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USE OF THE ACT ASSESSMENT WITH COLLEGE-BOUND DEAF AND HARD-OF-HEARING STUDENTS[1]

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Abstract

This paper summarizes the initial findings of studies conducted by researchers at ACT Inc. and the National Technical Institute for the Deaf concerning the performance of deaf and hard-of-hearing students on the ACT Assessment. The paper describes the ACT Assessment, and presents normative information about performance of a national sample of deaf and hard-of-hearing test takers in addition to results of performance of students entering NTID. Issues related to the effect of hearing loss, age of onset, and high school education are also discussed. Results for the studies reported in this paper indicate that the ACT Assessment is valid when used with postsecondary level deaf and hard-of-hearing students seeking admission to two- and four-year colleges in the United States.

Introduction

Since 1969, NTID has used the Stanford Achievement Tests (SAT) as a primary indicator of an applicant's academic preparedness to enter college. Thirty years ago, when the SAT was adopted, about 60 percent of NTID applicants attended schools for deaf students where this test was widely used to assess annual achievement gains. At that time, it made sense to adapt the Stanford Tests to assist with our admission decisions.

There have been many changes in the education of deaf students over the past 30 years. NTID has not been immune to these changes. First of all, today only about 25 percent of our applicants come from schools for deaf students; the remaining 75 percent enter from mainstreamed high schools or are transfers from other colleges. Many of the students applying from mainstream high schools do not have access to the advanced level of the SAT, which means applicants often must make special arrangements to take the test battery.

Second, an increasing percentage of entering deaf and hard-of-hearing students are seeking admission to baccalaureate-level programs. The other colleges of Rochester Institute of Technology require scores on the Scholastic Aptitude Tests or the American College Test (ACT) for admission. Currently, about 40 percent of NTID's students are mainstreamed in programs with hearing students – up from only 25 percent in 1990.

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Third, with increasing costs to both NTID and its applicants, it has been necessary for NTID to reduce its Summer Vestibule Program from four weeks to 10 days. This reduction has made it difficult to conduct the evaluations necessary to determine appropriate placement levels of entering students

For these reasons, researchers in NTID's Center for Research Teaching and Learning were asked to investigate the effectiveness of the ACT for meeting admission and placement needs. Part of NTID's investigation included interaction with ACT Inc. personnel with the result that ACT initiated a study of the characteristics of deaf and hard-of-hearing students who took the ACT under special testing conditions during the 1995-96 testing year. This paper summarizes the initial findings of studies conducted by researchers at ACT and NTID concerning performance of deaf and hard-of-hearing students on the ACT Assessment. The paper will cover the following topics:

- Description of the ACT Assessment
- Normative information for deaf students taking the ACT
- Findings from the ACT study
- Findings from the NTID study
- Summary and Conclusions

What is the ACT?

The ACT Assessment is a composite of tests and questionnaires designed to assist college admission and placement personnel to make quality decisions about applicants. The battery includes four tests of *Educational Development*, the *High School Course/Grade Information* questionnaire, the *ACT Interest Inventory*, and the *Student Profile* section.

The tests of *Educational Development* include four curriculum-based measures in English, mathematics, reading, and science reasoning. The tests are based on the major areas of instruction in American high schools and colleges. A student's performance has a direct and obvious relationship to his or her academic development. Scores on the tests of Educational Development range from a low of 1 to a high of 36 and can be interpreted as indicated below:

- 1 to 15 need significant preparation;
- 16-19 minimum level of performance to enter credit-bearing college courses;
- Average for college bound seniors is 29.[2]

The *High School Course/Grade Information* questionnaire asks students who register for national test dates about the courses they have

[2] For more information the reader is referred to ACT's *Educational Planning and Assessment System*, Standards for Transition, P.O. Box 168, Iowa City, IA 52243-0168, (319) 337-1040.

completed or plan to take in high school and the grades they have received. The 30 courses listed represent six major curricular areas—English, mathematics, natural sciences, social studies, languages, and arts. The courses include those that customarily form the basis of a college preparatory curriculum, and, frequently are required for college admission.

The ACT *Interest Inventory* is usually completed when students register for the ACT Assessment. The 90-item questionnaire results in six scales, each based on 15 questions which parallel Holland's six interest and occupational types: Science, Arts, Social Service, Business Contact, Business Operations, and Technical. Results from the Interest Inventory can be used by students and counselors as a basis for career exploration.

The *Student Profile* section collects nearly 200 questions of information in 12 categories related to students' educational and vocational aspirations, plans, abilities, accomplishments, and needs. These data are useful to college and university personnel in planning curricular and co-curricular services for entering students.

ACT Studies

The ACT reports scores for the four sub-tests (English, reading, mathematics and science reasoning). It also provides an overall performance score called the Composite Score. In the interest of space limitations, the Composite Score will be used for all analyses in remainder of this paper.

Figure 1 provides a breakdown of ACT Composite Scores for two groups of deaf and hard-of-hearing students and a national sample of high school graduates. It can be observed that deaf and hard-of-hearing students taking the ACT under special testing conditions perform significantly lower than deaf and hard-of-hearing students taking the test under regular scheduled testing. This difference is indicative that there may be reasons why special testing was chosen for these students. The score distributions for deaf and hard-of-hearing students taking the testing under regular conditions are similar to national normative distributions.

As a result of this difference, ACT Inc. conducted a study to collect information on the performance of deaf and hard-of-hearing students who had taken the ACT under special testing conditions during the 1995-96 testing year. The purpose was to investigate the effect of differing hearing levels on ACT performance and how high school preparation affects ACT performance. Questionnaires were sent to 499 deaf and hard-of-hearing students who had taken the test under special testing conditions in 1995-96. Forty-four percent, or 221 questionnaires, were returned. The questionnaire asked for information such as level of hearing loss, high school academic preparation, continuing education, employment history and background information such as age, race and additional disabilities.

Figure 1.

ACT Composite Scores for two groups of hearing-impaired test takers compared with national ACT norms.

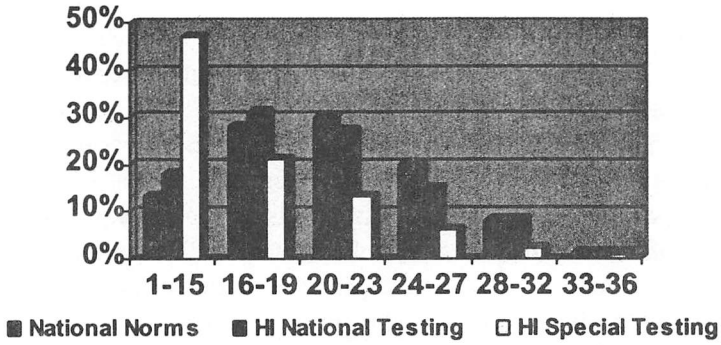


Table 1 provides information about performance on the ACT broken down by hearing level and age of onset of deafness. It can be seen that students with severe/profound hearing losses scored lower than students with better hearing. Also, students who lost their hearing before age six scored significantly lower than those who lost their hearing after age six. It is also interesting to note that students with mild hearing losses, but relatively early onset of hearing loss, performed lower than any other group. This fact may indicate that these students had additional handicapping conditions in addition to their hearing impairment. In such cases care must be exercised in interpreting the results for individual test takers.

In addition to hearing loss, the questionnaire inquired about the sign language skill of the test takers. Table 2 indicates that individuals with minimal or no sign language skills performed better on the ACT Assessment than individuals with good to excellent sign language skills. It is possible that individuals with no sign language skills also had better hearing and better English language skills. This fact could account for the improved performance levels. It should not be assumed that knowledge of sign language causes the lower scores. There are probably many other factors which interact to produce the results presented in Table 2. As a result caution must be exercised in generalizing from these findings.

Table 1. ACT Composite Scores by Hearing and Age-of-Onset

Group		<2 years	2 to 5 years	≥6 years	Overall-Hearing
Mild					
	Mean	16.8	16.6	20.1	17.6
	SD	4.0	4.2	4.9	4.4
	N	18	9	9	36
Moderate					
	Mean	19.3	17.4	29.0	19.3
	SD	4.7	3.9		4.8
	N	29	5	1	35
Severe/Profound					
	Mean	16.9	16.8	19.8	17.0
	SD	4.1	3.9	5.5	4.2
	N	105	19	5	129
Overall-Onset					
	Mean	17.34	16.8	20.6	17.4
	SD	4.3	3.8	5.3	4.3
	N	152	33	15	200

Table 2. Mean Composite ACT scores by sign language skill.

Sign Skill	Mean	SD	N
Excellent	16.1	3.7	53
Good	16.3	3.5	54
Fair	17.2	4.5	27
Minimal	19.7	4.7	34
No Skills	18.2	4.8	49

One such variable is the type of educational experience which students have been exposed to during their secondary education. *Table 3* provides analysis of the mean ACT scores for deaf and hard-of-hearing students categorized by whether they took a core of English, mathematics, science and social studies during all four years of their high education and whether they were on an academic track during their high school years. It is clear that students in an academic track and taking a core of basic courses perform significantly better than those who did take the courses to prepare for postsecondary education.

Table 3. ACT Composite Score by Core Courses and Educational Track

Group	Track	Non-track	Overall-Core
Core			
Mean	19.5	16.6	19.0
SD	5.0	2.0	4.7
N	60	14	74
Non-core			
Mean	17.8	15.3	16.6
SD	4.1	3.4	4.0
N	65	61	126
Overall-Track			
Mean	18.6	15.6	17.4
SD	4.6	3.2	4.2
N	124	75	200

The ACT studies indicate that individuals with severe to profound hearing losses do not perform as well as students with less severe losses, and students skilled in sign language do not perform as well as students with less skill in sign language. In addition, findings indicate that deaf and hard-of-hearing students who take core academic courses at the secondary level performed significantly better than students in non-academic high school tracks. Another finding, not documented in this paper, indicates that students who attended four year college programs had average ACT Composite scores of 19, while those who attended community colleges and vocational programs had mean Composite scores of 16.

Studies at NTID

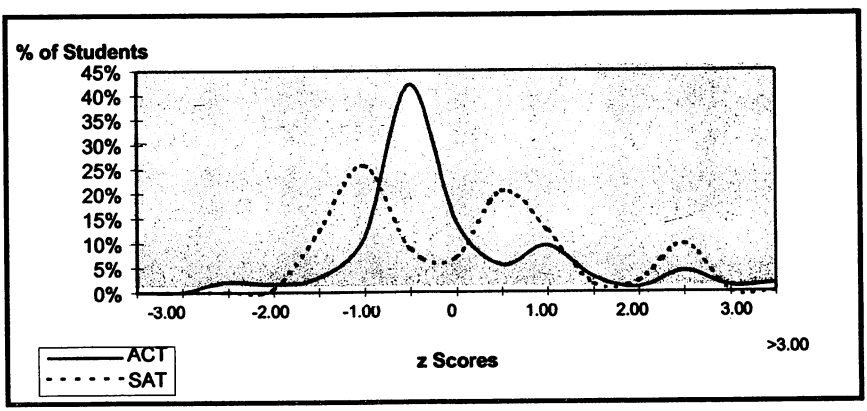
ACT test data were gathered from two sources: (1) ACT scores submitted by students during the admissions process, and (2) testing sessions conducted during the NTID's Summer Vestibule Program (SVP). These two sources of data resulted in complete ACT scores for 252 new students, 232 of whom registered for the fall quarter in 1996. The 252 students represent 80% of 315 first time students registering at NTID during 1995-96.

Relationship between the SAT and ACT: Frequency Distributions

A frequently raised issue concerns the limitations of the SAT scores when used for admission to the other colleges of RIT. The perception of faculty is that the SAT does not sufficiently discriminate at the upper range of scores. For this reason it is appropriate to compare the distributions of scores on the SAT and ACT sub-tests. In order to make these comparisons, the scores for each sub-test were converted to standard

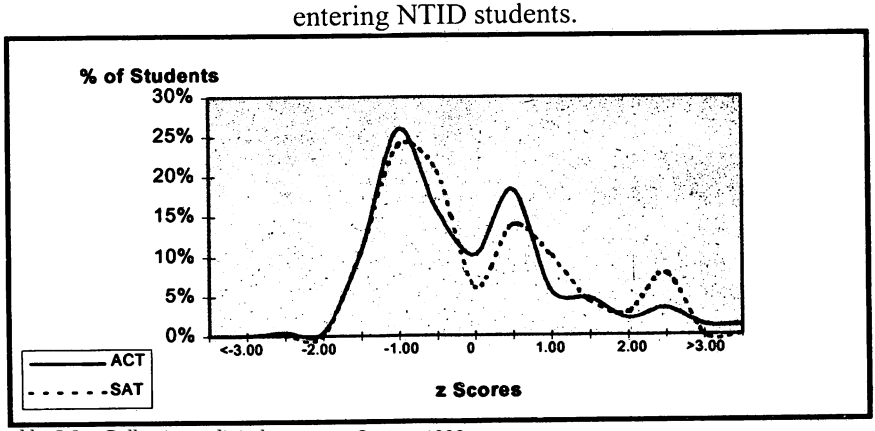
scores having the same metric: a mean of zero and a standard deviation of one (z scores). The SAT and ACT distributions are displayed below for the reading, language and mathematics sub-tests (*Figures 1, 2,* and *3,* respectively). On the **reading** sub-test the ACT yields greater dispersion than does the SAT, showing better assessment at the upper and lower extremes (*Figure 1*). In addition, the ACT distribution is unimodal and reasonably symmetrical, while the SAT distribution is trimodal, deviating markedly from normality.

Figure 1.
Distributions of SAT and ACT reading sub-test scores for 1996 entering NTID students.



The SAT and ACT **language** assessments distribute essentially identically (*Figure 2*). Both tests are right skewed indicating the difficulty which students have when taking tests of English language.

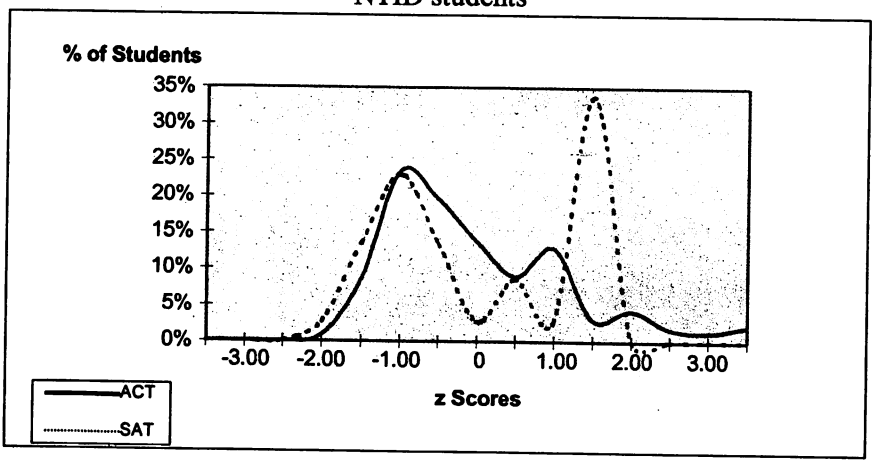
Figure 2.
Distributions of SAT and ACT English language scores for 1996 entering NTID students.



In the area of **mathematics**, the ACT provides a more difficult and useful assessment, particularly at the upper ranges of the test, than the SAT (*Figure 3*). The SAT displays a ceiling effect for students at the 90th percentile, while the ACT distributes scores more evenly above the 90th percentile. This indicates that the ACT has a much higher ceiling in terms of skill assessment than does the SAT.

Overall, it appears that NTID students' test results are more evenly distributed across the possible range of test scores on the ACT than on the SAT.

Figure 3.
Distributions of the SAT and ACT mathematics scores for 1996 entering NTID students



The ACT and Admission to NTID

The procedure for determining admissibility uses a point system for the SAT reading test and each of the three SAT mathematics tests: computation, concepts and applications. Basically, it consists of assigning a score from minus one to two for each of the four measures and summing across the four tests. This methodology yields scores between minus four and plus eight for each student. Students scoring less than two are rejected for admission to NTID, those scoring between two and four are referred to the Admission Review Board for further consideration, and those scoring five or greater are admitted to NTID. Using the SAT criteria described above, point values were determined for each of the students in our sample. Then, using these point values, students were grouped into each of the three categories: reject, refer to admission review board, and accept.

As shown in *Table 4*, the ACT is able to discriminate well between those students whose SAT scores allow for an unqualified admission decision and those who must be referred to the Admission Review Board. For the subjects in this study, the ACT was not able to discriminate between the students in the reject group and those in the refer group. One

reason is that significant numbers of students in both the reject and refer groups scored at the chance level on the ACT. Results clearly indicate, however, that students scoring 13 or better on the ACT should be admitted to NTID. We are less certain about where the cutoff point should be to deny admission to NTID. Since we do not have data on all applicants to NTID, we are unable to clearly specify a bottom cutoff point. Future research must be conducted to more clearly specify a score level below which an applicant is denied admission.

Table 4. Mean ACT scores by SAT admission status for entering 1996 NTID students.

SAT Admission Status	Number of Students	ACT Mean Score	ACT Standard Deviation
Reject (-4 to 1)	18	12.6	2.1
Refer (2 to 5)	71	12.9	1.8
Admit (6 to 8)	102	14.9	2.7

Determining Entry Degree Level

Another goal of this study was to determine which test, the SAT or ACT, is better at determining the potential degree level of a student. Students entering NTID can be placed into five degree levels depending on their academic preparation: Bachelor of Science, Associate of Applied Science, Associate of Occupational Studies, Diploma, and Preparatory studies. Students entering in 1997 were placed in these levels without using the SAT or ACT scores. This permitted researchers to evaluate the ability of the SAT and ACT in discriminating among these six levels. Mean composite SAT and ACT scores for each entry degree level are displayed in Table 5. The mean ACT score of 12.8 at the preparatory level is greater than chance which is 11. The ACT yielded distinctly separate means for all five entry placements. The SAT, on the other hand, fails to discriminate between the AAS and BS levels – the means for these two levels are very similar. It appears that the ACT is able to discriminate much better than the SAT, especially among the higher degree levels. Statistical tests indicate that there are significant differences for mean ACT scores between Preparatory /Diploma, AOS, AAS and Bachelor level students. The SAT is only able to discriminate among Preparatory/Diploma, AOS, and AAS/Bachelor level students. In keeping with the distributional analysis the SAT is not sensitive in distinguishing among skills for the most proficient students applying to NTID. Also, as indicated in *Table 5*, the correlation of .66 between the ACT composite score and degree level is better than that for the SAT which has a correlation with degree level of .57.

Table 5. Mean SAT and ACT composite scores by entry degree level for new 1997 NTID students.

Degree Level	SAT Mean	SAT SD	ACT Mean	ACT SD
Preparatory	8.3	1.8	12.8	2.1
Diploma	8.4	1.8	12.8	1.8
AOS	9.8	1.7	15.0	2.2
AAS	11.6	4.6	16.3	3.1
Bachelor	11.4	1.3	17.6	3.8
Correlation	.57		.66	

Summary of Findings

This paper has reported on studies conducted by NTID and ACT Inc. comparing performance on the American College Test (ACT) and the Stanford Achievement Test (SAT). These studies indicate that the ACT is a useful test for assisting with admission and placement of deaf and hard-of-hearing students at the postsecondary level. The following are some key findings documented in these studies.

Normative information. Deaf students being tested under special conditions perform significantly less well than deaf and hard-of-hearing students tested under regular conditions. Also, students with poorer hearing and early onset of the hearing loss perform less well than students with less of a hearing loss and later onset of the loss. It has also been found that deaf and hard-of-hearing students who take core academic studies in high school perform significantly better on the ACT than those whose programs of study did not include a core academic program.

Admissions. For admission, the findings indicate that, for deaf and hard-of-hearing students entering NTID, the ACT provides more normality in score distributions than does the SAT and discriminates better at the more advanced levels of performance, especially in mathematics, than does the SAT. Except in the area of reading, the ACT correlates higher than the SAT with tests currently used for placement in English and mathematics. In addition, it appears that the ACT can accurately discriminate between students who fully meet NTID academic admission criteria and those who need special consideration by the NTID Admission Review Board. Since ACT scores are not available for most students who were turned down for admission, it is not possible to determine whether the ACT can be used to identify such applicants. However, 18 students registered at NTID in 1996 should have been rejected based on their submitted SAT scores. It is noteworthy that the ACT was not able to separate that group from the group of students who should have been reviewed by the Admission Review Board.

Determination of entry degree level. The analyses indicated that the ACT discriminated among students at four of the five degree levels, while the SAT was able to discriminate only among the preparatory/diploma, AOS, and Associate of Applied Science/Bachelor degree levels. In addition, the ACT correlated at .66 with the degree levels while the SAT correlated at .57. These results favor the ACT over the SAT in being able to determine initial degree level of entering NTID students.