Guid	28	25	37	23	36	24	31	29	28	25	54
14 Home-Family Act	30	26	39	24	34	25	29	16	27	34	63
15 Home-Intell	19	14	26	21	24	25	15	14	16	17	51
16 Home-Work Habits	06	17	02	09	22	10	03	09	18	18	18
17 Pers Self-Deter	21	21	24	28	29	25	28	25	27	23	15
18 Pers Persist	36	12	38	36	23	44	28	11	26	35	19
19 Pers-Stim Seek	39	24	40	40	33	32	25	37	27	30	18
20 Pers-Compet	23	07	23	18	26	26	38	22	28	13	25
21 Pers-Resp to Dir	27	19	26	33	31	39	16	10	14	28	21
22 Pers-Dependence	—24	—13	—26	—40	—20	—22	—21	—32	—25	—24	—23
23 Pers-Emot Cont	22	14	24	27	16	30	14	22	23	11	07
24 Pers-Mood	—06	14	16	11	02	06	06	01	02	09	19

MATRIX

12	13	14	15	16	17	18	19	20	21	22	23	24
64												
61	67											
49	52	58										
23	09	05	21									
17	23	18	11	00								
22	32	29	26	03	61							
23	36	28	11	—02	64	64						
22	37	26	22	—04	08	12	21					
31	36	36	29	—08	34	51	42	10				
-25	—28	—22	—24	—09	—60	—55	—48	—18	—35			
20	18	22	18	—17	19	41	35	06	53	—23	13	
21	11	19	21	—03	36	24	26	—25	33	—26		

could feel reasonably confident in proceeding with factor analysis of the data

An iterative principal factor analysis was performed on the correlation matrix of 24 variables * Following Kaiser's (12) approach, which has been found to be adequate when the number of variables lies between 20 and 50 (6), the number of factors equal to the number of eigenvalues greater than one after the first iteration, was specified This number was seven Table 3 gives the unrotated factor matrix

To reduce the complexity of the factor structure, two orthogonal rotations (varimax and equimax) as well as an oblique rotation (promax) were performed on the matrix of factor loadings The criterion used in the selection of the appropriate factor solution was that of simple structure (25) a simple structure is one in which a large number of factor loadings approach zero, so that each variable is described in terms of very few factors Both the varimax and promax rotations produced matrices that approximated simple structure better than all the others When the varimax and promax solutions were compared, deleting all loadings below 40 there was a high degree of similarity between the two patterns The variables which emerged for each factor were exactly the same with one exception However, when individual loadings were compared, the varimax rotation more adequately met Thurstone's simple structure criterion The factor solution for the varimax orthogonal rotation was selected as the most appropriate solution and is presented in Table 4 The table also provides information on the percentage of common variance as well as the percentage of total variance accounted for by each factor The h^2 value is the proportion of each variable's total variation that is accounted for by the common factors

Description of factors

Factor 1 has a large cognitive component and may be regarded as reflecting 'general intelligence' It is best typified by the tasks of the Stanford-Binet Intelligence Scale In addition, it accounts for nearly one-half of the variance of the Peabody and Pre-School Inventory Factor C_2 The other measures of pre school attainment and language, as well as the measures of visual discrimination and visual-motor integration also load on this factor Compared with other factors, Factor 1 is the strongest, accounting for nearly one-third of the common variance

*The programme used was Buhler R P STAT An evolving user-oriented language for statistical analysis of social science data Princeton University, 1968

TABLE 4

FACTOR LOADINGS—VARIMAX ROTATION

Variables	Factor Loadings							
	1	2	3	4	5	6	7	h^2
1 Binet IQ	77	11	10	09	12	19	—05	67
10 Peabody	70	15	15	—09	—03	03	—06	54
5 PS Inv C_2	67	26	11	—09	03	10	26	62
6 Beery Vis Perc	62	13	20	12	10	—20	02	50
3 PS Inv B	58	25	17	12	00	08	18	48
4 PS Inv C_1	58	07	28	09	00	16	—01	47
9 ITPA Gram Clos	58	12	17	—07	14	12	18	45
2 PS Inv A	50	18	03	00	—13	16	41	50
7 UCLA Vis Dis	43	21	16	03	28	—14	39	50
11 Home-Achieve	11	78	08	—11	03	06	15	66
12 Home-Language	29	77	07	—04	—05	17	17	74
14 Home-Family Act	23	76	11	12	03	—02	05	65
13 Home-Acad Guid	20	71	19	10	19	10	05	64
15 Home Intell	15	68	11	—02	—01	—06	—16	52
17 Pers-Self Deter	14	05	84	01	—05	05	22	78
18 Pers-Persist	34	17	71	21	00	—19	—17	76
22 Pers-Dependence	—17	—18	—68	01	—02	—14	07	55
19 Pers-Stim Seek	29	11	66	23	04	17	08	62
23 Pers Emot Cont	24	13	23	53	—07	05	—06	42
16 Home-Work Habits	18	17	02	—52	—10	01	—07	35
21 Pers-Resp to Dir	30	31	35	49	—18	—11	—11	60
20 Pers-Compet	18	25	10	07	71	04	09	62
24 Pers-Mood	—04	22	35	11	—48	—06	17	44
8 UCLA Aud Dis	35	14	18	00	08	72	03	70
% Common Variance	32	24	19	07	07	06	05	100
% Total Variance	18	14	11	04	04	03	03	57

and approximately one-fifth of the total variance of the variables

Factor 2 may be labelled the home environment factor Five of the six home environment indices load between 68 and 78 on it Although purporting to measure various aspects of the home environment, the scales are obviously related to one another Taken together they may be regarded as constituting a 'home press' factor Table 1 indicates a moderate intercorrelation among the variables Twenty-five per cent of the common variance and 14 percent of the total variance are accounted for by Factor 2

Factor 3 is a personality factor Four personality ratings load highly

on it self-determination, persistence, and stimulus-seeking behaviour (all positively) and dependence (negatively) These characteristics involve initiative, interest and independence on the part of the child This factor accounts for 20 per cent of the common variance and 11 per cent of the total variance of the variables under consideration

Factor 4 has three variables with relatively high loadings Two are personality traits—emotional control and response to direction—while the third is a measure of the work habits of the family All three involve discipline, particularly the ability to lead a structured life

Factor 5 is also a personality factor, competitiveness being the most important component It is interesting that this trait was perceived by teachers as being distinct from other initiative and interest variables The behaviour described by the factor is obviously more social than that described by Factor 3 In addition to competitiveness, the trait, mood, loads moderately on Factor 5 Teachers' ratings for mood may, to some extent, have been dependent on children's reactions to success or failure in competition

Factor 6 is an auditory factor, the main component being the measure of the child's auditory discrimination

Factor 7 is a minor cognitive one Performance on the Pre-School Inventory (Subtest A) and the UCLA Visual Discrimination Test load moderately on it The Pre-School Inventory subtest examines the child's practical knowledge (e g his name, address, the parts of his body), the Visual Discrimination Test measures the child's ability to discriminate visual stimuli It is difficult to see what these tests have in common other than a general cognitive component

DISCUSSION

The seven factors which emerged from this analysis accounted for 57 per cent of the total variance of the variables They thus provide a good indication of the dimensionality of the data The first three factors are by far the most important, accounting for three quarters of the common variance and approximately two-fifths of the total variance

Each of the remaining four factors accounts for approximately 6 per cent of the common variance and only 4 per cent of the total variance

Of the seven factors, one is a home-environmental factor, three are personality factors and three are cognitive The emergence of a single environmental factor fails to support the differentiation of processes implied in the use of six separate rating measures It may be that raters formed a general impression of the home which was reflected in all their ratings, or it may be that the single factor is indicative of an underlying atmosphere 'home press' 'hidden curriculum' (23) or system of social relations in the home (10) High inter correlations between home scales, it should be noted, are not specific to the present study Davé (7) whose home measure was adapted for the present study, reported inter-correlations ranging from 62 to 85 for a sample of homes of eleven-year-old children

One measure of the home loaded on a factor that was predominantly made up of personality measures (Factor 4) The home measure related to the work habits of the family and the personality measures related to emotional control and response to direction It is of interest that a trait which we described as discipline and the ability to lead a structured life was perceived in both the home and the school

The perception by teachers of separate personality traits in children of this age is perhaps surprising Parsons (19) has speculated that there is a relative lack of differentiation of role in the child starting school He mentions independence as the most important 'predispositional factor' with which the child enters school Insofar as factor 3 in the present study describes independent behaviour, our data support Parsons' position on the existence of such a trait However, teachers were able to discriminate other traits and so perceive greater differentiation in the personalities of children than Parsons' position would have led one to expect In speaking of teachers' assessments of older children, Parsons (19) has spoken of the presence of a 'moral' component He sees teachers as evaluating pupils, not just in terms of a cognitive dimension (information, writing, mathematical thinking), but also in terms of a moral dimension—cooperativeness, respect for the teacher and work-habits There is empirical evidence that supports Parsons' position in the case of older children (9) Our present findings suggest that teachers are sensitive to attributes that fall into the 'moral' category in children as young as three years of age We may hypothesize that teachers' evaluations of children, on a moral as well as on a

cognitive dimension, begin at a very early age

The relative lack of differentiation in cognitive ability revealed in the present study must be regarded as a major feature of our findings Only one major factor was isolated and that is best described as general ability or intelligence It may be that cognitive ability at this age is relatively undifferentiated (cf 1) and this may be more true in the case of disadvantaged children than in the case of middle class children Or the lack of differentiation may be a function of the range of the tests selected Greater differentiation has been reported in a study of three- to five-year-old American children (18), in this study, however, measures of more basic perceptual and psychomotor functions were administered As far as the grouping of higher-order mental functions is concerned, the results of the American study are not dissimilar from our own

In attempting to interpret our findings it should be borne in mind that all the tests were administered by an adult who came from a background different from that of the child Thus each test required an adaptation to the testing medium by the child and satisfactory performance was dependent on the child's motivation (28), his willingness to adapt to 'working' with an adult, to 'working' on his own, to talking, and to answering questions for the sake of answering questions The test situation would have been the first occasion on which the children would have found themselves in such a social or task situation It could be that the child's major task was to adapt to this situation rather than to solve problems posed by tests such as the Stanford-Binet Thus the single factor derived from the battery of cognitive tests, to some extent at any rate, may be a function of the child's ability to adapt to a test situation rather than of his ability to solve the tasks presented in the tests

Since the battery of cognitive tests used in the present investigation showed relatively little differentiation among themselves—for whatever reason—there seems little value either in economic or educational terms in administering such batteries to similar samples of children The Stanford-Binet Intelligence Scale on its own provides a relatively good estimate of the abilities measured by the cognitive tests used in the study Of the other tests we have examined, the one of auditory discrimination seems useful in supplementing the information gained from the test of intelligence Measures based on teachers' ratings also show promise, at least as far as discriminating between pupils on personality

factors is concerned Furthermore, the measure of the child's home background provides information about the child, not obtainable from the other measures used in the investigation The value of all such tests in the context of the child's education, of course, remains to be determined

Since there are always hazards in making decisions based on a single cognitive test in the case of young children with relatively low scores (15) the search for more promising evaluation instruments for use with disadvantaged children will no doubt continue The findings of our analyses indicate that investigators should look beyond the well-worn paths of traditional test procedures and seek new approaches in their search for information about the abilities of disadvantaged children

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