TEMPERAMENTAL CHARACTERISTICS RELATED TO DISPARITY OF ATTAINMENT IN READING AND ARITHMETIC

By R. LYNN
(University of Exeter).

SUMMARY. 1.—Several studies suggest that a lack of balance or disparity in attainment in reading and arithmetic in school children is related to certain temperamental traits. These studies suggested the hypothesis that there is a general relationship between *anxiety* and good reading in relation to arithmetic.

2.—This hypothesis was investigated by studies of the relation of anxiety to reading-arithmetic disparity among a group of primary school children and among a group of secondary modern school boys. In both groups there was a tendency for anxious children to be better at reading than at arithmetic.

3.—This tendency might be due to the greater amount of time which anxious children spend on reading as a way of dealing with their anxieties and finding satisfaction in fantasy.

I.—INTRODUCTION.

THE child who is good at reading but poor at arithmetic is generally recognised as odd. Disparity between reading and arithmetic attainment has frequently attracted the attention of psychologists, and there is evidence from several sources suggesting that such disparity is related both to the total personality of the child and to his home environment. This paper reports the results of an investigation into the relation of levels of attainment in reading and arithmetic to temperamental characteristics and in particular to feelings of anxiety.

II.—REVIEW OF THE LITERATURE.

There appear to be no studies of what might be termed ' attainment disparity ' among normal school children. There are, however, several types of study which have an oblique relevance to the question.

(1) Attainment Disparity in Clinical Groups. There is some evidence that neurotic children tend to be better at reading than at arithmetic and that psychopaths are better at arithmetic than reading. In Burt's (1937) view, children who are anxious tend to be better at reading than at arithmetic. Speaking of anxious children, he writes :

> " With most, however, it is arithmetic that offers the severest trials. They would readily echo the sentiments of Pet Marjorie, the seven-year-old friend of Sir Walter Scott : ' I am now going to tell you the trouble and wretched plague that my multiplication gives me. You can't conceive it. The most Devilish thing is 8 times 8, and 7 times 7 is what Nature itself can't endure '." (p. 551.)

Jastak (1941) writes that " high reading and low arithmetic scores tend to occur in abnormal mental states of developmental nature and of long standing as in neurosis and schizophrenia." Feinberg and Moscovitch (1956) report that in most emotionally disturbed children achievement in arithmetic is significantly depressed.

In a study of maternally overprotected children, Levy (1943) found that these children were good at reading but poor at arithmetic. Since it is often thought that maternal overprotection is associated with nervousness in children, this evidence might be regarded as supporting Burt's thesis. However, the question of how parental attitudes are related to attainment disparity is a separate problem and will not be pursued here.

Both Chase (1932) and Feinberg (1947) report that juvenile delinquents are better at reading than arithmetic.

Very little research has been published concerning the relation of temperamental characteristics of good arithmetic in relation to reading. According to Jastak (1941) this pattern is frequently found in patients with acquired psycholosis due to alcoholism and syphilitic infection.

(2) Attainment Disparity and Sex Differences. There is a considerable literature showing that girls tend to be better than boys at reading, but poorer at arithmetic (e.g., Ayres, 1909 ; Lincoln, 1927 ; Stroud and Lindquist, 1942 ; and many other papers).

(3) Temperament Differences in Intelligence Test Scatter. Closely related to the question of reading-arithmetic disparity is that of the scatter of verbal and perceptual or performance sub tests in intelligence testing. Several studies of the relation of temperament to test scatter are available and these tend to be consistent with the findings on reading-arithmetic disparity. Himmelweit (1946) found that obsessional and anxiety neurotics have a high verbal ability in relation to their performance intelligence, and these results have been confirmed by Eysenck (1947, p. 124). Similar findings are reported by Rapaport (1946) and Altus and Clark (1949). On the other hand, especial weakness in verbal intelligence has been noted among delinquents and psychopathic personalities (Wechsler, 1941 ; Piquer y Jover, 1946 ; Bender, 1950).

Taken as a whole, these studies suggested the hypothesis that good reading in relation to arithmetic might be associated with nervousness and in particular with anxiety. The following investigation was undertaken to test this hypothesis.

III.—THE INVESTIGATION.

(*a*) *Primary School Children.*

Subjects.—The subjects were 80 unselected normal children attending a primary school. There were 42 boys and 38 girls, with an age range of 7·5 to 11·0 years and a mean age of 9·6. The mean I.Q., as assessed by the Stanford-Binet test, was 112·2, with a standard deviation of 17·2. The school was situated in a predominantly middle class district, and this probably accounts for the rather high mean intelligence.

Attainment Tests.—Reading attainment was assessed by Schonell's Graded Reading test, using the norms as modified by Vernon (1950a). The mean reading age was 9·11 (S.D. 20 months). Arithmetic attainment was assessed by a mechanical arithmetic test devised by the local education authority. The mean arithmetic age was 9·8 (S.D. 17 months). A ' disparity score ' was derived by subtracting the arithmetic age from the reading age.

Anxiety Tests. The children were given a number of tests of anxiety and the scores of these tests were positively inter-correlated. Two of the tests are described here and their relation to attainment disparity shown below.

(i) *Personal Anxieties.*—This is a test comprising six questions about the child's anxiety in his personal relationships, especially those concerning his mother. For example, the children were asked whether they had ever been afraid that their mother might die. The six questions are shown in full elsewhere (Lynn, 1955). Table I shows the relation of anxiety to attainment disparity in a contingency table. Chi squared=15·3, and is significant at the 5 per cent. level.

(ii) *Himmelweit and Petrie's Test.* This is a projection test devised by Himmelweit and Petrie (1951) for the study of children with behaviour disorders. The test consists of five brief stories in which the child reads of a social dilemma which must be dealt with in one of five ways. The child reads the story or hears it read to him, and then puts a tick against the response which

TABLE 1

READING-ARITHMETIC DISPARITY.

		−2	−1	0	+1	+2
Anxiety	0	12	5	11	5	
	1–2	4	10	5	8	
	3–5	3	2	5	10	

he thinks ' right.' Responses were scored anxious if they suggested that the child was seriously perturbed by the rejection or disapproval of other children or of the teacher.

Table II presents the results of this test and their relation to disparity in a contingency table. Chi squared=14·7, and is significant at the 5 per cent. level.

TABLE 2

READING-ARITHMETIC DISPARITY

		−2	−1	0	+1	+2
Anxiety	0	10	6	10	6	
	1	7	9	6	5	
	2–4	2	2	5	12	

(*b*) *Secondary Modern School Boys.*

The Subjects.—The subjects were 45 normal boys attending a secondary modern school. They were all the boys due to leave the school at the end of the term in which the testing took place. The age range was from 14·6 to 15·6.

The Attainment Tests.—Reading attainment was assessed by Schonell's Graded Reading Test using Vernon's modified norms ; the mean Reading Age was 13·6 (S.D. 14 months). Arithmetic attainment was assessed by Cattell's Mechanical arithmetic test with the addition of some standardised harder problems to make the test suitable for 15-year-old boys ; the mean Arithmetical Age was 13·7 (S.D. 22 months). A ' disparity score ' was derived by subtracting the Arithmetic age from the Reading age.

The Anxiety Test.—Anxiety was assessed by a modified version of the Taylor Anxiety Scale (Taylor, 1953). Of the 50 questions, 20 were asked and the rest omitted as unsuitable for English school children. Using Taylor's notation, the questions asked were Nos. 1, 4, 7, 11, 12, 14, 15, 16, 18, 19, 25, 27, 28, 32, 35, 38, 41, 44, 47, 50. These are questions about anxiety symptoms such as worrying, poor sleep, nightmares, feeling embarrassed easily, feeling depressed and unhappy and the like.

Procedure.—The boys were interviewed individually in the school for ten to fifteen minutes each. After some informal conversation about school, their prospective jobs, etc., the Taylor questions were asked and, if necessary, explained to ensure that they were undertsood.

Results.—Table III shows the relation of Taylor Anxiety scores to disparity in a contingency table. Chi-squared=2·6, which is not significant at the 5 per cent. level, but the tendency for anxiety to be associated with good reading—poor arithmetic is again present.

TABLE 3

READING-ARITHMETIC DISPARITY

		−3	−2	−1	0	+1
Anxiety	0–3	6	2	1	5	
	4–6	7	5	2	6	
	7–10	2	2	2	5	

DISCUSSION OF RESULTS.

(1) The positive association of anxiety with better reading than arithmetic is consistent with the clinical studies of attainment disparity and suggests that these should be viewed as extreme cases of a general relationship which is found among normal school children. The results are also consistent with the high verbal ability found in anxiety neurotics, and suggest that there may be a general association between anxiety and high VEd : low KM factors.

(2) The association of anxiety with poor reading in relation to arithmetic may throw some light on the problem of specific dyslexia, the specific backwardness in reading which is supposed by some writers to be due to a neurological defect or to differential maturation in the brain. It is, however, widely recognised that this condition is frequently accompanied by emotional and temperamental maladjustments (e.g., Schonell, 1942), and where this is so the present results suggest that insufficient anxiety may be a relevant temperamental trait. It is possible that some children do not learn to read because they are not anxious enough. If this is so, evidence for the inheritance of specific dyslexia (Hallgren, 1950) could be attributed to the inheritance of low anxiety, not poor reading ability as such.

(3) Both the present and previous findings could be explained by the theory that anxiety is a cause of good reading attainment. Such a theory would account for some of the apparently unconnected findings, especially: (*a*) the superior reading of girls might be due to their higher general level of anxiety, as reported by e.g., Burt (1937, p. 336) and Isaacs (1932); (*b*) the high verbal ability of anxious and obsessional neurotics might be due to their anxiety,; and (*c*) the poor verbal ability of the psychopathic personality might be attributed to the low level of anxiety, reported by e.g., Bowlby (1951) and Bender (1950).

It is not altogether easy to see why anxiety should manifest itself in this way. Perhaps the simplest explanation would be that the highly anxious child devotes a great deal of time to solitary reading, while the unanxious child is engaged in some more active pursuit. A similar explanation to account for sex differences in reading attainment has been put forward by Burt (1927, p. 196), who draws attention to the sedentary habits of the little girl, sitting at home reading while her brothers are out at play. This sex difference may be due to a more fundamental temperamental difference. Many writers have noticed that

the anxious, solitary child may become an avid reader to satisfy his needs in fantasy, as an escape from the real world or simply from the ambition for success which often characterises anxious children. It is less likely that anxious children would get pleasure out of doing arithmetic, and it is probable that anxiety has a disorganising effect on arithmetic, as Burt (1937) observed. There is considerable experimental evidence that anxiety impedes the acquisition of complex skills (e.g., Gordon and Berlyne, 1954) and arithmetic, for the school child, is undoubtedly a complex skill.

(4) The results suggest several hypotheses for further research. (i) If reading-arithmetic disparity and high VEd : low KM are both part of the same general syndrome, it would be expected (*a*) that psychopathic personalities would have poor reading attainment in relation tc arithmetic ; (*b*) that anxiety would bear a similar relationship to high VEd : low KM as it appears to have (according to the present findings) to reading-arithmetic disparity. In this connection it is interesting to note that girls tend to have high VEd : low KM (Vernon, 1950b, p. 32), and this might be explicable in terms of their higher average level of anxiety.

(ii) If anxiety is induced and developed, even in part, by patterns of parental discipline and behaviour, then there should be some relationship between these patterns and reading-arithmetic disparity and intelligence sub-test scatter. Evidence supporting this hypothesis does in fact exist (Levy, 1943 ; Feinberg, 1949 ; Davis and Kent, 1955), but consideration of its interpretation would take us too far field from the present paper.

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V.—REFERENCES.

ALTUS, W. S., and CLARK, J. H. (1949). The effect of adjustment patterns upon the intercorrelation of intelligence sub-test variables. *J. Soc. Psychol.*, 30, 39-48.

AYRES, L. P. (1909). *Laggards in Our School.* New York : Russell Sage Foundation.

BENDER, L. (1950). Anxiety in disturbed children. In *Anxiety*, ed. Hock, G. H., and Zubin, J. New York : Grune and Stratton.

BOWLBY, J. (1951). *Maternal Care and Mental Health.* Geneva : Bull. World Health Organisation.

BURT, C. (1937). *The Backward Child.* London : Univ. London Press.

CHASE, V. (1932). Educational achievement of delinquent boys. *J. Juv. Res.*, 16, 189-192.

DAVIS, D., RUSSELL, and KENT, N. (1955). Intellectual development in school children, with special reference to family background. *Proc. Roy. Soc. Med.*, 48, 993-995.

EYSENCK, H. J. (1947). *Dimensions of Personality.* London : Kegan Paul.

FEINBERG, H., and REED, C. L. (1940) : Reading level of a group of socially maladjusted boys. *J. Soc. Psychol.*, 12, 31-38.

FEINBERG, H. (1947) : Achievement of a group of socially maladjusted boys as revealed by the Stanford Achievement Test. *J. Soc. Psychol.*, 26, 203-212.

FEINBERG, H. (1949). Achievement of a group of children in foster homes, as revealsed by the Stanford Achievement Test. *J. Genet. Psychol.*, 75, 293-303.

FEINBERG, H., and MOSCOVITCH, E. (1956) : Achievement on the Stanford Achievement Test of children placed in difficult own home situations compared with children placed out of the home. *J. Exp. Educ.* (In press.)

FENDRICK, P., and BOND, G. (1936). Delinquency and reading. *J. Genet. Psychol.*, 48, 236-243.

HALLGREN, B. (1950). Specific dyslexia (congenital word-blindness) : A clinical and genetic study. *Acta. Psychol. Kbh. Suppl.*, 65, xiii, 287.

HIMMELWEIT, H. T. (1945). The intelligence-vocabulary ratio as a measure of personality. *J. Person*, 14, 93-105.

HIMMELWEIT, H. T., and PETRIE, A. (1951). The measurement of personality in children. *Brit. J. Educ. Psychol.*, 21, 9-29.
JASKAK, J. (1941). *Wide Range Achievement Test.* Wilmington : Story.
ISAACS, S. (1932). Neurotic difficulties in young children. *Brit. J. Educ. Psychol.*, 2, 257-265.
LEVY, D. M. (1943). *Maternal Over-protection.* New York : Columbia Univ. Press.
LINCOLN, E. A. (1927). *Sex Difference in the Growth of American School Children.* Baltimore.
LYNN, R. (1955). Personality factors in reading achievement. *Proc. Roy. Soc. Med.*, 48, 996-998.
LYNN, R. *The Relation of Anxiety to Educational Attainment in School Children.* Cambridge University : Unpublished Ph.D. thesis.
PIQUER Y JOVER, J. I. (1946). *El nino atardonado y delincuente.* Madrid.
SCHONELL, F. J. (1942). *Backwardness in the Basic Subjects.* Edinburgh : Oliver and Boyd.
STROUD, J. B., and LINDQUIST, E. F. (1942). Sex differences in Achievement in the elementary and secondary schools. *J. Educ. Psychol.*, 33, 657-667.
TAYLOR, J. A. (1953). A personality scale of manifest anxiety. *J. Abnorm. Soc. Psychol.*, 48, 285-290.
VERNON, P. E. (1950). *In Reading Ability.* London : H.M.S.O.
VERNON, P. E. (1950). *The Structure of Human Abilities.* London : Methuen.
WECHSLER, D. (1941). *The Measurement of Intelligence.* Baltimore : Williams and Wilkins.

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