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ABSTRACT

This study investigated the comparative value of nationally-normed tests versus high school mathematics grade point averages in predicting the mathematics success of college students. The study covers the period 1964-1981. The sample for the study was selected from 2 years of student records for all students completing any type of mathematics courses at 2-year colleges, one of which used Scholastic Aptitude Test (SAT) scores as admission criteria and one of which used American College Test (ACT) scores as admission criteria. Specific high school mathematics criteria were used as the independent variables. Gender factors were assessed when possible. Results indicate that high school mathematics average correlated best with college mathematics achievement for both the SAT and ACT. For SAT mathematics test students, the SAT mathematics test score, gender, mathematics units, course program, and high school of attendance correlated with college mathematics achievement, in that order. In general, the most valid predictor of a student's overall achievement in college mathematics was a combination of high school mathematics average and standardized test score. (TJH)

THE DECLINING YEARS OF NATIONALLY-NORMED TESTS (1964-1981)

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ABSTRACT

With increasing numbers of people entering higher education, the problem of selecting candidates continues to be critical. Colleges, junior colleges, community colleges, and universities use various criteria in their admissions program. Singly or in combination the following have been or are being used: College Entrance Examination Board Scholastic Aptitude Test, the American College test, the high school scholastic average and course program, and chance for success in the college program selected by the candidate as indicated by the candidate's grades in appropriate subjects. Candidates who apply for admission to college programs involving several courses in mathematics need to have an adequate level of ability in this area. The college will need to determine whether or not the candidate has enough aptitude and skill to achieve satisfactorily in mathematics courses. Many colleges and universities have relied heavily on either the College Entrance Examination Board Scholastic Aptitude Mathematics Test or the American College Mathematics Test. In many cases, candidates who do not score at a certain level in either of the tests are refused admission. Controversy exists as to whether the emphasis which has been placed on these two nationally-normed tests as instruments for college selection is appropriate. This study is significant in that it demonstrates that, indeed, high school mathematics average was a <u>better</u> predictor of college mathematics success than nationally-normed tests during the period of substantial test score decline (1964-1981). The decline of nationally-normed test scores

during this period may not have been an actual portrayal of decline in the overall achievement of mathematical abilities, but instead, evidence that the SAT and ACT test had become a less reliable predictor of mathematical success. An upward variation, such as we have seen in recent years, would seem to suggest the same conclusion.

The sample for this study was selected from two years of student records consisting of all students completing any type of mathematics courses from two-year colleges, one of which used the CEEB-SAT mathematics score as a criterion for admission and the other school which used the ACT mathematics score. The dependent variable for this study was college mathematics achievement. All other variables in this study were considered as possible predictors of this achievement.

Specific high school mathematics criteria (high school average, high school models, mathematics units taken, and the high school attended), and selected nationally-normed tests, (CEEB-SAT and ACT mathematics tests), were used as the independent variables. Achievement and test score differences between males and females were analyzed when the data were grouped according to the sex. In addition to these predictors, high school mathematics grade point averages were interpreted. The CEEB-SAT and ACT mathematics scores were used as a possible predictor for mathematics achievement.

Surprisingly, high school mathematics average correlated the highest with college mathematics achievement for both the CEEB-SAT and ACT students. For CEEB-SAT mathematics test students, the variables CEEB-SAT mathematics test score, sex, mathematics units,

course program, and high school attended correlated with college mathematics achievement in that order. In general, the most valid predictor of a student's overall achievement in college mathematics was a combination of high school mathematics average and standardized test score.

The development of appropriate admissions criteria remains an important concern in higher education. Colleges, junior colleges, community colleges, and universities used a variety of criteria in their admissions programs. Singly or in combination the following are the most common: College Entrance Examination Board Scholastic Aptitude Test (more commonly known as the SAT); the American College Test (hereafter referred to as the ACT); the high school scholastic average and course program; and lastly, the candidate's chance for success in the college program selected, as indicated by the candidate's high school grades in appropriate subjects. Candidates who apply for admission to college programs which necessarily involve several courses in mathematics, must have an adequate level of ability in this area, and the college will need to determine this. Many colleges and universities have relied heavily on either the College Entrance Examination Board Scholastic Aptitude Mathematics Test, or the American College Mathematics Test for this purpose. Controversy exists as to whether the emphasis which has been placed on these two nationally-normed tests as instruments for college selection is appropriate (10:245). The use of nationally standardized norms for the prediction of college mathematics success could be working to the disadvantage of candidates for admission, and the higher education institutions themselves. If students are being admitted on the basis of predictors which may no longer be functioning properly, the interests of students, faculty, administration, and society are not being properly served. The following study will suggest that a

student's high school mathematics average is a more reliable predictor of college mathematics achievement during the first two years of college than either the SAT or the ACT mathematics scores.

The ACT and SAT mathematics tests have been designed to predict future college achievement among those students taking the tests. In addition to these screening devices, some college mathematics departments have developed their own entrance tests. However, the nationally-normed tests have long remained the major criteria for future college prediction. For more than half a century, these standardized tests have been used as aids in predicting future college achievement. Anastasi defines a standardized test as one that implies "uniformity of procedure in administering and scoring the test" (1:17). In this sense, the SAT and the ACT mathematics tests are standardized. It has been suggested, however, that they not longer possess the predictive validity they once had since the performance on which the test norms are based may no longer be representative of the mathematical abilities and skills of the people now taking the tests. It might not be possible, therefore, to accurately compare test results from past and present test-taking populations. According to Wirtz, as early as 1977 the increase in the number of women and low income students as candidates for college may have drastically changed the predictive capacities of these tests (9:84). This may be due to the fact that test norms were established on the basis of the achievements of a particular group having characteristics much different than those of later test-taking population.

There have been other suggested limitations to nationally-normed testing. One limitation cited by Thresher in 1970 was that mistakes were made in test score interpretation and in overestimating their precision (7:2). Also, Thresher identified another limitation of test use as the equating of test which are different in origin and composition (7:2). In addition to such test limitations, Traxler cited many misused of tests, among these were: (1) the fact that teacher quality and effectiveness are appraised by standardized tests without controlling extraneous variables, thus reducing confidence in tests; (2) an overemphasis on the tests themselves, sometimes resulting in students being coached for them; and (3) much importance was sometimes attached to small differences in scores, even when the differences are not significant (8:4). All of this would seem to suggest that the tests were no longer valid for their stated purpose; that is, they were not measuring what they were intended to measure.

This study is significant in that it demonstrates that, indeed, high school mathematics average was a <u>better</u> predictor of college mathematics success than nationally-normed tests during the period of substantial test score decline (1964-1981). One of the implications of this proposition is that it is possible that the research by Wirtz and others, on the decline of SAT mathematics scores which was reported from 1964-1981 was not an actual portrayal of decline in the overall achievement of mathematical abilities, but instead, evidence that the SAT test had become a

less reliable predictor of mathematical success (9:83-85). An upward variation, such as we have seen in recent years, would seem to suggest the same conclusion.

Regarding the earlier decline in SAT scores generally, some educators cited what they regarded as a "de-emphasis" by schools of hard facts and analytic thinking as a possible explanation. Stressed instead, it was contended,...was a laissez faire attitude that encouraged "learning by doing," vocational courses, and a proliferation of electives ranging from anthropology to driver education (2:52). Consistent both with his own research and the research of the CEEB Panel, Wirtz cited many reasons for the decline in the SAT scores (9:83-86).

Contrary to Anastasi's thinking that the composition of the standard score had not changed along with the population, Wirtz believed that the SAT score had in 1977 approximately the same meaning that it had in any other year. In 1963, the SAT scores peaked and researchers claimed that later tests were easier than those of 1963 (9:84). The pressure placed on students to attend college, along with the revolutionary period of history that they had experienced, were considered to be major factors in the decrease of the SAT scores. Almost half of all high school students went to college in 1977 as compared to one-third in 1964 (2:52). The decline in scores continued, and from 1970 to 1978 the decline moved at an accelerated pace (9:84). For the past four years this decline has reversed (3:1, 37-38).

Women scored lower on the mathematics sections than the men,

(and still do) probably because of the traditional stereotyping of sex roles with respect to expectations and opportunities, according to one researcher (4:13). The ACT testing program noted that women were not less capable of performing on the mathematics section than men, but instead that more women were taking the nationally-normed tests, consequently the range of scores became greater during this period (3:37-38).

According to Wirtz, other reasons for the overall decline were grade inflation, reduction of homework, student absenteeism and grade-to-grade promotion (9:84). Shields reported in 1977 "Less thoughtful and critical reading is now being demanded and done and ...careful writing has apparently gone out of style. Less homework is required and textbooks have been written down to simpler language" (6:82-83).

In addition to less structure and control in the schools, mini-courses, decrease in enrollment in more difficult high school courses, and the continued use of drugs are some of the reasons cited by Nelson in regard to the test score decline in 1977 (5:78-79). Armbruster reported similar declines in 1976 in Japan and Britain primarily because of their saturation with television (2:52). Armbruster suggested: "Younger people are growing up in a cocoon at a time when it's becoming harder and harder to get along in our sophisticated economy without stronger verbal and mathematical skills (2:52). Since the "baby boom" students began taking the SAT tests in 1964, their course grades steadily increased to 3.12 while their SAT

scores declined from 502 to 466 (2:52) (3:1).

The sample for this study was selected from two years of student records (1978-1979) consisting of all students completing a variety of mathematics courses from two two-year colleges, one of which used the SAT mathematics score as a criterion from admission and the other school which used the ACT mathematics score. Each college had an approximate enrollment of 1,000 students.

The dependent variable for this study was college mathematics achievement. All other variables in this study were considered as possible predictors of this achievement.

Specific high school mathematics criteria (high school average, high school models, mathematics units taking, and the high school attended), and selected nationally-normed tests, (SAT and ACT mathematics tests) were used as the independent variables. Achievement and test score differences between males and females were analyzed when the data were grouped according to sex.

The following null hypotheses were tested: (1) H_0: High school achievement in selected secondary schools in Northeastern Pennsylvania did not serve as significant predictors of success in college mathematics achievement in selected two-year colleges in Northeastern Pennsylvania. (2) H_0: SAT mathematics scores did not serve as significant predictors of success in college mathematics achievement in selecting two-year colleges in Northeastern Pennsylvania. (3) H_0: ACT mathematics scores did

not serve as significant predictors of success in college mathematics achievement in selected two-year colleges in Northeastern Pennsylvania.

Using regression analysis, the data were divided into two sections: (1) analysis of the SAT data and (2) analysis of the ACT data. Data were entered on six different steps with one of six variables being entered at each step when it provided the more valid optimal prediction equation.

Those students who had taken the SAT mathematics test were analyzed first. The mean of the SAT mathematics test was 418.23 with a standard deviation of 85.13. This score was somewhat lower than the national mean for the previous school year (1976-1977) which had a mean of 471 for the SAT mathematics test scores with a standard deviation of 117.

A perfect college average or grade of A was denoted by 4.0. For this study, the overall college mathematics mean grade was 2.59 with a standard deviation of 1.03. Analysis of another high school criterion, high school mathematics units, resulted in a mean score of 3.11 with a standard deviation of .86. The highest possible number of units that could be taken was 4.5. Another variable, high school mathematics average, had a mean score of 2.55 out of a possible total of 4.0. The standard deviation of the high school mathematics average was .64.

When the correlation matrix was computed, the highest correlation was expected to be between high school mathematics and college mathematics achievement or with nationally-normed

tests and college mathematics achievement. It was found that high school mathematics average correlated the highest with college mathematics achievement, namely, .577. A correlation of .355 was obtained between SAT mathematics test scores and college mathematics achievement, followed by mathematics units with a correlation of .291.

The results of those students who took the SAT mathematics test showed that high school mathematics average followed by SAT mathematics test score, sex, mathematics units, course programs, and high school attended were the variables entered into the prediction equation in that order.

Regarding those students who took the ACT mathematics test, the average mathematics test score was 16.62 with a standard deviation of 5.03. It should be noted that the ACT test is based on a score of 1-36 (3:38). For college mathematics average, the mean score was 2.8 out of a possible 4.0 with a standard deviation of 1.27. The mean number of high school mathematics units taken was 2.47 with a standard deviation of .88. When analyzed, high school mathematics scores resulted in a mean of 2.88 with a standard deviation of .8.

When the correlation matrix was calculated, the highest correlation was found between high school mathematics average and college mathematics average, namely, .566. ACT mathematics scores had a low correlation of .363 with college mathematics grades. In addition, the number of high school mathematics units taken correlated .25 with college mathematics achievement.

The analysis of those students taking the ACT mathematics test showed that high school mathematics average followed by sex, mathematics units, ACT mathematics test scores, course program, and high school attended were the variables entered into the prediction equation in that order.

Results from the data analysis showed that for those students who took the SAT and ACT mathematics tests, high school mathematics average was the more valid predictor of college mathematics achievement than were the nationally-normed tests. Although high school mathematics average was the best single predictor of college mathematics achievement for both standardized tests, the remaining variables correlated in different order for the two tests. The test scores of the students who took the SAT mathematics tests had the next highest correlation with college mathematics achievement. One possibility for the SAT mathematics test score correlating second instead of first might be that within the last two years colleges have adopted new priorities in education. Examples of these new priorities would be different learning and communication modes. This change would not have been reflected in the SAT mathematics test. Another factor that could have resulted in the SAT mathematics tests score having a lower correlation might be the fact that high school and college mathematics courses are gradually being simplified. In some cases in high school, elective courses are easier and therefore are selected as an educational outlet for a student's poorer level of performance. The SAT mathematics test is based solely on academic performance and does not take into

consideration the variations in high school mathematics curricula and standards among different high schools and colleges.

On the other hand, we can speculate that SAT mathematics test scores correlated as highly as they did for a number of reasons. (1) There was a better chance of selecting and admitting into college one who would more likely benefit by a college experience rather than one who might encounter difficulties. (2) In most cases, the standardized test acted as an aid in guiding the student in relation to his capabilities. (3) Identification of the brilliant underachiever whose school performance might be below par was facilitated by the standardized test. (4) An overachiever of modest capacity might appear to be brighter than he was simply by working harder. (5) The mathematics background of many students differed from high school to high school. Not all college freshman were able to begin college instruction at the same mathematical level. The appropriate placement of college students in a certain classroom was made more difficult by the varying standards of high school instruction. In such cases, the SAT mathematics score would be a more relevant guideline in placing a prospective college student.

With respect to those students who took the ACT mathematics test, sex was the second best predictor of overall college mathematics achievement. However, when the ACT students were grouped according to sex, the ACT mathematics test correlated higher with college mathematics achievement than did the high school mathematics average. In the female sample, women ACT

student test scores correlated less with college mathematics achievement than did high school mathematics average. This difference in correlations might be a result of the increase in the number of women taking the test from 1960-1970. In addition, women have been stereotyped as being non-scientifically and non-mathematically oriented. We might reason that until women are reassured of their proper place in the scientific community, it will take some time before they perform up to their mathematical abilities and capabilities. The ACT mathematics test scores correlated lower than some of the variables with college mathematics achievement. Some students who took the ACT mathematics test were business-oriented and were from a college with an open admission policy. All types of students were accepted, whether qualified or not, thus possibly affecting the predictability of ACT scores. Mathematics courses, whether taken singly or in combination at this particular college, were much easier than those of the other college.

SUMMARY

High school mathematics average correlated the highest with college mathematics achievement for both SAT and ACT students during the period of substantial test score decline (1964-1981). For SAT mathematics test students, the variables SAT mathematics test score, sex, mathematics units, course program, and high school attended correlated in decreasing order of relationship with college mathematics achievement. With respect to ACT mathematics

students; sex, mathematics units, ACT mathematics test scores, course program, and high school attended correlated with college mathematics achievement in that order. In general, the most valid predictor of a student's overall achievement in college mathematics was a combination of high school mathematics average and the standardized test score.

Even though high school mathematics average was the best single predictor followed by the standardized test score, both variables as predictors still contain inadequacies. From time to time ambiguous questions, repetitive test questions, lack of originality, and unintentional trivialities have plagued the teacher constructed examination whether it be on the high school or college level. In case of the standardized test, it could be a hazardous practice to try to estimate equivalent scales of values for different aptitude tests. In addition, misunderstanding what the test numbers mean and thus overestimating their precision can be a problem. Thus, few recognize that a test score is meaningless except in its relationship to the other numbers.

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