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THE IOWA STATE COLLEGE REASONING TEST¹

THOMAS F. VANCE

In order to arrive at the point of this paper on the subject, "The Iowa State College Reasoning Test" it is necessary to describe briefly the other tests of which it is one in the series.

The psychological test which has been given this year to the Freshman class of Iowa State College is a modified Alpha. The Alpha was chosen as a basis on which to construct a new form for the reason that it has given consistently higher correlations than it has been possible to secure with any other test. In the modified form, Arithmetic, the Synonym and Antonym, the Disarranged Sentence, the Number Series, the Analogies and the Information tests remain very much the same as they appeared in the original form. The easier exercises at the beginning of each of these tests have been advanced to the bottom of the preceding page to serve in the capacity of fore-exercises which gives the student a preliminary practice before beginning the test proper. (After the fashion of the National Intelligence Test.) More difficult exercises were added toward the close of each test with the purpose of making the series more difficult.

The information test was changed as follows: The options were increased to five, each were numbered and the student required to write the number of his choice on the line to the right. A number of questions bearing more directly upon general lines of information which a high school might be expected to offer were substituted for some of the easier ones in the old test.

The old test has been converted into a reading test. The familiar circles, triangles, etc., appear somewhat as they do in the old form but they are printed to the right and the directions immediately to the left. Instead of the directions being read to the student, he reads them and carries them out as he reads. Two exercises have been added to this test.

Test 3 has been eliminated entirely.

The Reasoning test has been added. The exercises are for the most part cast into the syllogistic form. The following are representatives:

¹ Read before the Iowa Academy of Science, Cedar Rapids, April 30, 1925.

1. Texas is north of Mexico. The Rio Grande separates Texas from Mexico. What direction is the Rio Grande River from Texas? (1) North, (2) South, (3) West, (4) Insufficient data.

2. Suppose that fir were harder than oak and oak harder than walnut. Which would be the hardest? (1) Fir, (2) Oak, (3) Walnut, (4) Insufficient data.

Full directions were given with the fore-exercises.

To summarize the tests in the series:

1. Following directions.....	14 points
2. Arithmetic	20 points
3. Synonym and antonym.....	35 points
4. Disarranged sentences.....	24 points
5. Number series completion.....	20 points
6. Analogies	40 points
7. Information	40 points
8. Reasoning	35 points
Total number of points.....	228 points

It may be said, parenthetically, that the test is more difficult than the Alpha, the median being approximately twenty points lower. Its value in predicting achievement in college appears to be no better and no worse than the old Alpha. The correlation of the present test with first quarter average in the group of science students which may be taken as an illustration in this report is .52, lower than that given by the Alpha with this Division by .07.

The accompanying table contains the simple correlations between each of the eight tests and every other and each of the tests and academic standing as measured by the grade average for the first quarter.

CORRELATION TABLE—139 INDUSTRIAL SCIENCE STUDENTS, 1925

TESTS	2	3	4	5	6	7	8	AV.
1	.49	.48	.39	.51	.54	.46	.67	.33
2		.31	.21	.50	.47	.39	.47	.32
3			.43	.45	.51	.59	.31	.36
4				.39	.39	.50	.36	.43
5					.49	.45	.13	.19
6						.53	.49	.43
7							.48	.38
8								.26

It is to be observed in the table that Tests 4 and 6 tie for first place in correlating with college average, Test 7 following in second place; but Test 8, the reasoning test falling second from the bottom. The r. of .26 compared with .52, the r. of the eight tests

combined with college average indicates that Test 8 has very little value for predicting success in college.

The correlation array of the intelligence examination as a whole with college averages shows a closer relationship in the highest quartile than in any other part of the range. In the middle quartiles the relation is practically zero, becoming somewhat better in the lowest quartile. The method of grading may have some effect upon the correlation. There are but two grades below the passing mark of 75, "C" and "NP." In making out the averages the registrar computes these as 60% and 40% respectively. A unit above the passing mark becomes from fifteen to twenty times as great below the passing mark. A more uniform scale of grading in the lower levels might give a more normal distribution and tend to increase the size of the correlation.

Correlations are sensitive instruments, and may sometimes disguise a relationship in certain parts of the series which are after all significant and so it seems advisable to express the relationship in other terms, as for instance, the percentage of measures in the one series that equals or exceeds certain points in the other. Using this method of comparison it is found that:

Forty per cent of the students in the highest quartile in the intelligence series have a college average of 90% or above.

Eighty-six per cent of the students in the highest quartile have a college average of $82\frac{1}{2}$ or above which is the average of college grades.

In the lowest quartile of the intelligence series, sixty per cent fail to reach the passing mark of 75.

In the lowest quartile of the intelligence series, 91% fail to reach $82\frac{1}{2}$ %, the average of college grades.

Using the same method of comparing the scores on the reasoning test with college averages, it is observed that 34% of the students in the upper quartile make an average college grade of 90 or above; while 60% are at or below $82\frac{1}{2}$, the average of college grades.

In the lowest quartile of the reasoning scores 43% are below the passing average of 75.

Viewed from this angle the reasoning test does not measure up as a means of predicting success in the college career, at least not in the early stages of that career.

Of the various combinations of multiples it is apparent that the reasoning test neither adds nor detracts very little to and from the size of the correlations. No possible correlation by the multiple

method gives a higher figure than .52 which is the simple correlation between the sum of the eight tests and college average. It would seem that the entire load of this combination is carried by Tests 4 and 6 since they together correlate with the average at exactly the same value, .52. This would indicate that the series of tests could be reduced from eight to two and be as satisfactory for predicting college standing.

This illustrative data leads up to the question which is the main issue of this discussion: "Are schools and colleges training the young to reason?"

If schools, particularly colleges, fail in this all important function of teaching pupils to reason, they fail fundamentally. Indeed, they have sold themselves to the tax-supporting public on this very point. The new subjects introduced into the curriculum are given a place for the most part, because of the promise which they offer to stimulate thinking. Instructors, quite generally resent the implication that they are teaching "skill" or "memory" subjects rather than "thought" subjects. Departments of Education are featuring the problem method of instruction with the belief that it stimulates thinking. Places of leadership can be filled adequately only by people who think and by people who think clearly. That people do go into places of leadership from college does not necessarily mean that the college has trained them to reason. The natural gift with which they are endowed may be sufficient to carry them through.

There is no question before the educational world of any greater importance. But how can we know to what extent we are getting on toward its solution? The long years of speculation still leave the question unanswered. One of the necessary steps in the experimental attack on the problem is the perfection of a reasoning test. Such a test will not be simple test, it will involve a variety of exercises each of which will demand something more than memory, sensory perception, and the like; it will be a measure of the capacity to "catch on," figuratively speaking, and to ferret out hidden meanings. Performance tests should play a rôle as well as those of the linguistic type.

Syllogistic tests such as we have been describing would seem, naturally, to have a place in such a series. It correlates only to a small degree with college averages but so also does the arithmetic test. Not any of the series correlates very significantly, yet four of them must involve reasoning to some considerable extent. Test

8 correlates .38 with first quarter grades in Mathematics, .12 higher than with college averages.

Of course, the particular reasoning test is not perfect, no test is. One who still has some faith in it may be permitted to question very seriously whether colleges are even beginning to utilize the function of reasoning to any where near its limits. He may further question whether college grades are influenced much by thinking on the part of the student even when it shows itself in the classroom. It is not difficult to find numerous illustrations from the classroom where originality is discouraged rather than stimulated.

The vistas opening from this preliminary study are interesting. The testing of the validity of reasoning tests themselves by checking them with those aspects of certain college subjects which do without question demand reasoning, e.g., correlating the test with grades made by students in an original project in physics, or chemistry where objective methods of scoring have been devised, is one of the immediate problems of this study. The improved reasoning test will be correlated with the college standings from the Freshman to the Senior year. If students are being trained to reason, it should show itself in larger amounts and in better quality in the Senior class than in the Freshman class.

There is, of course, the possibility if not the probability that the results of such a study will not be conclusive. Even so, the effort promises to be practical and worth while. One of the greatest values of intelligence testing is to be found in the stimulus that is given both to instructor and to student to measure up to and to excel the rating set by the tests and to the construction and maintenance of standards in the several lines of work. An analysis of subject matter and methods of teaching such as this study will entail, will focalize the attention of instructors upon the problem, "Are we teaching our students to reason?" with the result of improved methods and a consequently greater utilization of this important function.

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