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RESEARCH MEMORANDUM

INCONSISTENT SCORES ON SPEEDED ASVAB SUBTESTS

Gary E. Horne

A Division of CNA Hudson Institute

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1. Enclosure (1) is forwarded as a matter of possible interest.

2. The Armed Services Vocational Aptitude Battery (ASVAB) is used by all branches of the armed services to measure the mental aptitudes of applicants for enlistment. The purpose of this Research Memorandum is to present analysis which indicates that, under some circumstances, scores on some of the ASVAB subtests are inflated. Implications for the joint-service ASVAB program are assessed and recommendations are made to reduce the risk to accession quality.

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Director
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and Training Program

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INCONSISTENT SCORES ON SPEEDED ASVAB SUBTESTS

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ABSTRACT

This Research Memorandum presents data showing that results on high school ASVAB speeded subtests are inconsistent with results on nonspeeded subtests. Causes for the inconsistencies are explored, and corrective actions based on these findings are recommended.

EXECUTIVE SUMMARY

The Armed Services Vocational Aptitude Battery (ASVAB) is used by all branches of the armed services to measure the mental aptitudes of applicants for enlistment. The ASVAB is administered to applicants at Military Entrance Processing Stations or at associated satellite sites. The ASVAB is also administered to approximately a million high school students in 14,000 schools each year as part of the Department of Defense Student Testing Program. Scores from the Student Testing Program may be used either for vocational counseling or enlistment qualification.

The ASVAB is composed of speeded and nonspeeded subtests. The nonspeeded subtests allow a generous time for responding so that most test takers have time to answer each question. The speeded subtests attempt to measure speed of response and consequently have short time limits so that most test takers do not have time to answer every question.

Scores on both speeded and nonspeeded subtests are meaningful only when compared to those of a reference population. The ASVAB reference population consists of a nationally representative sample of American youth who were administered the ASVAB under carefully controlled conditions.

The purpose of this report is to present data indicating that scores obtained on ASVAB speeded subtests administered in some high schools follow inconsistent patterns, to assess the implications, and to recommend corrective measures.

The data used in this analyses were collected for other purposes and resulted from a special research administration of the ASVAB to students in 51 high schools nationwide. Scores on speeded subtests were compared for the high school sample and the ASVAB reference population sample after controlling both samples for aptitude differences by using scores on the nonspeeded subtests. The results are illustrated in figure I and may be summarized as follows:

- The high school sample scored abnormally high on the speeded subtests (approximately 5 ASVAB standard score points or one-half of one population standard deviation).

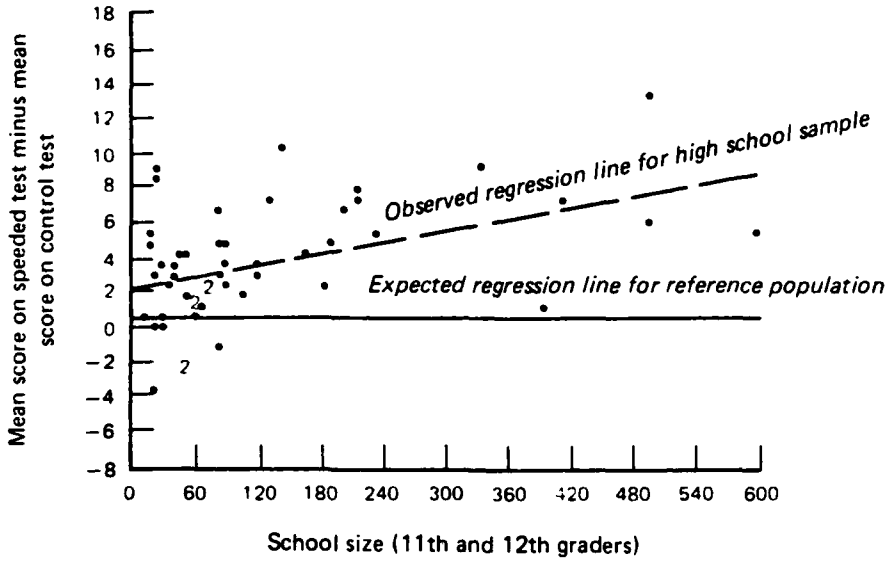

FIG. I: SCHOOL SIZE vs. DISCREPANCY IN SCORES ON SPEEDED TEST (NUMERICAL OPERATIONS)

- The discrepancies became larger as school size (and by implication test group size) increased.

These findings suggest that the administration of ASVAB in some high schools is not being accomplished under standard conditions and that the resulting scores are inflated and misleading. These findings lead to the following recommendations:

- A large sample of scores from the Student Testing Program should be examined to determine if the problems found in this analysis are representative.

- Testing conditions for the Student Testing Program should be improved in terms of test group size and/or monitoring.

- The use of scores from ASVAB speeded subtests should be restricted to those composites for which they have unique validity.

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INTRODUCTION

The Armed Services Vocational Aptitude Battery (ASVAB) is used by all branches of the armed services to measure the mental aptitudes of applicants for enlistment. The ASVAB is administered to applicants at Military Entrance Processing Stations or at associated satellite sites. The ASVAB is also administered to approximately a million high school students in 14,000 schools each year as part of the Department of Defense Student Testing Program. Scores from the Student Testing Program may be used either for vocational counseling or enlistment qualification.

The ASVAB measures four aptitudes [1]. The subtests that define each aptitude are shown in table 1.

TABLE 1

SUBTESTS DEFINING APTITUDES ON THE ASVAB

Verbal	Math	Technical	Speed
GS	AR	AS	NO
WK	MK	MC	CS
PC		EI	

GS = General Science
WK = Word Knowledge
PC = Paragraph Comprehension
AR = Arithmetic Reasoning
MK = Mathematics Knowledge
AS = Auto and Shop Information
MC = Mechanical Comprehension
EI = Electronics Information
NO = Numerical Operations
CS = Coding Speed

The two subtests that measure speed (speeded subtests) differ from the other eight subtests (nonspeeded or power subtests) in the manner in which they are designed to measure aptitudes. The speeded tests have more questions and shorter time limits than the power tests, as shown in table 2. The speeded tests are designed so that most people will not finish them but will correctly answer most of the questions that they do finish. On the power tests, most people will have time to attempt all questions but will usually answer questions incorrectly unless they have the appropriate knowledge.

Thus, adherence to established time limits is more important for the speeded tests than for the power tests.

TABLE 2

NUMBER OF ITEMS AND TESTING TIME FOR ASVAB SUBTESTS

Type	Subtest	Number of items	Testing time in minutes
Speeded	NO	50	3
	CS	84	7
Nonspeeded	GS	25	11
	AR	30	36
	WK	35	11
	PC	15	13
	AS	25	11
	MK	25	24
	MC	25	19
	EI	20	9

From September 1984 through January 1985, a total of 15,247 students in 52 high schools throughout the United States were tested on ASVAB Form 14 under the direction of the Military Entrance Processing Command (MEPCOM).

During the summer of 1980, the ASVAB was administered by the National Opinion Research Center (NORC) to a nationally representative sample of nearly 12,000 men and women, born in 1957 through 1964 [2, 3]. The NORC Profile of American Youth came from this sample and was used to establish current national norms for the ASVAB. Test group size was typically under 10, and the test was well monitored. Thus, this study uses the NORC data as the standard to which the MEPCOM data is compared.

Mean standard scores for the combined population of 11th and 12th graders in the MEPCOM sample were compared with scores of the 11th and 12th graders in the NORC sample. This comparison showed that as a group the MEPCOM sample scored lower than the NORC population on eight

of the ten ASVAB subtests. The two subtests in which the MEPCOM sample scored higher were the two speeded subtests. These results are summarized in table 3. The equations used to convert ASVAB subtest raw scores to standard scores were based on the NORC population of 18- to 23-year-olds and on [4, 5]. The equations can be found in appendix A.

TABLE 3

SUBTEST MEANS IN STANDARD SCORE

Subtest	NORC 11th and 12th	MEPCOM 11th and 12th	Difference
GS	48.024	46.341	1.683
AR	48.468	47.998	0.470
WK	47.330	46.001	1.329
PC	48.364	44.481	3.883
NO	48.886	53.485	-4.599
CS	47.779	51.224	-3.445
AS	46.631	45.733	0.898
MK	49.874	48.981	0.893
MC	48.087	46.021	2.066
EI	46.648	44.464	2.184

In the high school ASVAB testing program, the Numerical Operations Subtest is important because it is used as part of the Armed Forces Qualification Test (AFQT). The Coding Speed subtest is important because it is used as part of the Business and Clerical Vocational Composite (BC). If the speeded subtests cannot be properly normed, serious doubts are raised as to the value of including them in the AFQT and BC.

QUESTIONS

The data show that speeded subtests administered in high school settings yield different scores than those administered in the NORC setting. The question arises as to whether these differences are significant. If so, does school size (and by implication test group size) affect the difference between speeded subtest scores achieved in high school settings and those achieved in the NORC setting?

DATA USED

The portion of the total NORC Profile of American Youth (16- to 23-year-olds) used in this study was selected to represent the 11th and 12th graders in this profile. A total of 2,493 cases were selected. When weighted to reflect all 11th and 12th graders in the United States, this selection represented 7,553,408 people.

The MEPCOM test administrators were instructed to test all students in all grades, but in this study only the scores of 11th and 12th graders were used because no comparable NORC population was available for the 9th and 10th graders. Other editing of both individuals and schools left a total of 6,199 individuals and 51 schools to be used in this study. Detailed descriptions of the editing for both the NORC and MEPCOM data can be found in appendix B.

METHODOLOGY

The subtest discrepancies between the MEPCOM and NORC samples are depicted in figure 1. This figure shows that for nonspeeded tests the mean scores of the MEPCOM 11th and 12th grade sample are below the mean scores of the NORC 11th and 12th grade sample. The speeded test results do not follow this pattern. In order to analyze these inconsistent results, each speeded test was paired with a power test and the mean scores in standard form were subtracted. This pairing controls the samples for aptitude differences and thus yields a meaningful measure of the level of difference between the speeded and nonspeeded test results.

In the NORC 11th and 12th grade sample, the Numerical Operations subtest is significantly correlated with the nonspeeded Arithmetic Reasoning subtest ($r = 0.56$). Furthermore, the mean NO standard score minus the mean AR standard score (hereafter referred to as NOAR) was calculated for this group and was found to be close to zero (NOAR = 0.418). Thus, NO was paired with AR for comparison purposes in this study.

Similarly, the Coding Speed subtest is significantly correlated with the nonspeeded Word Knowledge subtest ($r = 0.47$). The mean CS standard score minus the mean WK standard score (CSWK) was also close to zero (CSWK = 0.449), and so CS was paired with WK.

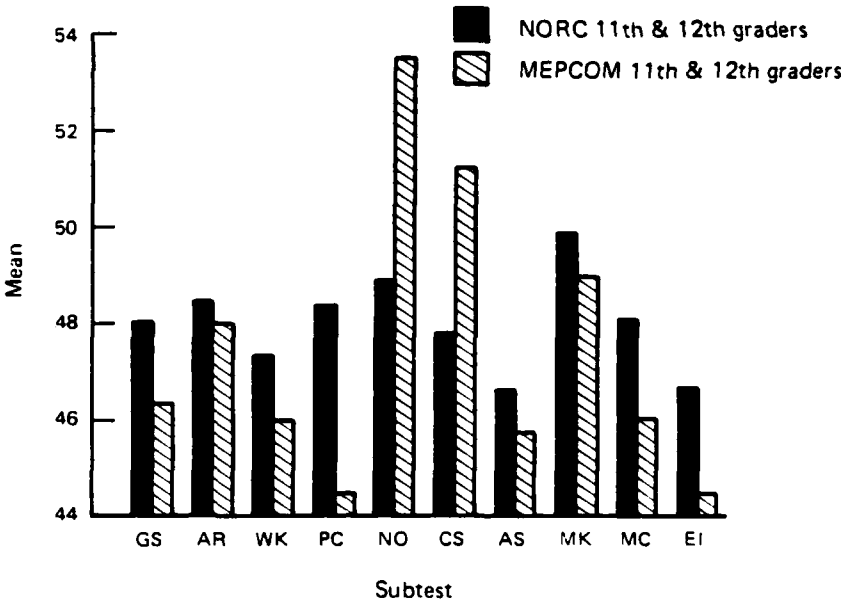

FIG. 1: SUBTEST MEANS IN STANDARD SCORE

NOAR and CSWK were also calculated for the MEPCOM 11th and 12th grade sample as a whole and for each of the 51 high schools separately.

Because the speeded tests were compared with the nonspeeded tests AR and WK, another nonspeeded test was chosen to compare with AR and WK for reference. GS was chosen for this purpose, since it correlated highly with both AR ($r = 0.68$) and WK ($r = 0.78$) in the NORC 11th and 12th grade sample. Also, the mean GS standard score minus the mean AR standard score (GSAR) and the mean GS standard score minus the mean WK standard score (GSWK) were found to be close to zero for this sample (GSAR $= -0.444$ and GSWK $= 0.340$).

GSAR and GSWK were also calculated for the MEPCOM 11th and 12th grade sample as a whole and for each of the 51 high schools separately.

RESULTS

Results for Entire Samples

The results for the entire samples are summarized in table 4. Mean NOAR and mean CSWK for the MEPCOM sample are well above the values for the NORC sample. Mean GSAR and mean GSWK for the MEPCOM sample are close to the values for the NORC sample. These results indicate that scores on the speeded tests from the MEPCOM sample are approximately 5 points higher than expected.

TABLE 4

MEAN VALUES FOR ENTIRE SAMPLES

	Mean values			
Sample	NOAR	CSWK	GSAR	GSWK
NORC 11th and 12th graders	.418	.449	- .444	.694
MEPCOM 11th and 12th graders	5.487	5.223	- 1.657	.340

Results by School

From the group results, reference values of 0.418 for NOAR and 0.449 for CSWK were obtained for the NORC 11th and 12th grade sample. If the speeded test results from the 51 high schools were consistent with the NORC sample results, approximately half of the values for NOAR and CSWK would be above the reference values and half of the values would be below. For NOAR, 44 schools were above the reference value and 7 were below. For CSWK, 35 schools were above the reference value and 16 were below. These findings are plotted in figures 2 and 3. For comparison, results for GSAR and GSWK are plotted in figures 4 and 5. In all figures it is assumed that the NORC 11th and 12th grade reference values are consistent across school size because size was not a factor in the NORC testing sessions which were generally very small.

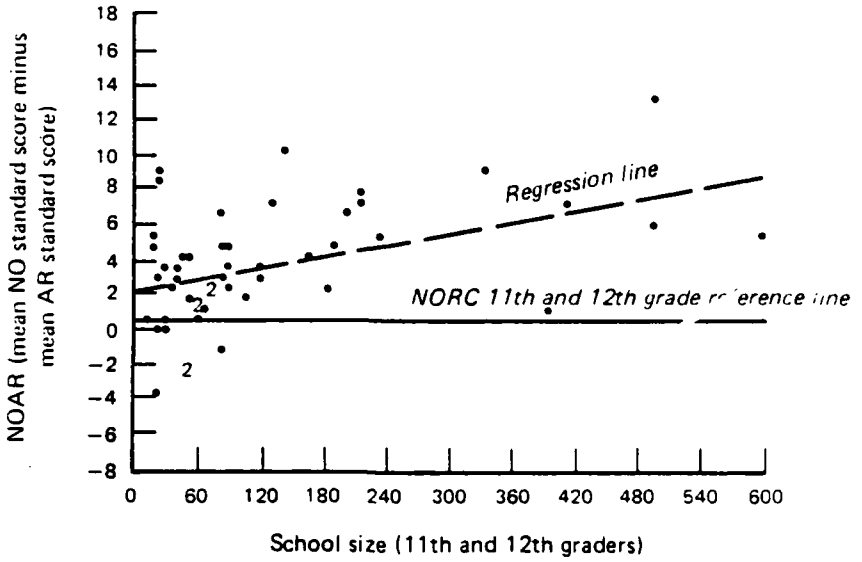

FIG. 2: SCHOOL SIZE vs. NOAR FOR 11th AND 12th GRADERS IN THE 51 HIGH SCHOOLS

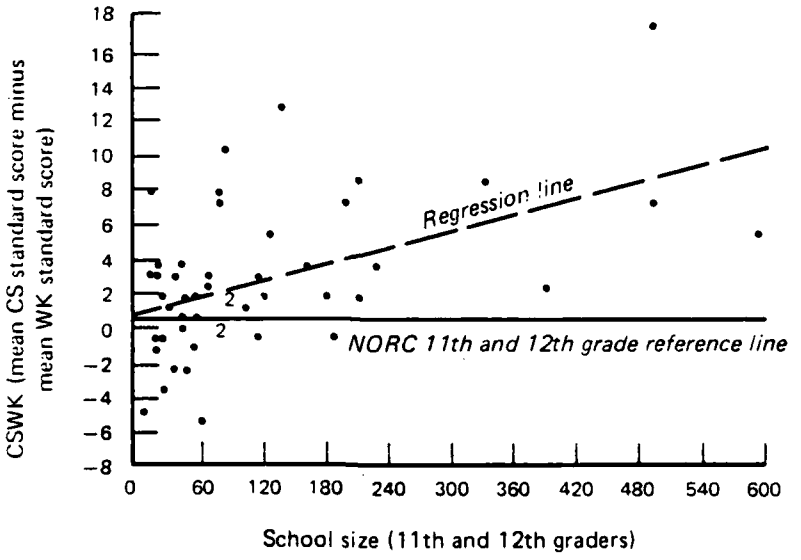

FIG. 3: SCHOOL SIZE vs. CSWK FOR 11th AND 12th GRADERS IN THE 51 HIGH SCHOOLS

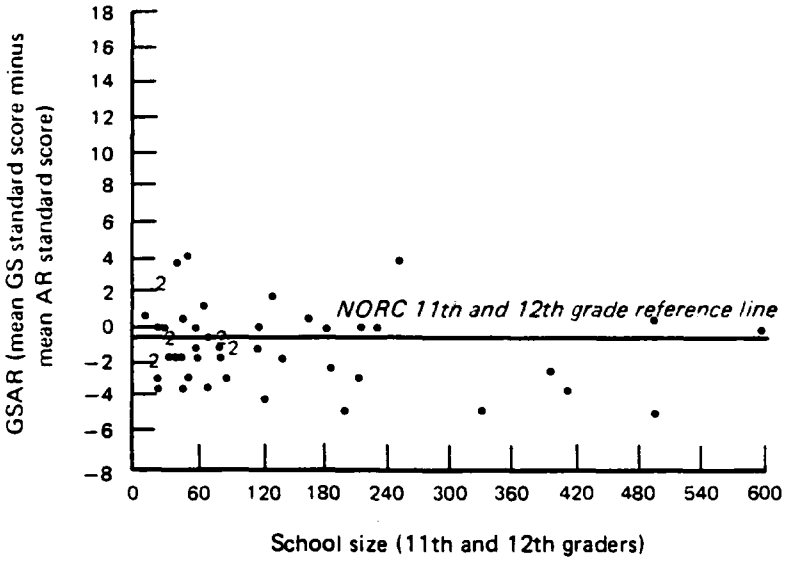

FIG. 4: SCHOOL SIZE vs. GSAR FOR 11th AND 12th GRADERS IN THE 51 HIGH SCHOOLS

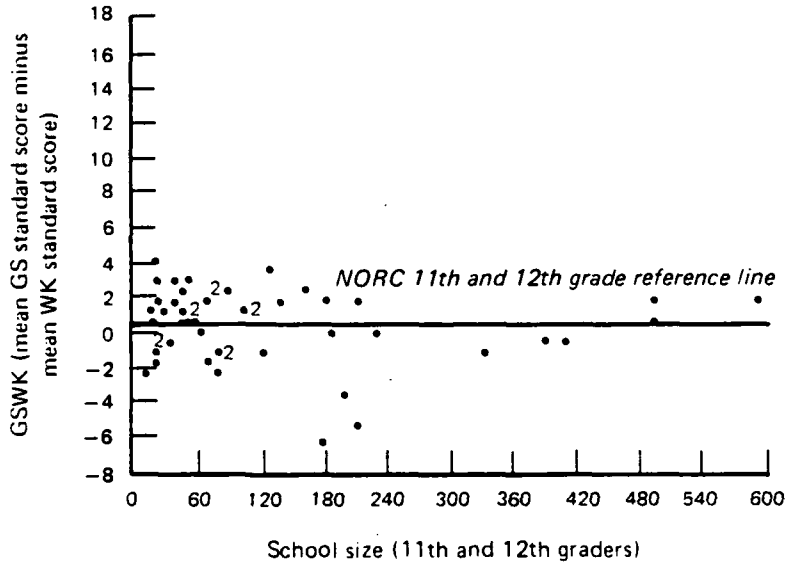

FIG. 5: SCHOOL SIZE vs. GSWK FOR 11th AND 12th GRADERS IN THE 51 HIGH SCHOOLS

Effects of School Size

In order to answer the question of whether test session size has an effect on speeded test scores, a measure of test session size was needed. For the NORC data, the sizes of the small test sessions were documented, and it was assumed that the NORC data was free of any test session size effect.

For the MEPCOM schools in general, the test session size equaled the number of students taking the test in the school. The test administrators were instructed to test all students at the school, and they were able to carry out these instructions reasonably well as noted in [6]. Therefore, the total number of 11th and 12th graders tested is generally proportional to the school size, and this number is a general indication of test session size.

The effects of school size (as measured by the total number of 11th and 12th graders tested) on NOAR, CSWK, GSAR, and GSWK were measured by computing linear regression equations. Results are summarized in table 5.

In figures 2 and 3 the regression lines for NOAR and CSWK are plotted. No regression lines are plotted in figures 4 and 5 since the regressions were insignificant for GSAR and GSWK.

TABLE 5

EFFECT OF SCHOOL SIZE ON RESULTS
FOR THE 51 HIGH SCHOOLS

Dependent variable	Fraction of explained variance (r^2)	Regression equation
NOAR	.228[a]	NOAR = 2.33 + .011(SIZE)
CSWK	.272[a]	CSWK = .79 + .016(SIZE)
GSAR	.061	–
GSWK	.008	–

a. Probability < .001

The demographic variables of gender and race/ethnic group were checked to be sure that they were not the variables that were actually causing the significant regressions. Regressions of size on NOAR and CSWK were calculated separately for females, males, blacks, Hispanics, and whites. The

effect of school size on both NOAR and CSWK was significant for all of these population groups except Hispanics, which may be attributable to the relatively small number of Hispanics in the sample. A description of the procedures used in calculating these results and separate graphs of these results can be found in appendix C. Summaries of these results follow in tables 6 and 7.

The difference between the results from the high schools and the results from the NORC sample became significantly larger for both NOAR and CSWK as school size became larger. School size was significant when analyzed separately for females, males, blacks, and whites.

TABLE 6

EFFECT OF SCHOOL SIZE ON NOAR FOR SEPARATE POPULATION GROUPS

Group	r^2	Significance level	Regression equation
Female	.228	.0012	NOAR = 4.42 + .011(SIZE)
Male	.228	.0006	NOAR = .28 + .012(SIZE)
Black	.399	.0502	NOAR = 4.72 + .012(SIZE)
Hispanic	.038	Not significant	-
White	.163	.0044	NOAR = 2.29 + .009(SIZE)

TABLE 7

EFFECT OF SCHOOL SIZE ON CSWK FOR SEPARATE POPULATION GROUPS

Group	r^2	Significance level	Regression equation
Female	.168	.0063	CSWK = 4.25 + .013(SIZE)
Male	.306	.0000	CSWK = - 1 65 + .015(SIZE)
Black	.772	.0008	CSWK = - 5.01 + .036(SIZE)
Hispanic	.084	Not significant	-
White	.264	.0002	CSWK = .45 + .015(SIZE)

ESTIMATED Z SCORES

A clearer picture was desired of how far the values of each high school could be expected to stray above the NORC reference values as a result of random variability. To obtain this information, Z scores were estimated for each of the 51 high schools for NOAR, CSWK, GSAR, and GSWK. These Z scores represent a measure in standard deviations of how different each school was from the NORC 11th and 12th grade sample, where the Z score for this reference population was zero. A two-tailed test with alpha = 0.02 (z = 2.33, alpha = 0.01 in each tail) was set to classify each school as either significantly higher or significantly lower than the NORC 11th and 12th grade sample. The results are summarized in table 8.

TABLE 8

ESTIMATED Z SCORE RESULTS FOR THE 51 MEPCOM HIGH SCHOOLS

	Number of schools with significant estimated Z score	
Subtest difference	Significantly high	Significantly low
NOAR	23	0
CSWK	16	1
GSAR	4	11
GSWK	12	6

For NOAR and CSWK, more schools have significantly high Z scores than GSAR and GSWK, while fewer have significantly low Z scores.

More schools are significantly different from the NORC sample for NOAR than for CSWK. This result suggests that the problem of nonconformance to norms may be worse for NO than it is for CS. One possible explanation for this result is that NO is a shorter test (3 minutes) than CS (7 minutes) and would more readily reflect deviations from proper timing and monitoring procedures.

Examination of the Z scores showed a distinct difference in significance between schools with size values under 60 and those with size values over 60. These results follow in table 9.

TABLE 9

SEPARATE ESTIMATED Z SCORE RESULTS FOR SCHOOLS WITH SIZE VALUES BELOW AND ABOVE 60

Subtest difference	Number with significantly high estimated Z score out of 23 schools with size value below 60	Number with significantly high estimated Z score out of 28 schools with size value above 60
NOAR	3	20
CSWK	0	16

Recall that the school size value equals the number of 11th and 12th grade students tested in a school. Ninth and tenth graders were also tested. Thus, the test session size may have been greater than the size value of the school. Alternatively, all of the 11th and 12th graders from a particular school may not have been tested in the same test session. Thus, the test session size may have been less than the size value of the school.

Not enough is known about how the values for school size translate into test session sizes to establish a maximum on test session size that ensures reasonable conformance to the NORC norms from speeded tests. However, it can be inferred that most schools with school size values over 60 do not conform to the present norms. For most schools with size values under 60, speeded subtest scores were higher than expected. But the difference was not enough to infer that they do not conform to the present norms.

The formulas used in estimating Z scores, a complete table of Z scores, and graphic representations of these scores can be found in appendix D.

CONCLUSIONS

This work demonstrates that speeded test results from many of the high schools studied do not conform to the established norms. The ASVAB speeded test scores in the high school sample are significantly higher than expected. Furthermore, the discrepancies become larger as school size becomes larger. Thus, students (i.e., potential recruits) from larger schools are systematically favored on composites which include speeded tests. Since school size is a

general measure of test session size, this study indicates that larger test sessions will result in inflated speeded test scores.

RECOMMENDATIONS

Based on the preceding results, the following recommendations are offered:

- A large sample of scores from the Student Testing Program should be examined to determine if the problems found in this analysis are representative.
- Testing conditions for the Student Testing Program should be improved in terms of test group size and/or monitoring.
- The use of scores from ASVAB speeded subtests should be restricted to those composites for which they have unique validity.

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APPENDIX A

CONVERTING ASVAB FORM 14 RAW SCORES TO STANDARD SCORES

APPENDIX A

CONVERTING ASVAB FORM 14 RAW SCORES TO STANDARD SCORES

The ASVAB Form 14 raw scores were converted to standard scores (mean of 50 and standard deviation of 10) based on the NORC population of 18- through 23-year olds using the equations in table A-1. The general formula is:

Standard score = (10) ((raw score – mean)/standard deviation) + 50.

TABLE A-1

EQUATIONS TO CONVERT ASVAB FORM 14 RAW SCORES (R) TO STANDARD SCORES (S)

Subtest	Equation
General Science	S = (10) ((R - 15.950) / 5.010) + 50
Arithmetic Reasoning	S = (10) ((R - 18.009) / 7.373) + 50
Word Knowledge	S = (10) ((R - 26.270) / 7.710) + 50
Paragraph Comprehension	S = (10) ((R - 11.011) / 3.355) + 50
Numerical Operations	S = (10) ((R - 37.236) /10.800) + 50
Coding Speed	S = (10) ((R - 47.606) /16.763) + 50
Auto and Shop Information	S = (10) ((R - 14.317) / 5.550) + 50
Mathematics Knowledge	S = (10) ((R - 13.578) / 6.393) + 50
Mechanical Comprehension	S = (10) ((R - 14.165) / 5.349) + 50
Electronics Information	S = (10) ((R - 11.569) / 4.236) + 50

APPENDIX B

DATA EDITING

APPENDIX B

DATA EDITING

NORC SAMPLE

The ASVAB was administered during the summer of 1980 to a nationally representative sample of 11,914 men and women, born in 1957 through 1964. All but 203 people in this sample were interviewed in April 1980 to get information such as the grade in school in which they were enrolled at that time. Since this information was necessary to better define the sample, these 203 records were removed. Also edited out were 36 records of people who were administered the test in a nonstandard way.

From the remaining sample, students were identified as 11th graders or 12th graders by using the interview question: "What grade or year of regular school are you attending or enrolled in?" If the response was "10" the student was flagged as an 11th grader, and if the response was "11" the student was flagged as a 12th grader.

Justification for this selection is as follows. By the summer of 1980, most students flagged as 11th graders would have passed the 10th grade and thus would have been ready to start the 11th grade when tested by NORC. The word "most" is used, because there is no way of identifying students who were not promoted to the 11th grade either because of failure and/or dropping out after the April interview. Justification for the selection of students flagged as 12th graders follows a parallel line of reasoning.

The NORC data was weighted to reflect the 1980 population by age, gender, and race/ethnic group. Table B-1 shows the weighted frequencies for the NORC 11th and 12th grade sample used in this study.

MEPCOM SAMPLE

The data from MEPCOM included records from 15,247 students tested in 52 schools throughout the United States. The MEPCOM test administrators were instructed to test all students in each school so that within each school there would be no self-selection.

TABLE B-1

NORC 11th AND 12th GRADE SAMPLE

Variable	Frequency	Percent
Female	3,689,362	48.8
Male	3,864,046	51.2
Black	1,081,973	14.3
Hispanic	483,219	6.4
White	5,988,216	79.3
Total	7,553,408	100.0

One of the 52 schools was not used in this study. This school was actually a junior high school with only 9th graders tested and thus was not used.

MEPCOM gathered other information in addition to the test results, including the race/ethnic background of each student. Thirty-four students were labeled "unknown" on race/ethnicity. They were edited out because this information was necessary in checking regressions due to race/ethnicity.

Students who did not try on the tests administered by MEPCOM could have caused the results to become distorted. Some zero scores were to be expected by chance. However, a subtest score of zero recorded by an individual who omitted every item on the subtest clearly is not a legitimate zero and serious doubts are raised as to the effort of the student on all of the subtests. Thus, the entire records of the 264 students who omitted all items on one or more subtests were edited out. When these records were removed, the proportion of zero scores remaining was comparable to the proportion of zero scores in the NORC data.

Records of 17 individuals were entered twice on the MEPCOM data tape. The extra occurrence of each of these entries was deleted.

Only the remaining 11th and 12th graders were used in this study. The 9th and 10th graders were not used since no comparable NORC population

was available. Table B-2 shows the frequencies for the MEPCOM 11th and 12th grade sample used in this study.

TABLE B-2

MEPCOM 11th AND 12th GRADE SAMPLE

Variable	Frequency	Percent
Female	3,150	50.8
Male	3,049	49.2
Black	1,081	17.4
Hispanic	523	8.4
White	4,595	74.1
Total	6,199	100.0

APPENDIX C

EFFECTS OF SCHOOL SIZE ON RESULTS FROM SEPARATE POPULATION GROUPS

APPENDIX C

EFFECTS OF SCHOOL SIZE ON RESULTS FROM SEPARATE POPULATION GROUPS

To determine if the effect of school size on NOAR and CSWK was present for different population groups, separate regressions were calculated for female, male, black, Hispanic, and white students. For each school the mean values of NOAR and CSWK were calculated using only those students in the population group being considered at that time.

Many schools had few, if any, students in some of the groups. Thus, a minimum number of eight students was chosen. If a school did not have eight students or more in a particular group, that school was not included in the regression calculation for that group. The number eight was chosen to be consistent with the total regression calculations where the smallest school size was eight. Table C-1 shows how many schools qualified for inclusion in each group.

TABLE C-1

NUMBER OF SCHOOLS HAVING EIGHT OR MORE STUDENTS IN POPULATION GROUPS

Group	Number of schools
Females	43
Males	48
Blacks	10
Hispanics	9
Whites	48
Total	51

Figures C-1 through C-10 show the results for the separate groups. Regression lines are included when the effect of size was significant.

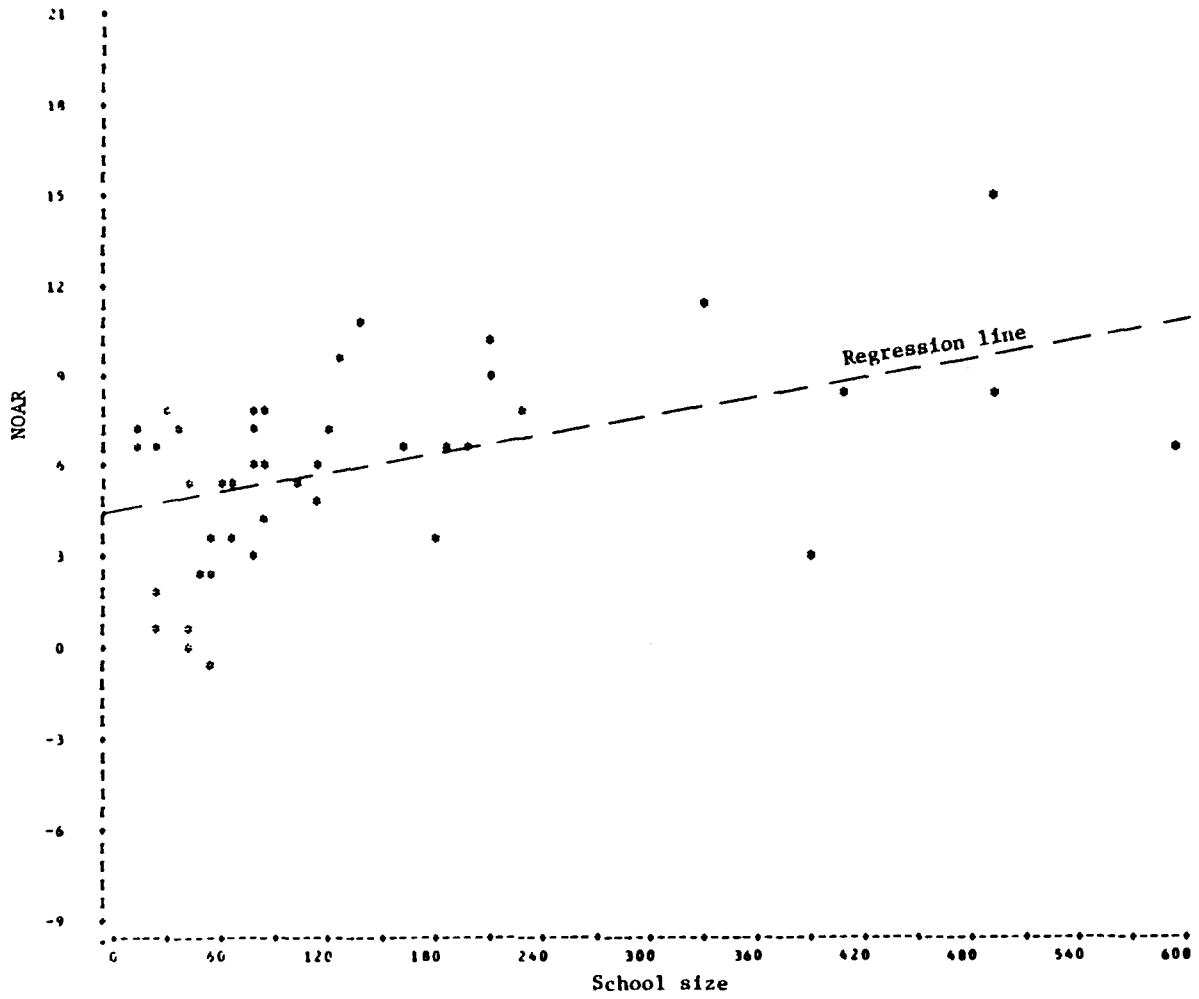

FIG. C-1: SCHOOL SIZE VS. NOAR FOR FEMALE STUDENTS

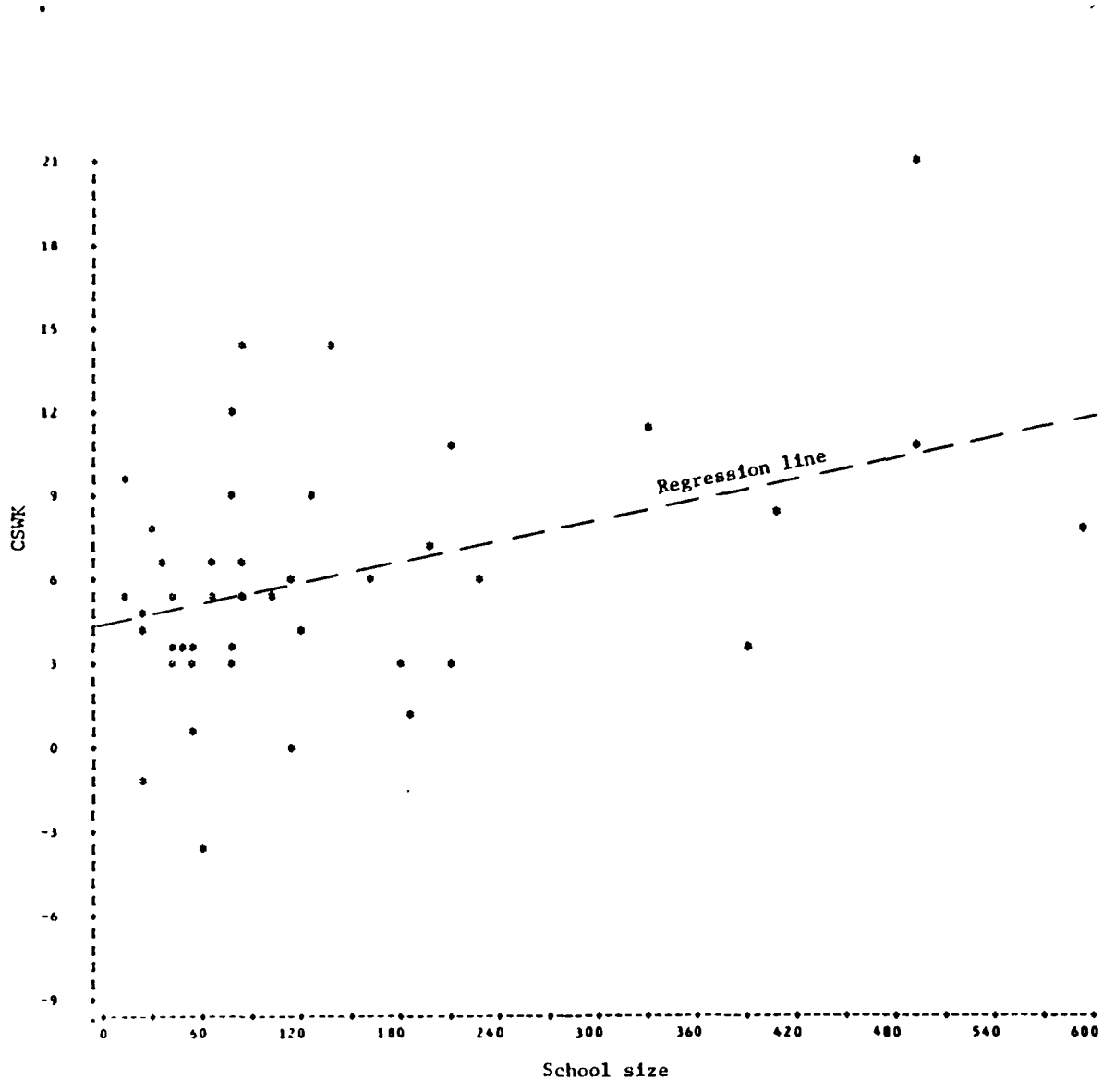

FIG. C-2: SCHOOL SIZE VS. CSWK FOR FEMALE STUDENTS

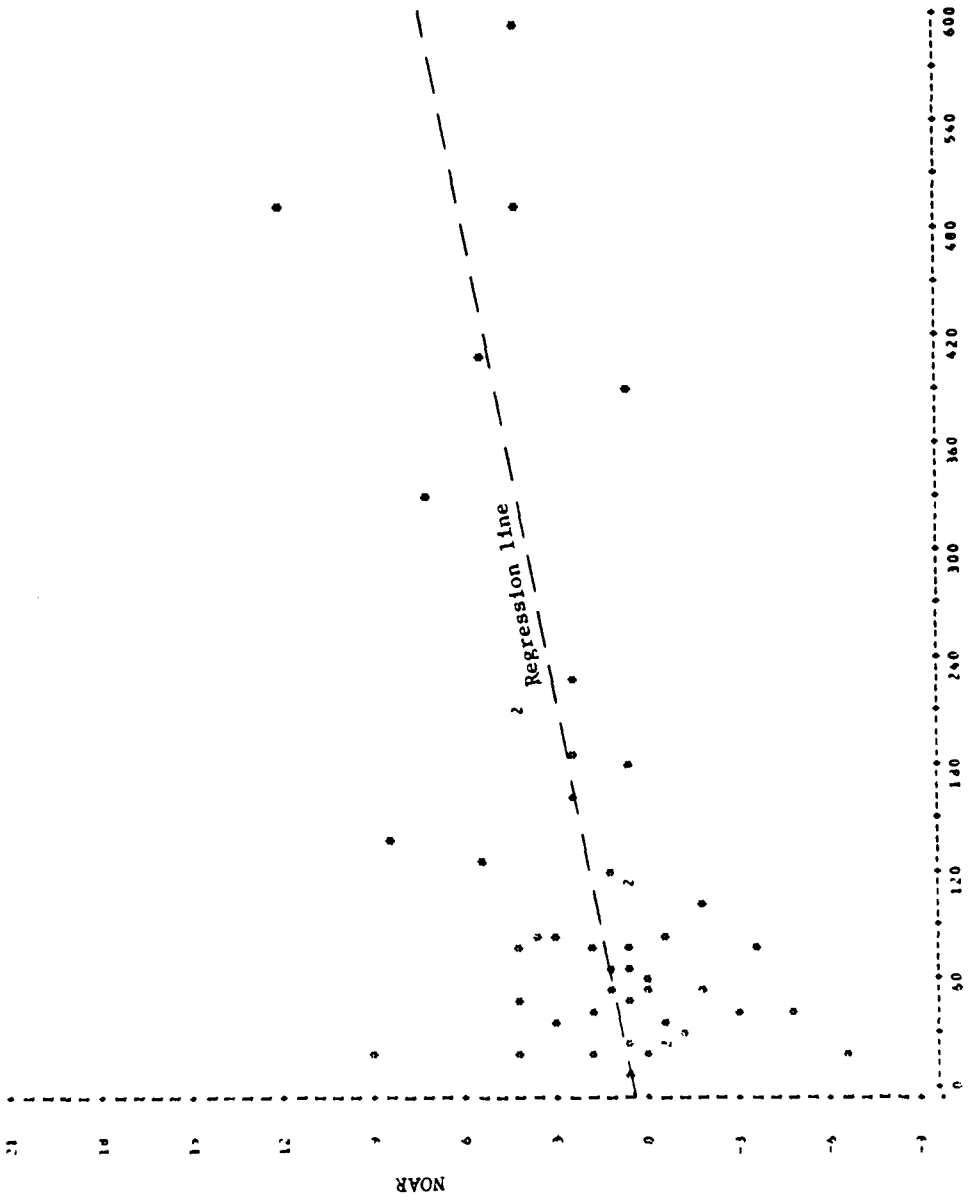

FIG. C-3: SCHOOL SIZE VS. NOAR FOR MALE STUDENTS

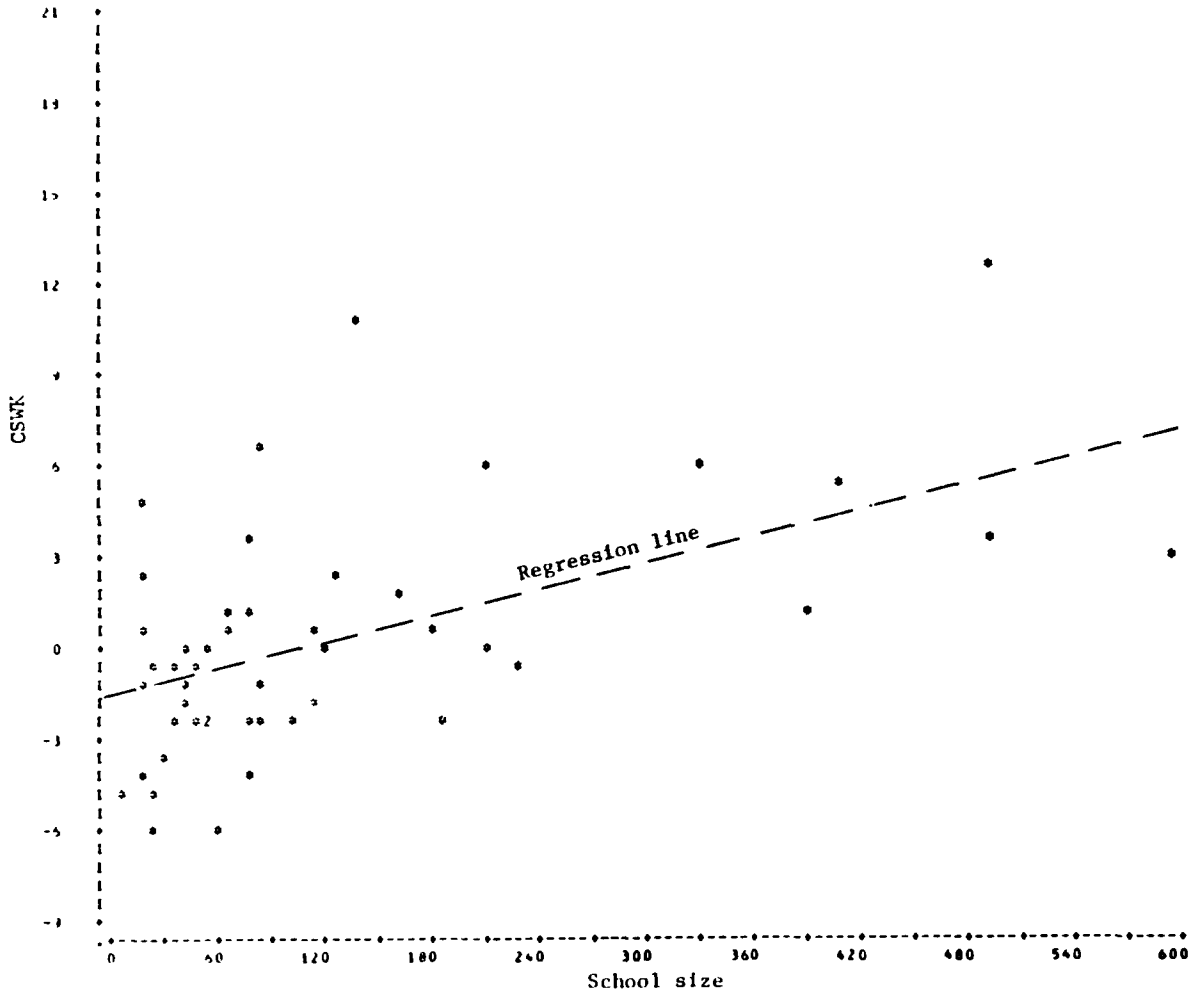

FIG. C-4: SCHOOL SIZE VS. CSWK FOR MALE STUDENTS

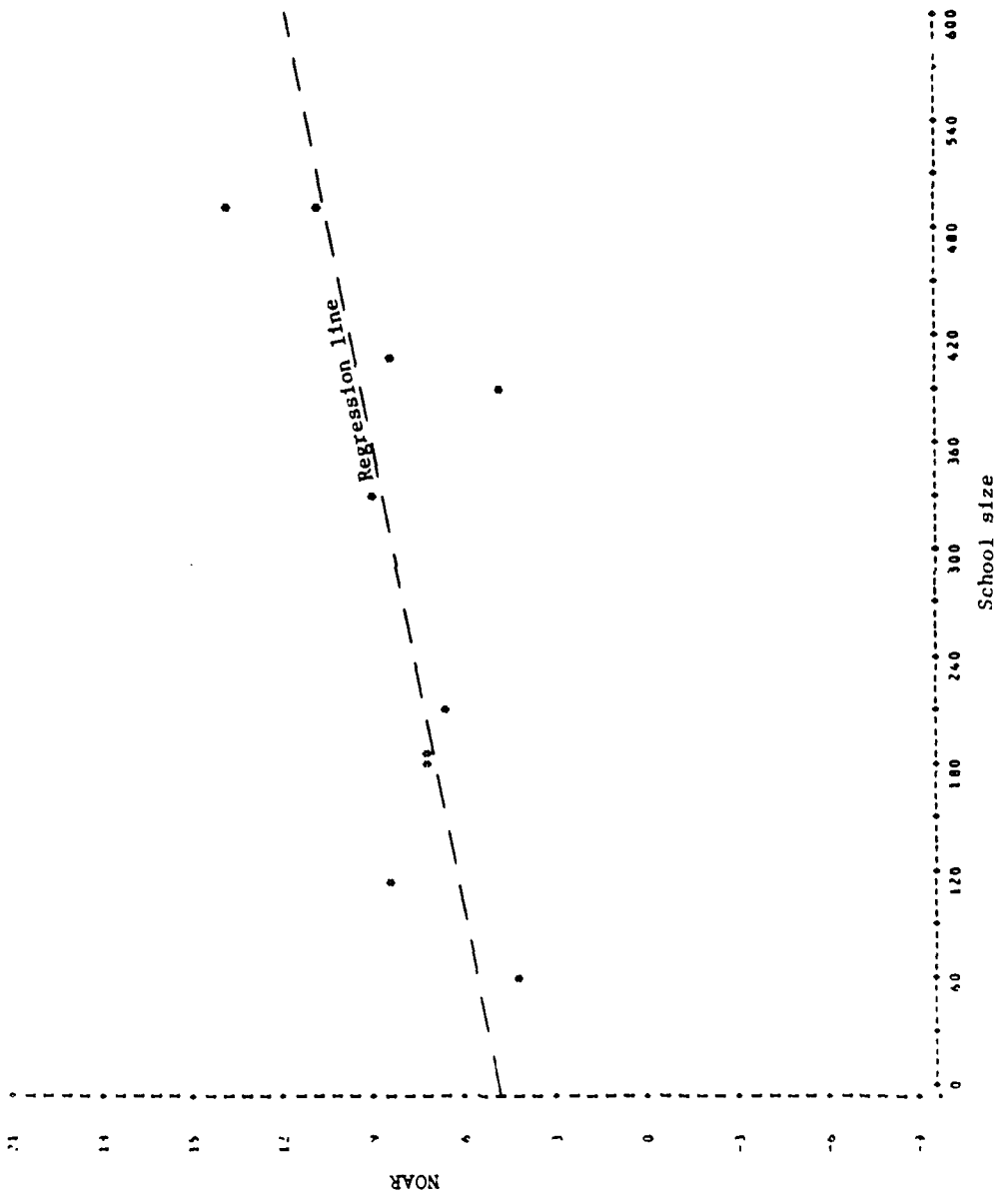

FIG. C-5: SCHOOL SIZE VS. NOAR FOR BLACK STUDENTS

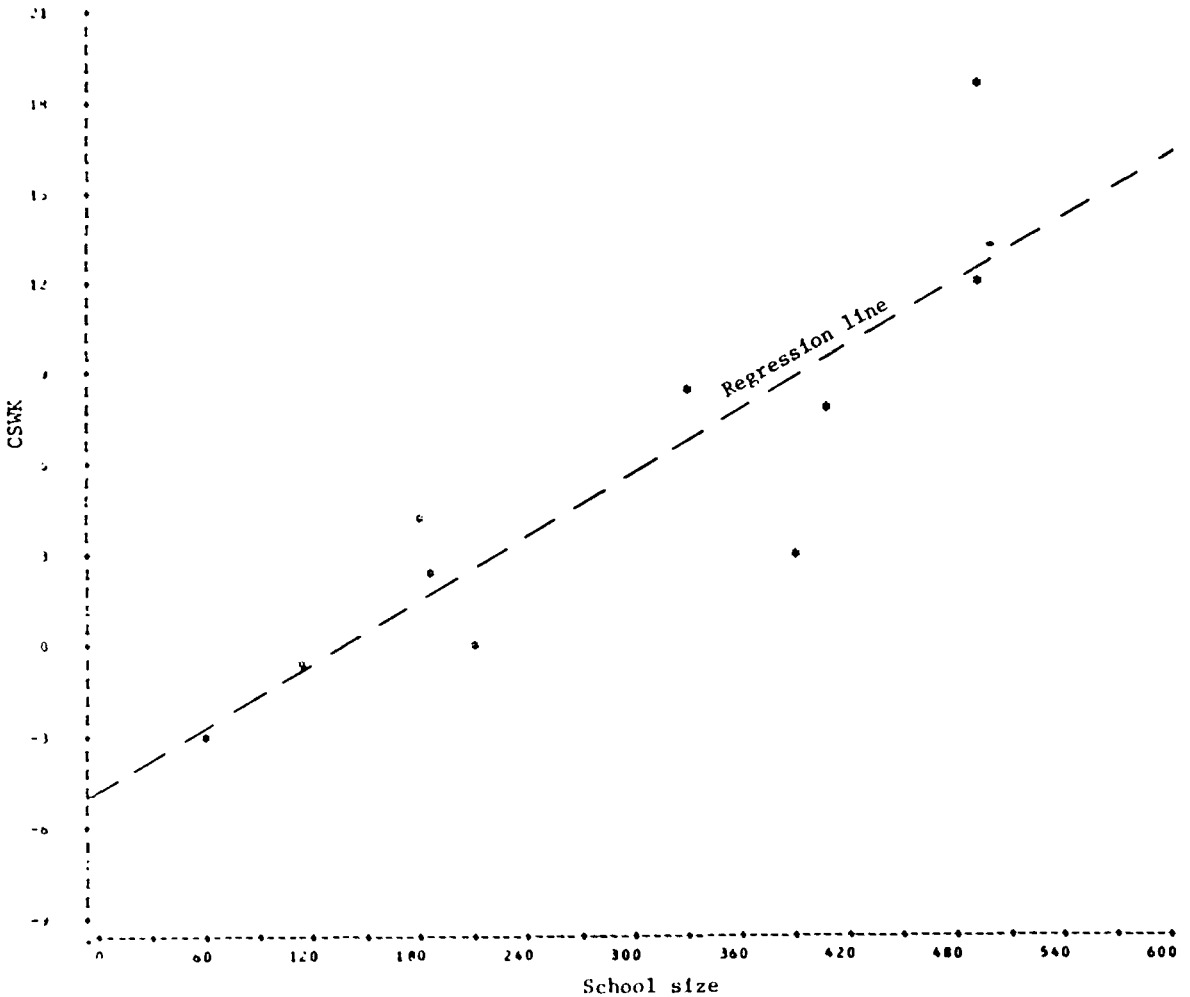

FIG. C-6: SCHOOL SIZE VS. CSWK FOR BLACK STUDENTS

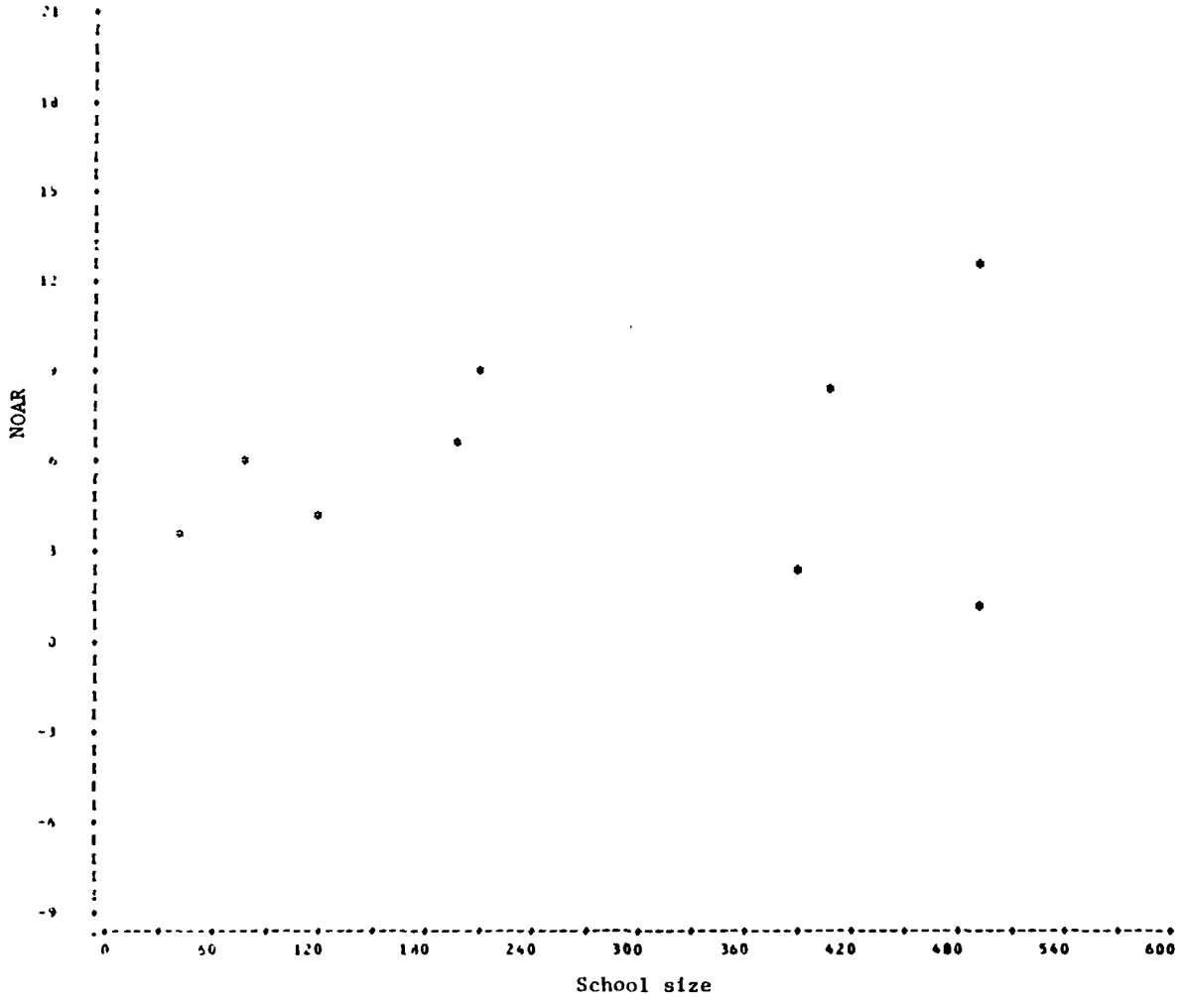

FIG. C-7: SCHOOL SIZE VS. NOAR FOR HISPANIC STUDENTS

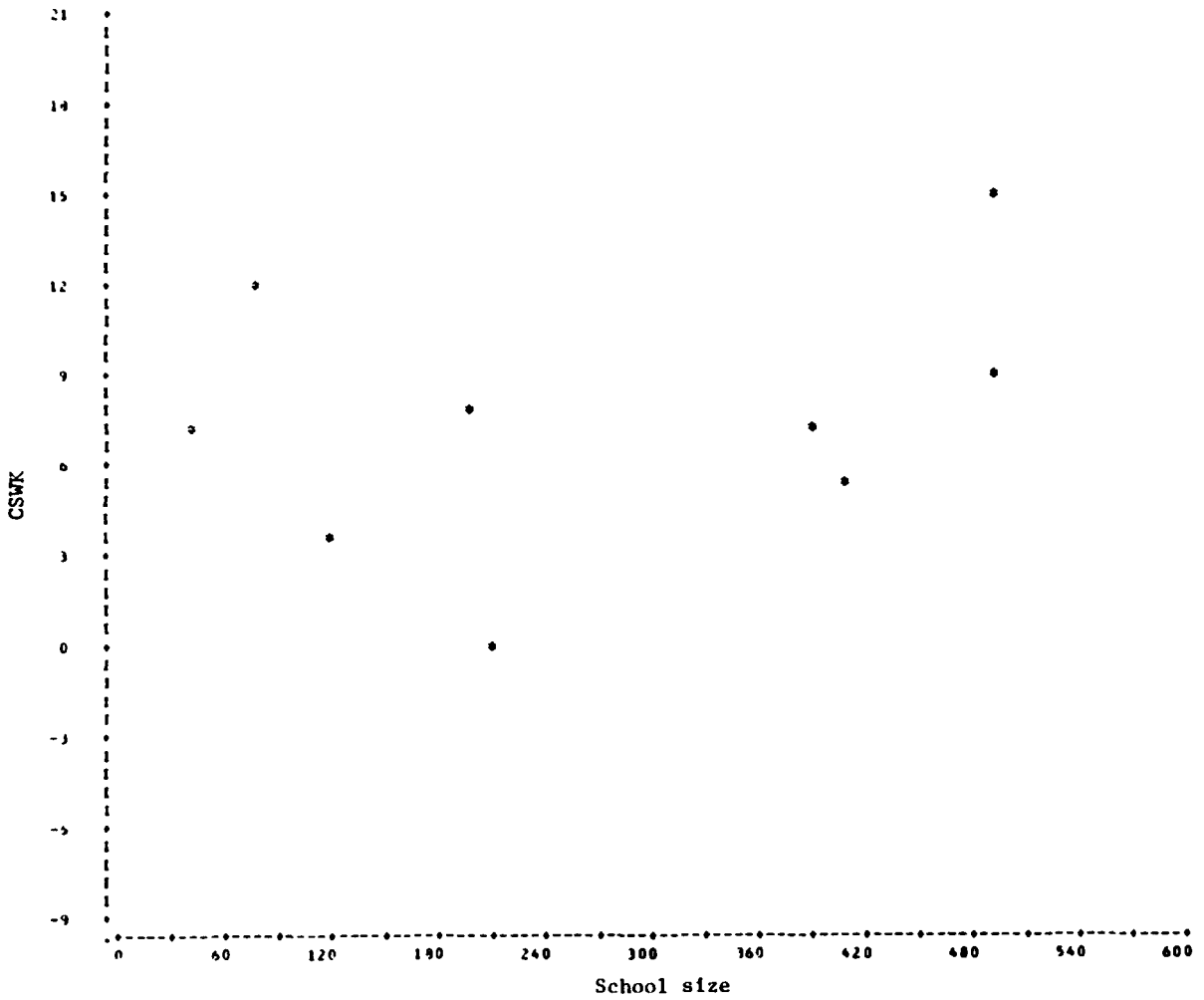

FIG. C-8: SCHOOL SIZE VS. CSWK FOR HISPANIC STUDENTS

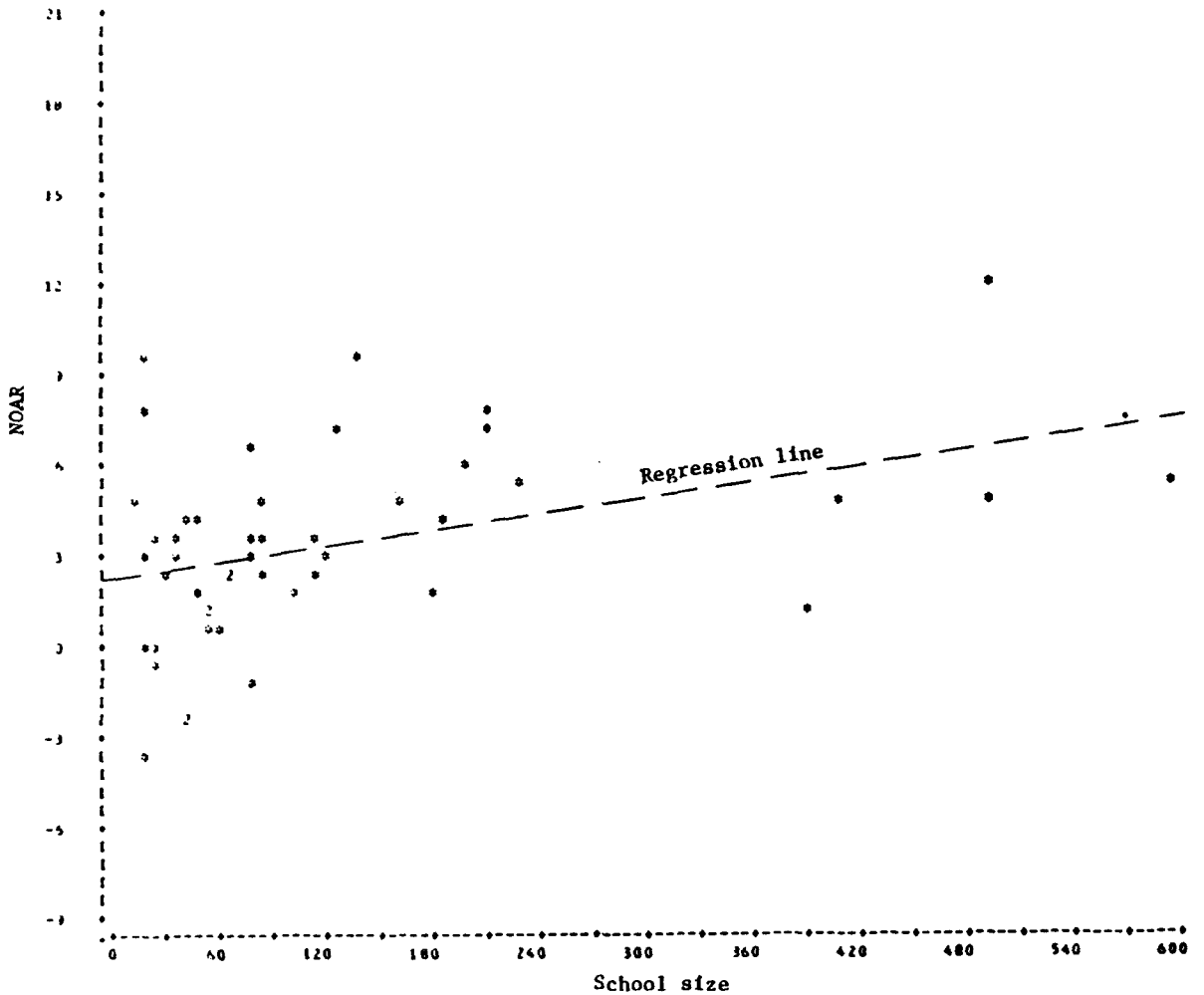

FIG. C-9: SCHOOL SIZE VS. NOAR FOR WHITE STUDENTS

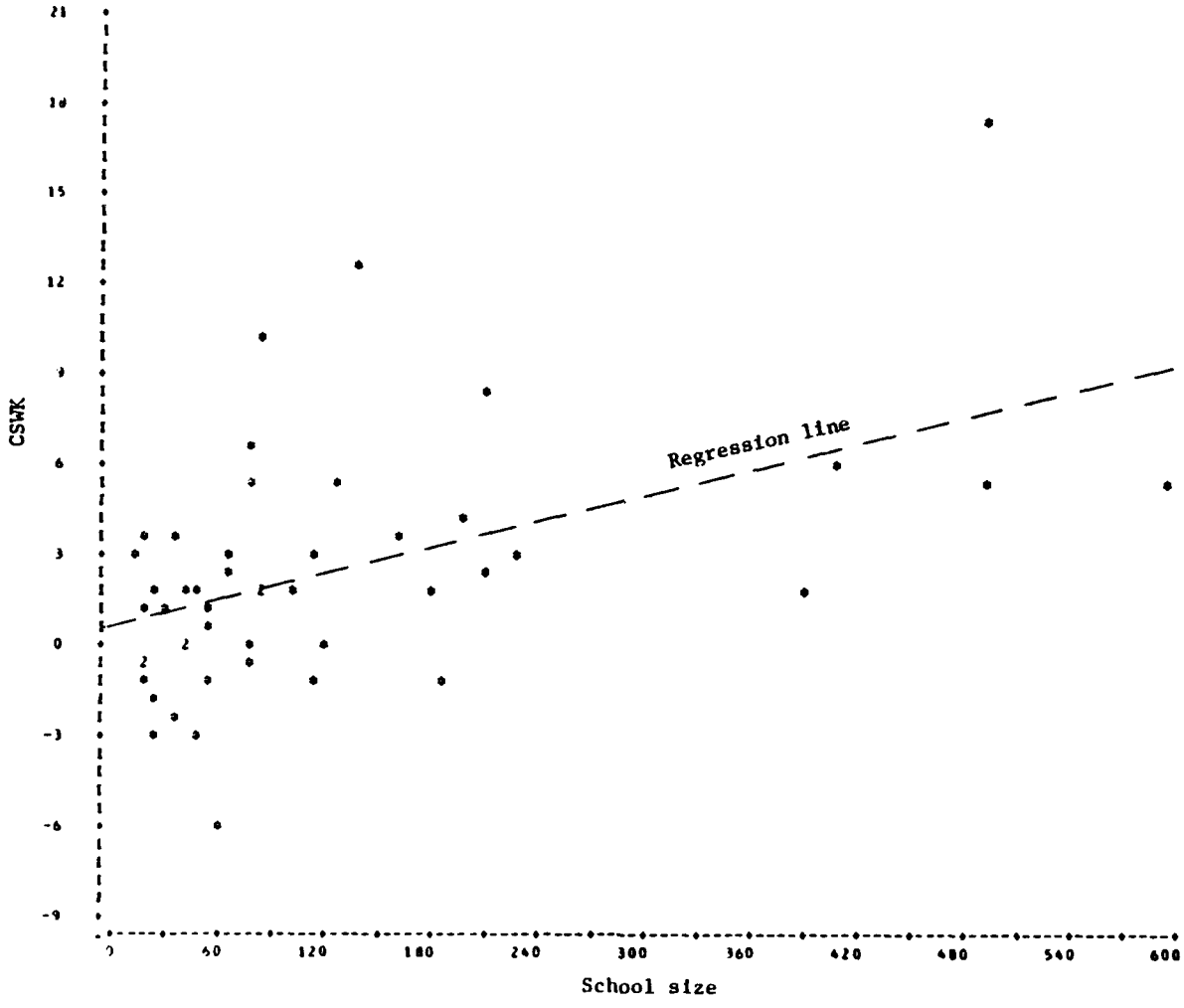

FIG. C-10: SCHOOL SIZE VS. CSWK FOR WHITE STUDENTS

APPENDIX D

ESTIMATED Z SCORES

APPENDIX D

ESTIMATED Z SCORES

Z scores were estimated for NOAR, CSWK, GSAR, and GSWK for each of the 51 MEPCOM high schools. The Z scores will be referred to as ZNOAR, ZCSWK, ZGSAR, and ZGSWK.

The standard deviation for NOAR (SD_{NOAR}) was estimated using the following equation where SD_{NO} is the standard deviation of NO, SD_{AR} is the standard deviation of AR, and $CORR_{NO/AR}$ is the correlation between NO and AR.

$$SD_{NOAR} = \sqrt{\left(SD_{NO}\right)^2 + \left(SD_{AR}\right)^2 - 2\left(CORR_{NO/AR}\right)\left(SD_{NO}\right)\left(SD_{AR}\right)}$$

SD_{NO} and SD_{AR} were each estimated to be 10 since the scores were in standard form and $CORR_{NO/AR}$ was calculated using the MEPCOM 11th and 12th grade sample.

ZNOAR was then calculated for each school using the following formula where $NOAR_{SCH}$ is the value of *NOAR* for the school being calculated, $NOAR_{REF}$ is the value of *NOAR* for the NORC 11th and 12th grade reference population, and *SIZE* is the school size as measured by the number of 11th and 12th graders tested in that school.

$$Z_{NOAR} = \frac{NOAR_{SCH} - NOAR_{REF}}{SD_{NOAR} / \sqrt{SIZE}}$$

ZCSWK, ZGSAR, and ZGSWK were calculated similarly. The estimated Z scores are listed in table D-1 and plotted in figures D-1 through D-4.

TABLE D-1

ESTIMATED Z SCORES FOR THE S1 MEPCOM HIGH SCHOOLS

SIZE	ZNOAR	ZCSWK	ZGSAR	ZGSWK
596	11.15	9.59	1.33	4.47
493	11.38	12.48	2.57	4.20
489	26.05	30.91	-12.17	-0.02
409	11.90	11.35	-7.98	-2.26
391	1.92	2.97	-4.46	-3.03
329	14.03	12.27	-10.09	-3.59
225	7.02	3.74	1.00	-0.79
210	8.61	9.43	.81	3.33
207	9.35	1.88	-4.83	-12.66
198	7.87	8.02	-7.26	-9.09
188	5.14	-1.46	-3.58	-1.28
180	2.18	1.33	.55	2.60
161	4.66	3.31	1.68	4.02
140	10.24	12.11	-1.76	3.03
124	7.04	4.54	3.39	5.80
119	3.22	1.22	-5.08	-2.19
114	2.37	-1.06	.84	1.54
114	2.97	2.47	-1.26	1.17
99	1.36	.85	.13	1.70
84	3.81	7.33	-2.58	2.86
83	1.78	.85	-0.54	-1.94
82	2.65	1.10	-1.00	-2.32
77	4.86	4.78	-0.88	-2.01
77	2.22	-0.53	-1.62	-3.98
76	3.28	5.29	-0.09	3.05
75	-1.18	-0.44	-0.03	2.52
65	1.40	1.90	-3.01	-2.99
63	1.43	1.49	-0.35	1.80
57	.44	-3.77	1.54	-0.55
56	.48	-0.07	-1.11	1.31
55	.57	.87	.34	.98
55	-0.02	-0.97	-0.53	.02
50	.82	.75	-2.27	.08
46	2.42	-1.59	3.78	3.07
41	2.05	1.69	-1.00	.27
41	-1.67	.05	.74	2.03
40	-1.47	-0.18	-2.41	.64
38	1.61	1.37	-0.80	1.27
36	1.58	-1.48	2.87	2.43
32	1.16	.29	-0.77	-0.75
25	-0.17	-1.57	-0.17	-0.57
25	1.52	.64	-0.11	.88
24	.01	-0.35	.28	-0.88
20	.99	-0.13	.38	.96
17	3.29	.80	1.38	1.57
15	-1.35	-0.46	-1.50	-0.75
15	-0.14	-0.25	1.31	2.30
15	2.84	1.07	-1.12	-1.33
11	1.36	.65	-0.53	.44
9	1.35	1.89	-0.53	.10
8	.10	-1.24	.34	-1.29

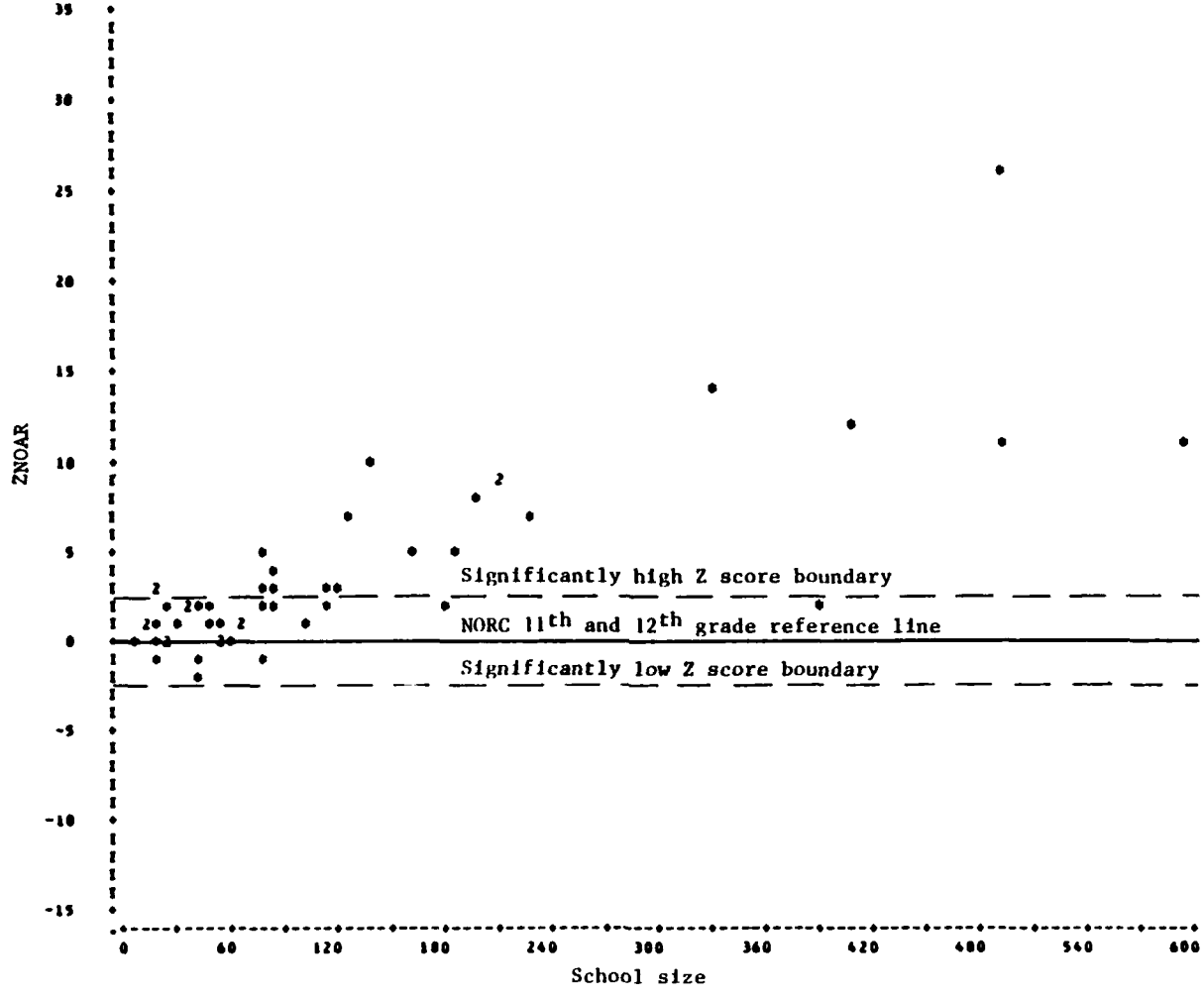

FIG. D-1: SCHOOL SIZE VS. ZNOAR FOR 11TH AND 12TH GRADERS IN THE 51 HIGH SCHOOLS

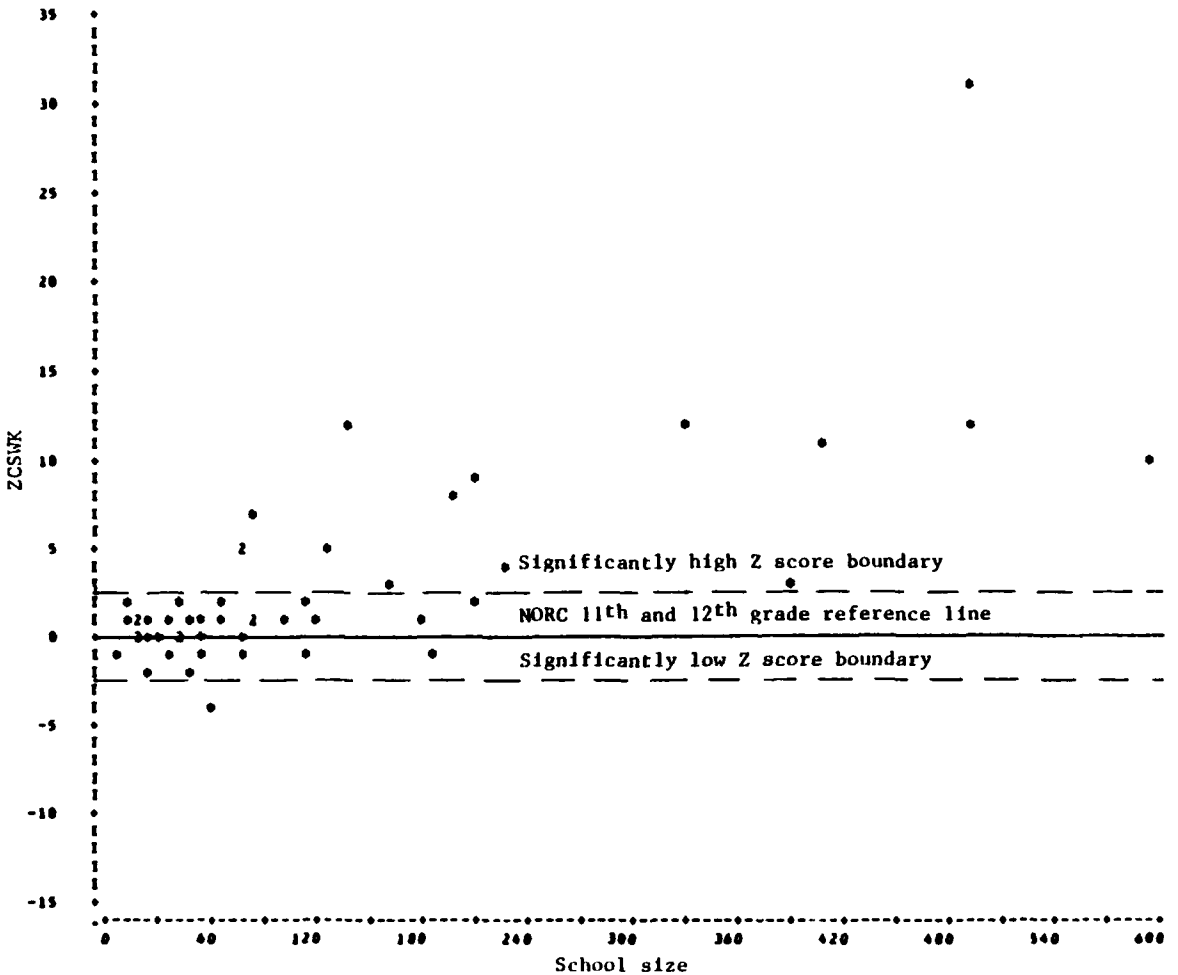

FIG. D-2: SCHOOL SIZE VS. ZCSWK FOR 11TH AND 12TH GRADERS IN THE 51 HIGH SCHOOLS

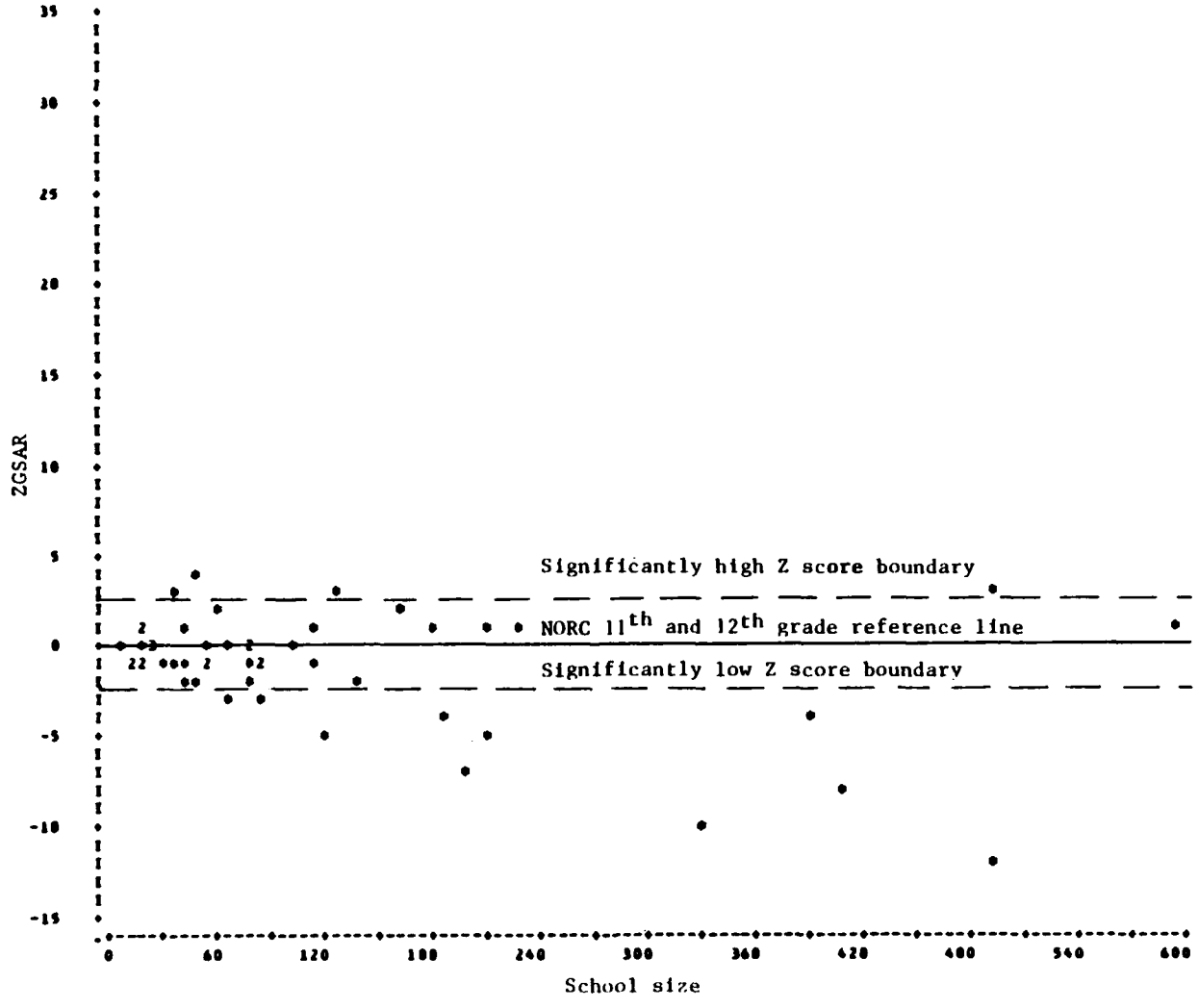

FIG. D-3: SCHOOL SIZE VS. ZGSAR FOR 11TH AND 12TH GRADERS IN THE 51 HIGH SCHOOLS

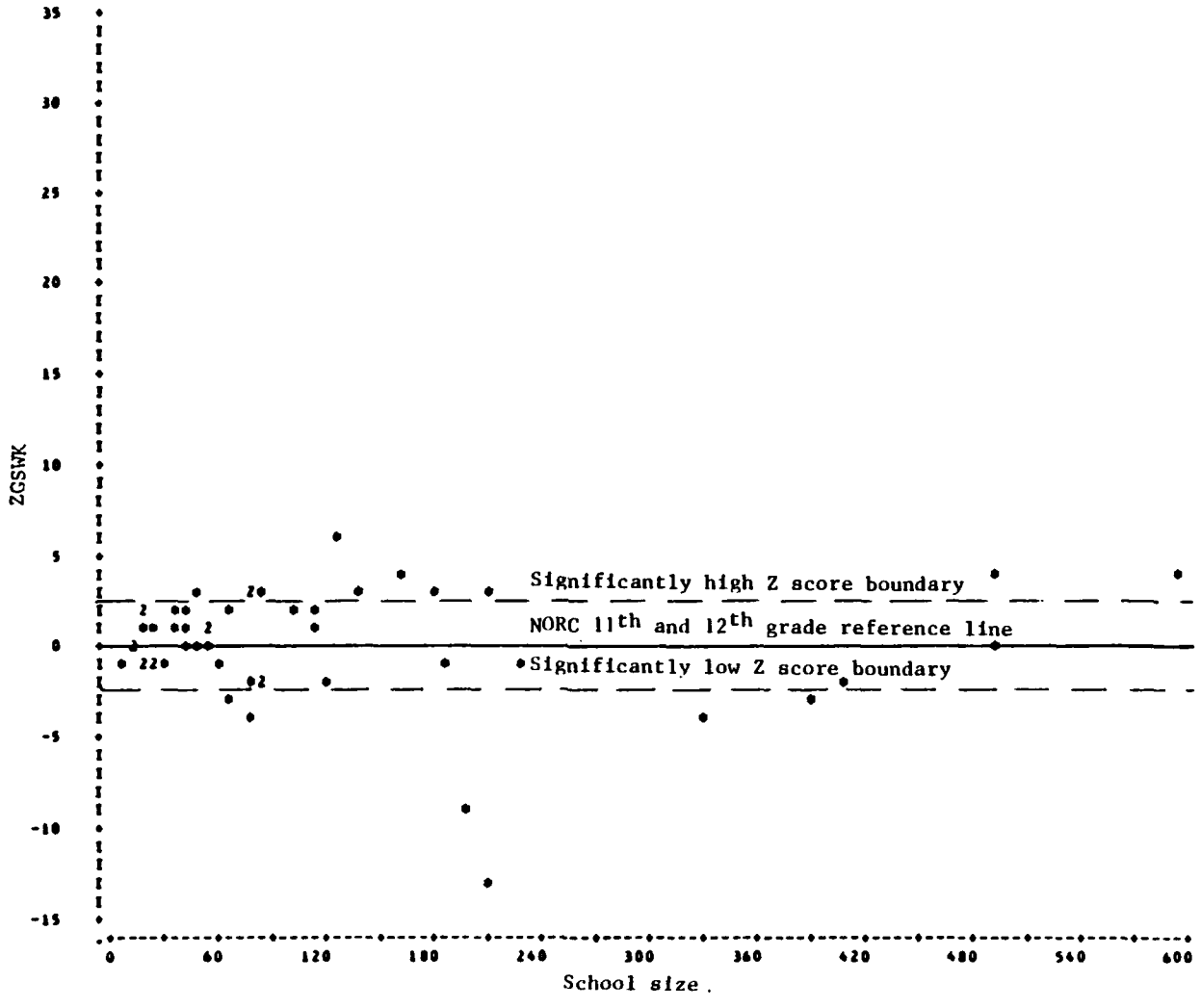

FIG. D-4: SCHOOL SIZE VS. ZGSWK FOR 11TH AND 12TH GRADERS IN THE 51 HIGH SCHOOLS