

PERSONALITY AND ACHIEVEMENT IN MATHEMATICS¹

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This study on the relationship between personality factors and achievement in mathematics was suggested by certain statements of Adler. According to Adler: "Of all school subjects, arithmetic requires the most independence. Especially pampered children are far removed from this manner of independent thinking" (1, p. 401). The pampered child has come "to a standstill in the development of his social interest and acquired a picture of the world that promised him easy and quick fulfillment of his wishes" (1, pp. 241-242).

To follow up this observation, we compared overachievers in mathematics with underachievers with regard to their performance on the California Psychological Inventory. This instrument was chosen because it uses "descriptive concepts which possess broad personal and social relevance" and is "addressed principally to personality characteristics important for social living and social interactions" (3). Thus it is theoretically akin to the psychology of Adler and appears well suited for testing his conceptions.

METHOD

The subjects were 56 eighth-grade boys from a public school, 29 overachievers in mathematics and 27 underachievers. They were selected as follows. The Co-operative Mathematics Test, Grades 7-9, Form Y, and the Otis Quick-Scoring Mental Ability Test, Form CM, Beta, were administered to 225 eighth-grade boys and girls. Eleven subjects with Otis IQ's below 80 and above 130 were excluded at this point, leaving 214 subjects.

The Mathematics and Otis scores were converted into T-scores, and the differences between these scores found for each subject. The mean difference was -0.29 with a standard deviation of 5.7. Subjects with difference scores of $+3$ and above, and -3 and below, 139 in all, were selected as the mathematics overachievers and underachievers, respectively.

These subjects were then given the California Psychological Inventory (CPI) two months after the initial testing. At this point only the 75 boys were retained for further study, in order to eliminate the complication of sex differences.

This number was further reduced by 19 on the basis of dissimulation or "faking" scores on the CPI. Since the test offers no dissimulation norms, it was arbitrarily decided to eliminate those who scored below 2 SD's from the mean of the present sample on the Wb and Cm scales, and above 2 SD's on the Gi scale (see Table 1 for explanation of these symbols). Nine overachievers and 10 underachievers were excluded in this way.

For the initial 214 subjects the correlation between Mathematics and Otis scores was .63. Yet, the 29 overachievers in the final sample achieved a mean IQ

¹Grateful acknowledgement is made to the principals of the Burlington Junior High Schools, and to Miss R. Hoag and Mrs. A. Truax, guidance counselors, for permitting and aiding in all the test administration; to Dr. B. B. Murdock for his assistance with the statistical treatment of the data; and to Dr. Doris Kraeling for her suggestions.

of 103.5, the 27 underachievers, a mean IQ of 110; the difference yielded an F of 6.36 which is significant at the .025 level. The age difference between the two groups was not significant.

Because of the relationships found between mathematics achievement and intelligence, the differences in CPI scores between our finally selected 29 overachievers and 27 underachievers were examined by analysis of covariance as described by Edwards (2).

RESULTS AND DISCUSSION

The mean raw scores of the overachievers and underachievers on the 18 scales of the CPI, ranked according to degree and significance of difference between the two groups, are shown in Table 1. On all scales

TABLE 1. MEAN RAW SCORES OF 29 MATHEMATICS OVERACHIEVERS AND 27 UNDERACHIEVERS ON THE 18 SCALES OF THE CALIFORNIA PSYCHOLOGICAL INVENTORY, RANKED ACCORDING TO THE SIGNIFICANCE OF THE DIFFERENCE.

Name and purpose of scale (3)	Uncorrected means		Covariance	
	Over-achievers	Under-achievers	F	p
<i>Cs</i> (<i>capacity for status</i>): to serve as an index of capacity for status (not achieved status), personal qualities which underlie and lead to status.	18.1	12.6	14.1	.005
<i>Sc</i> (<i>self-control</i>): to assess adequacy of self-regulation and freedom from impulsivity and self-centeredness.	27.6	21.7	10.2	.005
<i>Py</i> (<i>psychological-mindedness</i>): to measure interest in the inner needs, motives, and experiences of others.	10.5	9.1	10.0	.005
<i>To</i> (<i>tolerance</i>): to identify permissive, accepting, and nonjudgmental social beliefs and attitudes.	18.8	16.7	7.7	.01
<i>Sp</i> (<i>social presence</i>): to assess poise, spontaneity, and self-confidence in personal and social interaction.	33.6	31.7	7.5	.01
<i>Ac</i> (<i>achievement via conformance</i>): to identify interest and motivation which facilitate achievement where conformance is a positive behavior.	22.8	20.5	7.3	.01
<i>Ai</i> (<i>achievement via independence</i>): to identify interest and motivation which facilitate achievement where autonomy and independence are positive behaviors.	15.5	14.1	6.8	.025
<i>Ie</i> (<i>intellectual efficiency</i>): to indicate personal and intellectual efficiency.	34.2	33.1	6.0	.025
<i>So</i> (<i>socialization</i>): to indicate social maturity, integrity, and rectitude.	36.7	34.2	5.9	.025
<i>Cm</i> (<i>communality</i>): to indicate degree to which reactions and responses correspond to the modal ("common") pattern established for the inventory.	25.2	25.3	5.7	.025
<i>Sy</i> (<i>sociability</i>): to identify outgoing, sociable, participative temperament.	22.4	21.3	5.2	.05

<i>Re</i> (<i>responsibility</i>): to identify conscientious, responsible and dependable disposition.	27.5	26.0	5.0	.05
<i>Gi</i> (<i>good-impression</i>): to identify persons capable of creating a favorable impression, and who are concerned about how others react to them.	16.3	13.3	4.5	.05
<i>Wb</i> (<i>sense of well-being</i>): to identify persons who minimize their worries and complaints, and who are relatively free from self-doubt and disillusionment.	33.6	32.5	2.8	n. s.
<i>Do</i> (<i>dominance</i>): to assess leadership ability, dominance, persistence, and social initiative.	24.2	23.3	2.6	n. s.
<i>Sa</i> (<i>self-acceptance</i>): to assess sense of personal worth, self-acceptance, and capacity for independent thinking and action.	18.34	18.30	.22	n. s.
<i>Fx</i> (<i>flexibility</i>): to indicate flexibility and adaptability of thinking and social behavior.	9.2	8.8	.14	n. s.
<i>Fe</i> (<i>femininity</i>): to assess masculinity or femininity of interests (high scores indicate more feminine interests).	16.2	16.0	.0	n. s.

but the Cm scale the overachievers scored higher than the underachievers, and on 12 scales the difference is significant, once correction for intelligence differences was made by application of covariance. The difference on the Cm scale is not considered valid, since results with this scale did not meet the requirement of normalcy of distribution for the variance analysis and since it is also probably the most important of the dissimulation scales on the basis of which 19 subjects had been excluded. Results with this scale are therefore omitted from further discussion.

Since the CPI is concerned with "the favorable and positive aspects of personality," except for the Fe scale, and is scored in this sense, the results are distinctly in favor of the overachievers.

The CPI manual includes sets of adjectives describing how high and low scorers on the various scales "tend to be seen," supplementing the meaning of the various scales (3). If we tabulate the adjectives which occur more than once for the 12 scales which discriminate significantly, we find the following:

High scorers, i.e., mathematics overachievers, tend to be seen as:

cooperative	independent	clear thinking	broad interests
conscientious	enterprising	progressive	informed
responsible	active	quick	verbally fluent
honest	forceful	capable	talkative
sincere	spontaneous	efficient	industrious
outgoing	persistent	planful	thorough
			resourceful

Low scorers, i. e., mathematics underachievers, tend to be seen as:

self-centered	conventional	disbelieving	apathetic
aloof	inhibited	submissive	simple
stubborn	passive	shrewd	unassuming
opinionated	cautious	wary	awkward
resentful	impulsive	stereotyped	defensive

These results can well be taken as supporting Adler's observation that the child who does well in arithmetic is one who shows independence and social interest, concomitants of which latter are: "an improved mind," courage, an optimistic view, feeling at home in the world, strength to overcome adversities, common sense, being master of one's fate, regard for the welfare of others, being a good loser (1, pp. 155-156). The underachiever, on the other hand, corresponds better to Adler's conception of the individual with a pampered life style. Such an individual is characterized by: lack of independence, self-centeredness, feeling ill-treated (1, pp. 369-370), expecting everything from others, little activity, hesitation, oversensitivity, impatience, exaggerated emotion, tendency to retreat, signs of weakness, need for support (1, pp. 241-242).

While in our study intelligence was held constant, achievement in other school subjects was not controlled. Thus we cannot tell to what extent the results are specific to mathematical achievement, or may apply to school achievement in general.

SUMMARY

Twenty-nine mathematics overachievers and 27 underachievers (eighth grade boys) were compared with regard to their scores on the California Psychological Inventory. The overachievers emerged with higher scores, i. e., more favorable personality characteristics than the underachievers, the difference on 12 of the 18 CPI scales being statistically significant. The test manual's descriptive adjectives for high and low scorers, occurring more than once on the scales for which significant differences were obtained, are well in agreement with Adler's observation regarding personality and mathematical achievement in children.

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