

**THE VALIDITY OF THE DIFFERENTIAL APTITUDE
TESTS IN PREDICTING SUCCESS IN
VOCATIONAL HIGH SCHOOL COURSES**

BY

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THE VALIDITY OF THE DIFFERENTIAL APTITUDE TESTS
IN PREDICTING SUCCESS IN VOCATIONAL
HIGH SCHOOL COURSES

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Janice Hardin Magnuson

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To the Graduate Council:

I am submitting herewith a Research Paper written by Janice Hardin Magnuson entitled "The Validity of the Differential Aptitude Tests in Predicting Success in Vocational High School Courses." I recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Arts with a major in Psychology.

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Dean of the Graduate School

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CHAPTER I

INTRODUCTION

There is much concern today about the effectiveness of the high school curriculum, both academic and vocational, as regards the preparedness of students for college or for the world of work. Students are given the opportunity to choose the course of study which they will follow, yet all too often, their choices are neither realistic nor practical based upon their known capabilities.

Counselors are very much aware of the needs for more efficient and valid methods of identifying those students who would be successful in vocationally oriented programs. This is substantiated by Wilson (cited in Moorehead, 1976) who contends that advisement regarding success possibilities in a particular program should be based on objectively validated evidence. It is commonly agreed that whatever the method used for the gathering of such evidence, it should be used firsthand; that is, the identifying instrument should be administered and interpreted by those directly involved in the decision-making process. In the school setting this would, of course, involve the student and counselor.

Hill (1963), in recommending statistical procedures, emphasized the need for research in individual schools to secure accurate information of the value of predictive instruments used in the advisement of students. Aiken (1971) states, "The fact that validity coefficients vary from place to place and from group to group emphasizes the need for validating a test in the specific situation where it is to be employed" (p. 175).

At present, the best and most widely used means for advisement of

students based on abilities is the aptitude test. The information provided by an aptitude battery can sharpen a student's awareness of his strengths and weaknesses and serve as a guide in his educational and occupational decision making. In the words of Aiken (1971);

Traditionally, the term "aptitude" has referred to a person's ability to profit from further training . . . Thus, aptitude tests have been devised to measure potential achievement and thus predict level of performance, with the purpose of fitting the man to the job. (p. 173)

One of the oldest and most widely used aptitude tests is the Differential Aptitude Tests (DAT), (Bennett, Seashore, and Wesman, 1947, The Psychological Corporation). Designed for use in educational and vocational counseling, the DAT consists of the following eight subtests: Verbal Reasoning, Numerical Ability, Abstract Reasoning, Clerical Speed and Accuracy, Mechanical Reasoning, Space Relations, Spelling, and Language Usage. A ninth score is derived from the sums of the Verbal Reasoning and Numerical Ability tests and is an index of scholastic aptitude. Many schools administer the DAT in the eighth or ninth grade, as it is at this time that students are beginning to make serious career decisions and plans on what high school curriculum to follow. The DAT is, however, considered a guidance tool, and not a teaching or selection instrument. Chauncey (1963) states, "DAT scores never tell a student he should be anything, only that among his own academic and certain occupation skills, there are some that seem to be more highly developed than others, and among a large group of students his own age, these skills have given

ranking" (p. 161). Based on his studies, Aiken (1971) projects, "The pattern of an individuals' scores on a multiple aptitude test serves as a rough indicator of his suitability for a particular job, but occupational success cannot be accurately predicted from test scores alone" (p. 202).

While it is certainly true that success in school or occupations is not necessarily dependent upon scores derived from a single battery of test scores, the problem for counselors still remains. Just how can it best be determined if a student will have a chance of success in a particular program? In suggesting use of the DAT as a means for predicting success, Schutz (1965) states, "From a relative point of view, this is the best we can currently offer; no alternative procedures of any sort which possess greater utility can be suggested at the present time" (p. 1007). Wesman (1952) agrees with this statement and further reasons, "To require a future garage mechanic or carpenter to take several years of Latin and French seems futile; to deprive him of the opportunity to take automotive or woodworking courses is worse than futile - it is unfair to the student and the community" (p. 170). For this reason, he advocates the use of the DAT in planning high school curricula as its use has made a significant contribution to educational practice.

Purpose of the Study

The DAT is perhaps the most widely used, and in many instances the only used means of predicting success in any one program. Therefore, counselors, educators and students should base its use on studies of their own situation.

The purpose of this study is to measure the validity of the DAT in predicting success of high school students in vocational courses offered by one particular school system. Once it is determined if there are valid correlations between DAT scores and success in particular vocational courses, it may be possible to set up a criteria by which counselors can better advise students wishing to enter these particular courses.

Hypothesis

This study is based on the hypothesis that the DAT is a good predictor of performance in vocationally oriented courses. More specifically, based on previous studies conducted (many of which are cited in the Review of Related Literature which follows), it would seem that certain subtests are good predictors in certain vocational areas. For instance, in courses dealing with mechanics, it is assumed the Mechanical Reasoning and Space Relations subtests would be the best predictors of success. In office practice courses, it would be reasoned that the Clerical Speed and Accuracy, Verbal Reasoning, Language Usage and Spelling subtests would be the most accurate predictors of success.

It is further hypothesized that in addition to specific subtests being predictive of success in specific subjects, the Verbal Reasoning and Numerical Ability subtests, and the composite score of VR+NA, will be good overall predictors of success in most areas.

Limitations of the Study

This study is limited in that the number of individuals tested is small--eight classes with no more than 32 students per class.

CHAPTER II

REVIEW OF RELATED LITERATURE

The Differential Aptitude Tests were first developed in 1947 by Bennett, Seashore, and Wesman. According to the authors (1974):

The original forms (A & B) of the DAT were developed . . . to provide an integrated, scientific, and well-standardized procedure for measuring the abilities of boys and girls in grades 8-12 for purposes of educational and vocational guidance. (p. 1)

Super (1962) noted that the DAT was developed in response to the widespread feeling among vocational psychologists and counselors that a major defect in the testing programs at that time was the lack of a uniform baseline for the various tests which were used with a given student or client.

At the outset, it was necessary for the authors to decide what aptitudes should be measured by the battery. The attempt was made to include tests in the battery each of which would be useful in many areas rather than in only one or two, and each of which would provide meaningful scores readily interpretable by informed counselors and teachers. Carroll (1959) states, "In constructing the battery, the authors banked heavily upon results of various researches which have been done on the dimensions of human ability, that is, researches utilizing the statistical techniques of factor analysis" (p. 671). In his contention that the DAT more often than not has reached its goal, Carroll further states that "the authors

have done such a thorough and technically satisfactory job that a reviewer finds it hard to make himself appear sufficiently critical" (p. 672). He feels the tests are of excellent quality "in format, item construction, standardization, validation and just about every other aspect which is regarded as important in the testing fraternity" (p. 672).

There have, of course, been several revisions of the original 1947 forms, in an attempt to facilitate their administration and scoring. In addition, several of the tests have been upgraded; however, the revisions have always left unchanged the essential nature of the abilities measured.

Because the DAT is so widely used, there have been many reviews and validation studies run since its conception. The reviews are highly favorable. Bechtoldt (1953) commended the authors for their work and recommended the tests to vocational counselors for use in educational guidance and educational research programs. He felt that the basic hypothesis used in the development of this battery would enable vocational and educational counselors to form realistic judgments about the educational curricula appropriate to the skills of students. Also, reasonable judgments could then be made as to which students should take each course. Frederiksen (1959) upheld this view by noting the evidence of the usefulness of DAT scores in a wide variety of situations. Course grades were found to be predictable, and achievement test scores were even more so. DAT scores appeared to differentiate groups tested in high school who went on to various educational and vocational careers. For these reasons, he did not hesitate in recommending the DAT for use in testing programs at the secondary school level.

Carroll (1959) also praised the Differential Aptitude Tests in his

assessment that it constituted the best available foundation battery for measuring the chief intellectual abilities and learned skills which were needed for use in high school counseling.

Based on the many research studies done on the DAT, it is understandable why these and other reviewers are so favorable in their critiques of it. Numerous studies of the predictive validity of the DAT have been conducted in a variety of settings, including both the traditionally oriented and vocationally oriented high schools. In most instances, a significant correlation was found between the DAT scores and the variables under investigation.

An early study by Doppelt and Bennett (1951) reports the correlation between DAT scores when the same tests were administered to a group of high school students twice with an interval of three years between testings. The researchers found a significant correlation and found that in general, the abilities measured by the DAT were very stable over a three year period.

This work, perhaps, led to further study. Berdie (1953), in reviewing the research, concluded that the tests had some validity in predicting success in high school courses and in predicting vocational success as well.

One study which led Berdie to the previous conclusion is reported by Wesman (1952). He found that correlations between DAT scores and various course grades existed as might be expected. His findings indicate that the Language Usage and Verbal tests are the best predictors of grades in English, the Numerical Ability test is most efficient in predicting mathematics and bookkeeping grades, social studies have useful

predictors in the Verbal, Language and Numerical Ability tests, and science is best predicted by those same three tests with Abstract Reasoning also useful. It appears vocationally oriented courses are also predictable as indicated by his findings. In his studies, shorthand was virtually always best predicted by the Spelling test; and the Space Relations test was effective for mechanical drawing and plane geometry.

Hall (1957) reported on a study conducted by the test authors. He states, "The study provided fairly conclusive evidence that various educational and vocational classifications can be differentiated in terms of antecedent scores on the DAT" (p. 567).

Osburn and Melton (1963), in a test administered to high school students in classes of "traditional" and "modern" algebra, found that the DAT with the exception of Clerical Speed and Accuracy, showed fairly substantial validities. The best predictors were Verbal Reasoning, Numerical Ability, and particularly the sum of these two tests, VR+NA. In a report of the Test Service Bulletin, it was reported that the DAT scholastic aptitude score (VR+NA) was also a good predictor of achievement in biology in research conducted by the Psychological Corporation.

In two separate studies reported for shorthand courses, it was found by Cheney and Goodish (1963) that of 75 students tested for probable success in shorthand, the DAT Language Usage and Spelling tests were the best predictors. Kinsey and Smith (1970) similarly found that the sentence subtest had the highest relationship with shorthand grades.

Some of the most extensive validity research of the DAT has been conducted and reported by the authors (1974). They report findings of various studies they have conducted in academic and vocational subject

areas with students in grades 8-12 at various geographical locations. Their findings are summarized and shown in Table 1, following.

Table 1

Summary of Research by Bennett, Seashore, and Wesman (1974)

Course	<u>DAT Subtests</u>								
	VR	NA	VR+NA	AR	CSA	MR	SR	Sp	LU
Academic Areas									
English	*	*	**						*
History	*	*	**						*
Mathematics		**	**						
Science	*	*	**						*
Social Studies	*	*	**						*
Vocational Areas									
Data Processing		**		**	**		**		
Heating, Refrigeration						**			
Machine Shop	**	**	**	**					
Office Practice		**	**		**			**	

**Indicates primary predictors

*Indicates secondary predictors

In reviewing the information shown in Table 1, the reader will note that the tests of Verbal Reasoning, Numerical Ability, Language Usage and particularly the composite score, VR+NA, seem to be the best predictors of grades in several areas of general academics.

While their research studies done in vocational schools are fewer in number, the authors do report some findings in this area. The reader is again directed to Table 1 for a summary of their findings. It will be noted that these courses appear to have some specific predictors, such as the relationship shown between Clerical Speed and Accuracy and the vocational courses of Data Processing and Office Practice, but at the same time the Numerical Ability and VR+NA tests appear to be good predictors in certain vocational areas as well as in general academic areas.

Bennett et al. (1974) review several validity investigations which have been conducted by various other researchers. One such study by Doppelt, Seashore, and Odgers (1959), in which machine shop students were rated by their instructors according to their course work, found that for a group of 135 students, the Mechanical Reasoning, Space Relations and Abstract Reasoning tests were singled out as a particularly effective combination for predicting ratings. However, scores on Numerical Ability and Verbal Reasoning also showed good correlation with the ratings.

A study by Stoughton (cited in Bennett et al., 1974), tested the validity of the DAT for boys enrolled in several technical schools. The results led to the conclusion that the Verbal Reasoning and Numerical Ability tests showed a relatively high relationship with success in all of the general education and shop courses, and thus were of greater value

for general prediction than for differential prediction. The Abstract Reasoning, Mechanical Reasoning, and Space Relations were more useful for predicting performance in the shop than performance in general education courses.

In this review of validity investigations, it would be worthwhile to mention some of the follow-up studies conducted which have sought to find what patterns of test scores are characteristic of students who are later successful in various educational and vocational careers.

Bennett, Seashore, and Wesman (1956) report that in a follow-up study involving students who took the DAT in high school and who later went on to various occupations, these observations are made:

1. Engineers are decidedly superior on tests of Numerical Ability, Abstract Reasoning, and Mechanical Reasoning.
2. Businessmen are slightly above average on most tests, but tend to be below average on Space Relations and Mechanical Reasoning.
3. Factory workers are average on the space and mechanical tests but considerably below average on all other tests.
4. Among women, teachers score higher than nurses, nurses score higher than stenographers, stenographers score higher than clerks . . . (p. 90)

Bennett et al. are quick to point out that "generalizations should be considered merely suggestive. The profiles describe what aptitudes the students actually had, not necessarily what students needed to

have" (p. 91).

From other follow-up studies done in 1950 and 1951, Bennett et al. drew these conclusions:

1. College students tended to have special aptitudes in verbal and language skills.
2. Those students who had special strengths were found in curricula which call for those strengths.
3. The students seeking college degrees obtained higher average test scores than the non-degree-seeking students, who in turn scored higher than already-employed groups.
4. Job level within an occupation area was related to scores on the most relevant tests. For example, in Numerical Ability, Mechanical Reasoning, and Space Relations, engineering students were clearly best, and were followed by non-degree technical students, skilled mechanical, electrical and building trades employees, and unskilled workers, in that logical order.

(p. 125)

With all this wealth of information, just what conclusions should the school counselor be allowed to draw concerning the use of the DAT? Bennett et al. (1956) attempted to project the usefulness of the DAT

based upon the known research results. They found that each of the tests can yield useful predictions under some circumstances. Even though there can be no guarantee that these or any other tests will inevitably predict success in a given course, the evidence is strong that there are many courses which actually require the kinds of abilities the DAT measure. Also, the data provide valuable clues as to which of the tests are most likely to be predictive in a given type of course. But, while this is useful knowledge, it is still a guide and not a principle. Therefore, the counselor would be wise to know which tests work best for the actual courses in his school.

CHAPTER III

PRESENTATION OF DATA

Subjects

For this study, 225 eleventh and twelfth grade students representing four different Robertson County high schools were used. The students were each enrolled in one of eight vocational classes at the county vocational center. Students were ranked in their vocational classes by their instructors to represent highest grade point average to lowest grade point average. Each of the 225 students had taken the DAT previously--during their freshman year in high school.

Apparatus

A test of statistical significance, the Pearson Product Moment Correlation Coefficient, was used to determine the degree of correlation between the students' DAT scores and their success in the vocational courses.

Procedure

After each student was ranked according to his grade point average, the rankings were converted into stanine scores for the purpose of the correlation. DAT scores were obtained for each student and correlations between each student's stanine score and DAT scores were run on the computer using the Pearson Product Moment Correlation Coefficient. A total class correlation was then found for each of the DAT subtest scores and the eight vocational courses.

In addition to the vocational course-DAT score correlations, the

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mean and standard deviation for each course as correlated with each DAT
subtest score was computed.

CHAPTER IV

ANALYSIS AND INTERPRETATION OF DATA

Table 2, Table 3, and Table 4 show test results for computed validity coefficients, means, and standard deviations, respectively.

Discussion of Tables

By studying and analyzing the data presented in Table 2, the following generalizations can be made.

1. The most correlations at both the .01 level and the .05 level of significance fall under the DAT subtests of Verbal Reasoning, Numerical Ability, Language Usage, and the composite VR+NA.
2. In looking across the table, there are no significant correlations for the vocational course of General Building, and the figures shown, in fact, represent inverse relationships.
3. In looking across the table, there is only one significant correlation in the vocational course of Occupational Home Economics.
4. In looking across the table, all other courses except those mentioned above have no fewer than four statistical correlations.

By studying and analyzing the data presented in Table 3, the following generalizations can be made.

Table 2
Summary of Validity Coefficients Between DAT Scores (Form S)
and Student Stanines in Vocational Courses

Course	<u>Coefficients of Correlation</u>								
	VR	NA	VR+NA	AR	CSA	MR	SR	Sp	LU
Agri-Mechanics	.589**	.331	.561**	.711**	.318	.711**	.510*	.203	.450*
Auto Mechanics	.338	.485**	.495**	.424*	.042	.493**	.295	.108	.377*
Electricity and Electronics	.489**	.498**	.527**	.583**	-.095	.641**	.530**	.307	.425*
General Building	-.180	.065	-.073	.141	-.332	-.009	.256	-.303	-.060
General Metals	.463**	.385*	.471**	.202	.212	.224	.076	.139	.358*
Health Occupations	.541**	.475**	.582**	.267	-.269	.174	.661**	.235	.325
Occupational Home Economics	.165	.166	.176	.031	-.034	-.276	.008	.041	.414*
Vocational Office Education	.596**	.709**	.710**	.410*	.461*	.254	.459*	.490**	.114

**Significant at .01 level

*Significant at .05 level

Table 3

Summary of Means of DAT Scores in Each Class

Course	<u>Mean Scores</u>								
	VR	NA	VR+NA	AR	CSA	MR	SR	Sp	LU
Agri-Mechanics	14.92	15.84	30.68	28.04	41.80	43.96	23.08	57.24	24.00
Auto Mechanics	15.53	14.50	30.03	24.50	49.17	44.17	21.93	50.70	21.23
Electricity and Electronics	20.78	19.47	40.25	30.72	46.88	43.90	26.88	60.53	26.19
General Building	17.64	17.79	35.43	28.29	52.61	46.82	24.71	60.96	26.18
General Metals	20.35	19.26	39.61	29.84	43.55	46.45	24.91	63.58	26.13
Health Occupations	16.09	16.68	32.77	27.91	60.32	32.45	20.14	64.27	27.50
Occupational Home Economics	13.03	16.03	29.07	26.50	63.80	32.80	20.30	65.43	26.53
Vocational Office Education	22.37	22.48	44.85	34.07	48.85	36.56	26.00	77.11	34.63

Table 4

Summary of Standard Deviations of DAT Scores in Each Class

Course	<u>Standard Deviations</u>								
	VR	NA	VR+NA	AR	CSA	MR	SR	Sp	LU
Agri-Mechanics	6.05	5.90	9.55	9.06	13.54	11.05	8.58	15.28	8.18
Auto Mechanics	6.26	7.17	11.30	10.11	20.42	9.50	9.17	15.16	7.64
Electricity and Electronics	10.57	7.70	17.09	9.93	19.65	11.38	9.78	16.21	12.65
General Building	7.57	7.11	12.41	9.49	20.27	9.36	8.23	16.60	9.83
General Metals	7.92	8.16	14.48	9.60	8.14	6.96	9.75	13.28	8.41
Health Occupations	9.13	5.47	12.95	7.56	21.03	7.53	6.74	15.28	8.45
Occupational Home Economics	7.45	5.71	12.39	10.30	24.42	12.60	7.20	19.77	9.11
Vocational Office Education	9.33	5.97	13.79	7.53	15.65	8.73	8.78	15.14	10.99

1. The highest mean scores are for Spelling.
2. The lowest mean scores are for Verbal Reasoning in five areas, and for Numerical Ability in three areas.
3. Among the lowest means, there is very little difference in the scores for General Building, Health Occupations, and Vocational Office Education.

By studying and analyzing the data presented in Table 4, the following generalizations can be made.

1. The highest standard deviations are found for Spelling in Agri-Mechanics; for VR+NA in General Metals; and all others for Clerical Speed and Accuracy.
2. The lowest standard deviations are found for Verbal Reasoning in Agri-Mechanics; for Mechanical Reasoning in General Metals; and all others for Numerical Ability.

By comparing the data presented in Table 3 and Table 4, the following can be generalized. Where the means are the lowest for Verbal Reasoning, the standard deviations are the lowest for Numerical Ability. The only exception to this is in Electricity and Electronics where Numerical Ability has both the lowest mean and standard deviation.

CHAPTER V

SUMMARY AND CONCLUSIONS

A study was conducted testing the predictive validity of the Differential Aptitude Tests in relation to success in a particular vocational school in Robertson County, Tennessee. 225 eleventh and twelfth grade students who were enrolled in one of the eight vocational courses and who had previously taken the DAT were tested. These students were ranked by their vocational instructors to represent the highest grade point average to the lowest grade point average in their class. These rankings were then converted to stanine scores. DAT scores were obtained for each of the students. All these scores, stanine and DAT, were run through computation using the Pearson Product Moment Correlation Coefficient as the test of statistical significance.

The results of this study show that for this particular school system, the DAT tests of Verbal Reasoning, Numerical Ability and the composite score of VR+NA, have the most significant correlations, and thus the greatest predictability for each of the eight vocational courses taught. This partially supports the hypothesis upon which the study was based. However, since these DAT subtests are also the best predictors of general academic success, the test results indicate that those students who do well in academic areas would also be expected to do well in vocational areas. In addition, it seems that specific DAT scores would not predict success in vocational courses as well as might be anticipated.

From these results, it cannot be concluded that certain DAT scores

should be used as directives to certain vocational courses. But it is apparent that general aptitude scores are most predictive of success in a number of vocational areas.

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