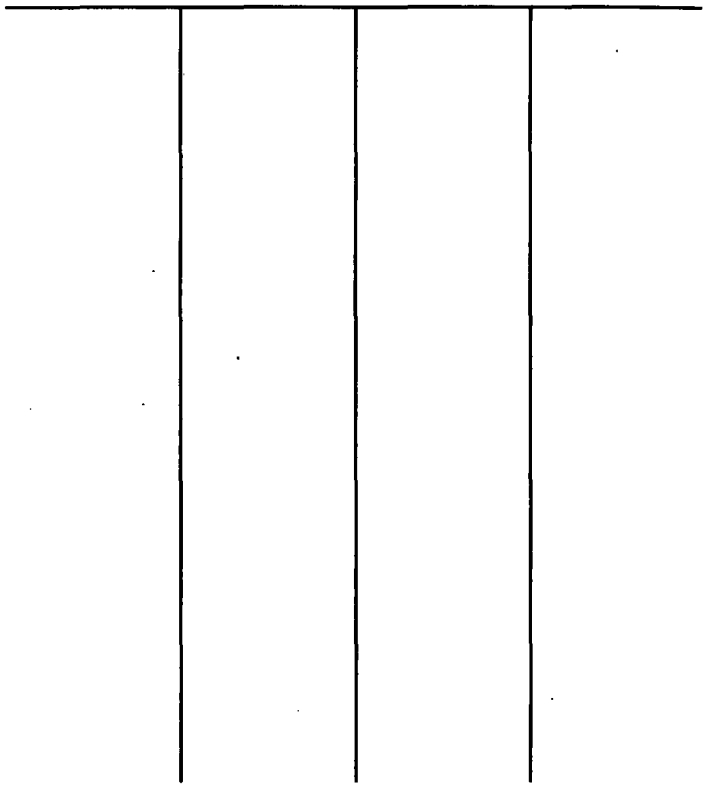

The functioning of the GSAT Senior for students of the Department of Education and Training

HLE Hugo

NCW Claassen

Report ED-13

The functioning of the GSAT Senior for students of the Department of Education and Training

HLE Hugo
NCW Claassen

Human Sciences Research Council
Pretoria
1991

ISBN 0 7969 1057 X

HLE Hugo, Hons B.A. Researcher
NCW Claassen, D.Litt. et Phil., S.E.D. Senior Research Specialist

Division for Psychology in Education
Group: Education

Published by:

Human Sciences Research Council
134 Pretorius Street
Pretoria
0002

INTERNAL ADVISORY COMMITTEE

Dr NCW Claassen
Mev HLE Hugo
Dr J Landman
Mnr Z Langa
Dr K Owen
Mnr WBJ Prinsloo
Mnr AR van den Berg
Mev R van Eeden
Mev M van Tonder
Mnr HN Vosloo

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

BESTUURSOPSOMMING

In die praktyk het opvoedkundiges dikwels behoefte aan die evaluering van die akademiese aanleg van hulle studente. Die Algemene Skolastiese Aanlegtoets (ASAT) is vir hierdie doel ontwikkel vir Engels- en Afrikaanssprekende studente. Aparte nie-verbale en verbale tellings sowel as 'n totaaltelling word met die ASAT verkry. Baie studente se moedertaal is egter nie Engels of Afrikaans nie, maar een of ander Afrikataal. In hierdie ondersoek is die geskiktheid van die ASAT vir hierdie studente ondersoek.

Ten einde die geskiktheid van die ASAT te ondersoek vir studente wat 'n Afrikataal as huistaal het, is ongeveer 1 400 sestien- en sewentien-jarige leerlinge van die Departement van Onderwys en Opleiding (DOO) met die ASAT getoets. Hierdie studente het hul onderrig sedert standerd 3 deur medium van Engels ontvang. Aangesien die ASAT vir leerlinge in skole van die Departement van Onderwys en Kultuur (DOK) ontwikkel is en dus vir hierdie groep geskik is, is dit nuttig om die resultate te vergelyk met dié van studente in skole van DOK wat die toetse in hul moedertaal afgelê het.

Die betroubaarheid van die nie-verbale deel van die ASAT was prakties dieselfde vir DOO-studente en vir DOK-studente. Die betroubaarheid van die verbale deel was swakker, maar nie onbruikbaar laag nie. Groot verskille in gemiddelde prestasie in sowel die nie-verbale as die verbale subtoetse is gevind ten gunste van studente wat in hul moedertaal getoets is. Die verskille in gemiddelde tellings was egter baie groter in die geval van die verbale subtoetse. Verskille tussen gemiddeldes kon in 'n mate verklaar word op grond van sosio-ekonomiese faktore. DOO-studente het genoeg tyd gehad om die toets te voltooi. Die twee subtoetse met figuurinhoud - wat beskou kan word as die verste verwyder van die soort leerstof wat op skool geleer word - toon die kleinste verskil ten opsigte van gemiddeldes vir die twee groepe wat ondersoek is. Die nie-verbale ASAT-telling was 'n nie-sydige voorspeller van akademiese prestasie vir daardie groepe mits die kriterium nie swaar met taalvermoëns gelaai was nie. Verbale tellings het geneig om die skolastiese prestasie van DOO-studente in vakke soos Wiskunde en Natuurwetenskap effens te onderskat.

In die studie is deurgaans aanduidings gevind dat die meeste studente wat nie in hul moedertaal getoets is nie, benadeel is as gevolg van 'n gebrek aan kennis van die taal wat gebruik is. Daar is talle aanduidings dat verbale toetse wat in die moedertaal afgelê word gewoonlik beter korreleer met skolastiese prestasie as nie-verbale toetse. Op hierdie stadium lyk dit egter nie of toetsing in die moedertaal vir alle studente haalbaar is nie. Daar word derhalwe aanbeveel dat die nie-verbale deel van die ASAT gebruik word as 'n tussentydse maatreël, maar dat 'n meer omvattende nie-verbale redeneringstoets soortgelyk aan die figuursubtoetse van die ASAT wat vir alle groepe in die land geskik sal wees, ontwikkel behoort te word.

EXECUTIVE SUMMARY

In practice educators often need to assess the academic aptitude of their students. To meet this need, the General Scholastic Aptitude Test (GSAT) was developed for English-speaking and Afrikaans-speaking students. Separate non-verbal and verbal scores as well as a total score are obtained. However, the mother tongue of many students is not English or Afrikaans but an African language. This study investigated the GSAT's suitability for such students.

In order to investigate the suitability of the GSAT for students whose home language is an African language, approximately 1 400 sixteen- and seventeen-year-old students from schools of the Department of Education and Training (DET) were tested with the GSAT. All these students had had English as their medium of instruction since Standard 3. Since the GSAT was developed for students from schools of the Department of Education and Culture (DEC), it was useful to compare the results of the DET students with those of DEC students who had taken the GSAT in their mother tongue.

The non-verbal part of the GSAT proved to be as reliable for DET students as for DEC students. The verbal part was less reliable, but not unusably low. Large differences in performance in favour of those tested in their mother tongue were found on both the non-verbal and the verbal subtests. The differences between mean scores were however much greater in the case of the verbal subtests. Mean differences could to some extent be explained by differences in socio-economic status. DET students did have enough time to complete the test. The two subtests with figural content - which can be regarded as furthest removed from the kind of material taught at school - showed the smallest difference in means for the two groups investigated. The non-verbal GSAT score proved to be an unbiased predictor of academic achievement for these groups provided that the criterion was not too dependent on language skills. Verbal scores tended somewhat to underestimate the scholastic achievement of DET students in subjects such as Mathematics and Physical Science.

This study revealed in a number of ways that most of the students not tested in their mother tongue were handicapped by a lack of knowledge of the language used. There are many indications that verbal tests taken in the mother tongue usually correlate better with scholastic achievement than do non-verbal tests, but at this stage testing all students in their mother tongue does not appear feasible. It is therefore recommended that the non-verbal part of the GSAT be used as an interim measure. A more elaborate non-verbal reasoning test similar in nature to the figural subtests of the GSAT, and suitable for all groups in the country, should however be developed.

1.0 THE FUNCTIONING OF THE GSAT SENIOR FOR STUDENTS OF THE DEPARTMENT OF EDUCATION AND TRAINING.

1.1 BACKGROUND AND PROBLEM

Until 1985 it was common practice to standardize separate tests for the various ethnic groups in South Africa. However, in all ethnic groups acculturation is taking place towards a common scientific industrial culture. Gradually a broad spectrum of cultural loyalties has developed, and a stronger need was felt to delineate target groups for tests and norms not on the basis of population group, but on the basis of more relevant psychological variables.

The GSAT is a test that was developed to measure general scholastic aptitude across population groups for all students who are either Afrikaans- or English-speaking. The question arose as to the applicability of the GSAT for persons who were reasonably proficient in English, but neither Afrikaans-speaking nor English-speaking. There was a possibility that the test scores of such a group could be influenced by their lack of intimate knowledge of the English language. The majority of the students studying in schools under the control of the Department of Education and Training (DET) fall into this group. In the overwhelming majority of high schools in this department, the language of instruction is English while English is the second or third language of virtually all the children.

1.2 AIM OF THE PROJECT

The aim of this project was to evaluate the suitability of GSAT for students of the Department of Education and Training. Questions like the following needed to be answered:

- How do the distributions of non-verbal and verbal scores differ from those of students of the Departments of Education and Culture (DEC)?
- How reliable is the test for this group?
- Is the GSAT suitable for predicting school achievement?
- To what extent are differences in GSAT scores related to other measured differences between the groups?
- Are scores affected by the testing time limits?
- What kind of item is more biased against persons not tested in their mother tongue?

1.3 METHOD

1.3.1 Procedures

In order to investigate various aspects of the functioning of the GSAT three different experiments were designed. These will henceforth be designated as *procedures*.

1.3.1.1 Procedure 1

The main purpose of this procedure was to determine the reliability of the GSAT as well as GSAT mean scores for DET students. This procedure entailed the following:

In each school in the sample 60 students were tested. They were a random sample of all the students in the school who were 16 or 17 years old. The sample was divided in two groups of thirty that were tested consecutively.

Students first completed the GSAT form AE and afterwards the Survey of Study Habits and Attitudes. A socio-economic deprivation questionnaire (SED questionnaire) was completed by the school for every student, in order to obtain an indication of certain aspects of the living conditions of the testees.

1.3.1.2 Procedure 2

The main purpose of this procedure was to determine the predictive validity of GSAT scores for DET students.

In each school in the sample 30 students were tested. They were a random sample of all the Std 8 students in the school. Testing took place on two consecutive days.

On the first day the GSAT form AE was done and a questionnaire about the student's environment was completed by students. On the second day students wrote the scholastic achievement tests based on the Std 7 syllabi for Mathematics and Physical Science. The Jung Personality Questionnaire was also completed. A SED questionnnaire was completed by the school for every student in the sample.

1.3.1.3 Procedure 3

The main purpose of this procedure was to determine the test-retest reliability of the GSAT for DET students.

In each school in the sample 30 students were tested. They were a random sample of all the students in the school who were 16 years old. Testing took place on two days a fortnight apart.

On the first day the GSAT form AE was done and a questionnaire about the student's environment was completed by students.

A fortnight later the same students completed the GSAT Form BE as well as the Survey of Study Habits and Attitudes. A SED questionnnaire was completed by the school for every student in the sample.

1.3.2 Biographical details

In order to assess the educational and economic climate in which a student was functioning a SED questionnaire (Van den Berg, 1985) was completed by the school for every student in the sample. For two of the procedures testeeso also completed an environmental questionnaire. Questions were also asked to assess the degree of exposure students had had to English outside of school hours.

1.3.3 Samples

Eight circuits of the Department of Education and Training took part in the investigation. Every circuit was randomly allocated to a procedure. In those circuits allocated to a procedure a number of schools were randomly drawn in order that Procedure 1 would be completed by approximately 1000 students, and Procedures 2 and 3 by approximately 500 each.

PROCEDURE	CIRCUIT	NUMBER OF SCHOOLS
1	Highveld	7 schools
	Johannesburg	6 schools
	Natal	5 schools
2	Diamond Fields	5 schools
	OFS	6 schools
	Orange Vaal	6 schools
3	Cape	8 schools
	Northern Transvaal	7 schools

In a few cases other schools had to be substituted for selected schools because of lack of access. All in all testing was done in 50 schools. The complete list of schools in the samples appears in Appendix A.

The samples for DEC students are described in the *Manual for the General Scholastic Aptitude Test: Senior Series* (Claassen, de Beer, Hugo & Meyer, 1991).

1.3.4 Testers

Inspectors of the DET were trained by HSRC staff to administer the tests. Test administration took place during August 1989.

2.0 STATISTICAL DATA

2.1 RELIABILITY

Test reliability concerns the accuracy of the test as a measuring instrument. More specifically it refers to the consistency in a testee's scores when taking the test on more than one occasion. Test theory makes it possible to estimate which proportion of the observed test score variance is error variance and which is true variance.

The Kuder-Richardson formulae provide indices of reliability based on the internal consistency of achievement in the items in the test. Here the K-R 8 formula was used. The K-R 8 reliability coefficient is actually the mean of all split-half coefficients (Cronbach, 1951).

Parallel form reliability is a measure of both the consistency of response with regard to different samples of items and of stability over time. The parallel form of the test was administered to a sample of 16-year-old students two weeks after the first form in order to determine parallel form reliability.

2.1.1 K-R 8 reliability and standard errors of measurement

Statistics for 16- and 17-year-old students from schools under control of the Department of Education and Training are presented in Table 1. These include the means, standard deviations, skewness and kurtosis, as well as the K-R 8 reliability coefficients and standard errors of measurement. SED refers to the index of socio-economic deprivation provided by the SED questionnaire (Van den Berg,1985). The same statistics for students from schools under control of the Departments of Education and Culture appear in Table 2.

Although DET students have been divided into two groups (environmentally disadvantaged and non-environmentally disadvantaged) for the sake of completeness as in the case of DET students, they will be dealt with as one group because the one group was extremely small and test score means did not differ much.

For DET students, the K-R 8 reliability coefficients are slightly higher for the non-verbal than for the verbal scores whereas, for DEC students, the reliability coefficients are approximately the same for non-verbal and verbal scores for both the environmentally non-disadvantaged and the environmentally disadvantaged.

The F-test suggested by Feldt (Reynolds, 1982) was utilized to test whether reliability coefficients differ significantly. K-R 8 reliability coefficients did not differ significantly between the non-environmentally disadvantaged and environmentally disadvantaged DEC students. The reliability coefficients for verbal and total scores differed significantly between DET and non-environmentally disadvantaged DEC students. This implies that the differences are real even though they may be small.

The raw score distributions of the non-verbal and the verbal scores of 16-year-olds appear in Figures 1 and 2 respectively. The distributions for both the 16- and 17-year-old DET students are positively skewed. In both cases skewness is more pronounced for the verbal scores than for the non-verbal scores. This difference can clearly be seen in Figures 1 and 2. In spite of the skewness, the distributions are not so peaked that there is reason to believe that the test will not be able to distinguish between DET students of

TABLE 1

DESCRIPTIVE STATISTICS, K-R 8 RELIABILITY COEFFICIENTS AND STANDARD ERRORS OF MEASUREMENT FOR 16 AND 17-YEAR-OLDS. FORM A - COMPLETE GSAT AS A POWER TEST FOR DET STUDENTS

		GSAT										SED	
Age	N	Score	Max. Raw Score	Mean	SD	Skewness*	Kurtosis*	K-R 8	Standard error of measurement			Mean	SD
									Raw score	SA**	Stanine		
DET STUDENTS													
16	909	Non-verbal	75	29,13	10,88	0,10	-0,71	0,90	3,39	4,67	0,61	7,72	3,82
		Verbal	75	23,71	8,76	0,59	-0,13	0,85	3,42	5,86	0,77		
		Total	150	52,84	17,92	0,36	-0,49	0,93	4,87	4,08	0,53		
17	456	Non-verbal	75	29,45	11,25	0,21	-0,75	0,91	3,42	4,56	0,60	7,05	3,59
		Verbal	75	24,47	9,24	0,56	-0,23	0,87	3,44	5,58	0,73		
		Total	150	53,92	18,93	0,39	-0,59	0,93	4,89	3,87	0,51		
DET STUDENTS : ENVIRONMENTALLY DISADVANTAGED													
16	849	Non-verbal	75	29,06	10,78	0,10	-0,70	0,90	3,40	4,73	0,62	8,19	3,49
		Verbal	75	23,61	8,65	0,55	-0,25	0,85	3,42	5,93	0,77		
		Total	150	52,67	17,76	0,33	-0,52	0,93	4,87	4,11	0,54		
17	407	Non-verbal	75	28,97	11,21	0,24	-0,78	0,91	3,42	4,58	0,60	7,79	3,05
		Verbal	75	24,06	9,06	0,62	-0,03	0,86	3,44	5,70	0,74		
		Total	150	53,03	18,69	0,44	-0,50	0,93	4,89	3,92	0,51		
DET STUDENTS : NON-ENVIRONMENTALLY DISADVANTAGED													
16	60	Non-verbal	75	30,13	12,18	0,09	-0,95	0,92	3,33	4,10	0,54	1,00	0,94
		Verbal	75	25,12	10,15	0,89	0,42	0,89	3,42	5,05	0,66		
		Total	150	55,25	20,08	0,56	-0,44	0,94	4,86	3,63	0,47		
17	49	Non-verbal	75	33,47	10,86	0,04	-0,20	0,90	3,36	4,64	0,61	0,94	0,88
		Verbal	75	27,86	10,09	0,04	-1,02	0,87	3,39	5,04	0,66		
		Total	150	61,33	19,40	-0,02	-0,79	0,94	4,82	3,73	0,49		

* In a normal distribution = 0
** Scholastic Aptitude

TABLE 2

DESCRIPTIVE STATISTICS, K-R 8 RELIABILITY COEFFICIENTS AND STANDARD ERRORS OF MEASUREMENT FOR 16 AND 17-YEAR-OLDS. FORM A - COMPLETE GSAT AS A POWER TEST FOR DEC STUDENTS

		GSAT										SED	
Age	N	Score	Max. Raw Score	Mean	SD	Skew-ness*	Kur-tosis*	K-R 8	Standard error of measurement			Mean	SD
									Raw score	SA**	Sta-nine		
DEC STUDENTS : ENVIRONMENTALLY DISADVANTAGED													
16	364	Non-verbal	75	38,81	12,44	-0,11	-0,53	0,93	3,25	3,92	0,51	6,29	3,11
		Verbal	75	41,87	13,04	-0,01	-0,71	0,94	3,14	3,61	0,47		
		Total	150	80,68	24,27	-0,05	-0,58	0,96	4,57	2,82	0,37		
17	295	Non-verbal	75	42,52	12,08	-0,12	-0,41	0,93	3,17	3,94	0,51	5,57	2,64
		Verbal	75	47,13	11,72	-0,29	-0,40	0,93	2,99	3,83	0,50		
		Total	150	89,64	22,47	-0,20	-0,31	0,96	4,42	2,95	0,39		
DEC STUDENTS : NON-ENVIRONMENTALLY DISADVANTAGED													
16	458	Non-verbal	75	49,88	11,81	-0,71	0,35	0,93	3,02	3,84	0,50	1,56	0,68
		Verbal	75	53,99	11,44	-0,75	0,47	0,93	2,81	3,68	0,48		
		Total	150	103,87	22,28	-0,76	0,55	0,96	4,16	2,80	0,37		
17	426	Non-verbal	75	52,41	10,65	-0,88	0,93	0,92	2,94	4,14	0,54	1,60	0,65
		Verbal	75	57,11	10,77	-1,10	1,57	0,93	2,68	3,73	0,49		
		Total	150	109,52	20,41	-1,01	1,43	0,96	4,02	2,95	0,39		

* In a normal distribution = 0
** Scholastic Aptitude

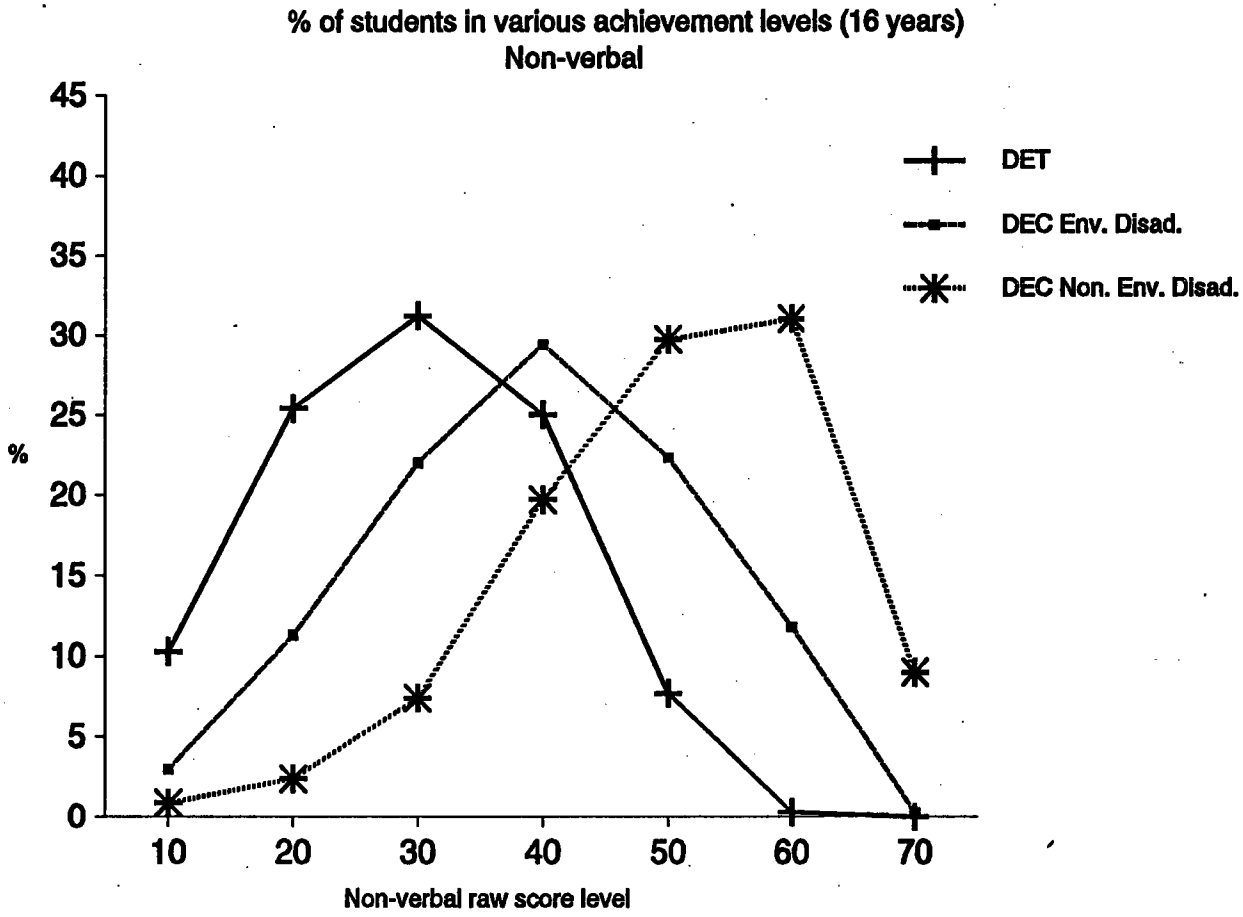

FIGURE 1
PERCENTAGE OF 16-YEAR-OLD STUDENTS IN VARIOUS ACHIEVEMENT LEVELS (NON-VERBAL)

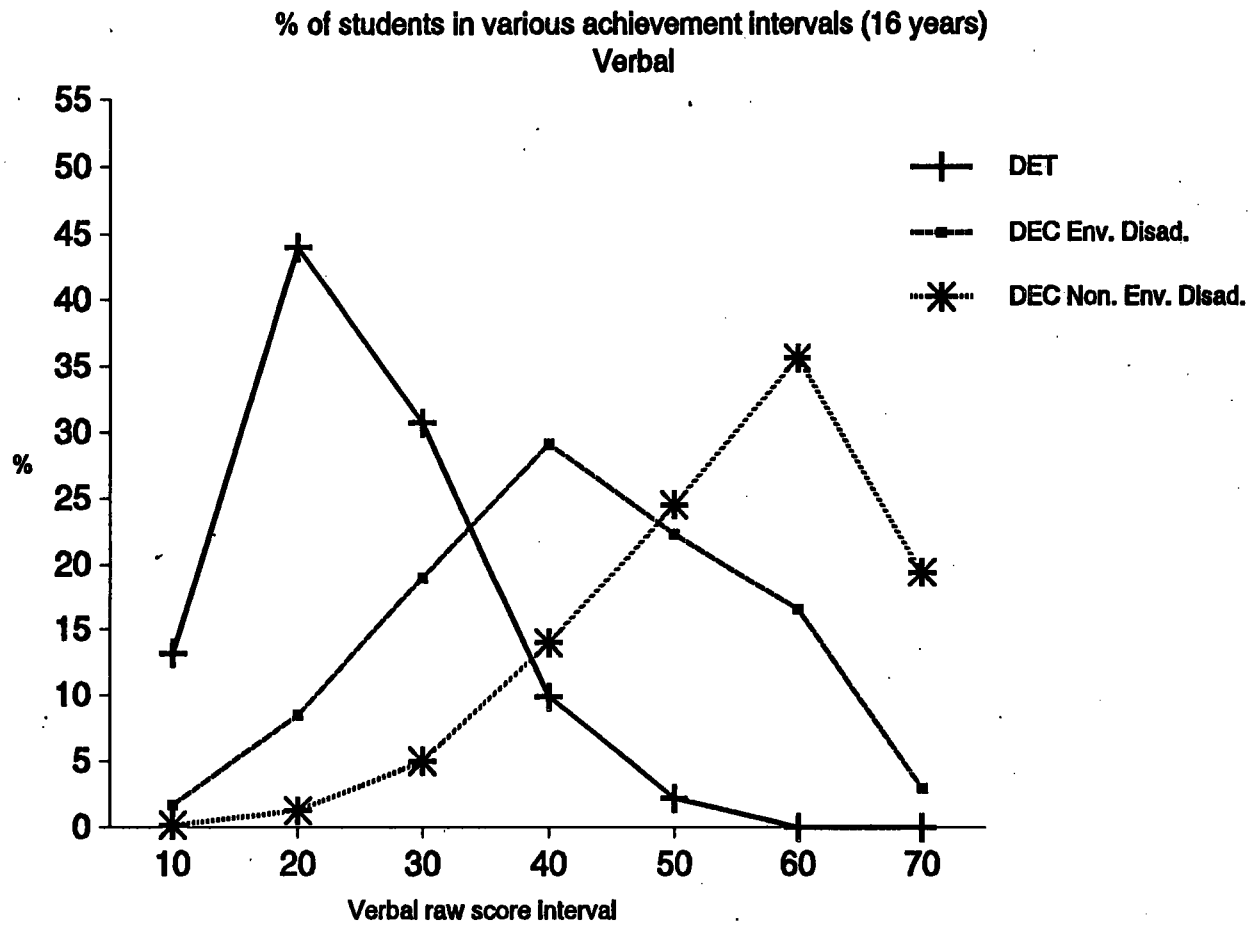

FIGURE 2
PERCENTAGE OF 16-YEAR-OLD STUDENTS IN VARIOUS ACHIEVEMENT LEVELS (VERBAL)

various ability levels. This is especially true for the non-verbal scores. As far as the verbal scores are concerned, a fairly large percentage of students received scores close to a chance score. This means that the verbal subtests were generally too difficult for DET students.

2.1.2 Parallel form reliability

Table 3 indicates the parallel form reliability for a sample of 16-year-old students. For DET students the reliability of the GSAT was higher for the non-verbal score than for the verbal score. See Table 1. This is probably the reason why the correlation between Form A and Form B (DET students) is higher for the non-verbal score than the verbal score. The parallel form reliability coefficients can be regarded as quite satisfactory. For DEC students the correlation between Form A and Form B is extremely high for both the verbal and the non-verbal score.

It appears that DET students improved their non-verbal as well as their verbal scores to a greater extent than did their DEC counterparts on the second application. In order to test for the significance of the difference of this improvement, an analysis of covariance was done. It was found, however, that only the improvement on the verbal scores was significantly different at the 1 % level. The difference on the non-verbal scores was not significant. This implies that the test is an equally reliable measure of non-verbal ability for both groups.

TABLE 3
PARALLEL FORM RELIABILITY FOR A SAMPLE OF 16-YEAR-OLD STUDENTS (ORDER OF ADMINISTRATION - FIRST FORM A AND THEN FORM B

Form		DET - Raw scores N = 375			DEC - Raw scores N = 222		
		Non-verbal	Verbal	Total	Non-verbal	Verbal	Total
A	Mean	29,85	24,36	54,21	45,56	49,36	94,91
	SD	10,76	8,53	17,52	13,45	14,48	27,12
B	Mean	33,65	25,90	59,55	48,17	49,73	97,90
	SD	11,30	8,08	17,80	13,79	14,38	27,24
	r	0,86	0,79	0,89	0,93	0,95	0,96

2.2 DIFFERENCES IN TEST SCORE MEANS

From Tables 1 and 2 it is clear that large mean test score differences exist between DET students and students of the Departments of Education and Culture. Both the mean verbal and non-verbal scores of DET students are much lower than those of students of the Department of Education and Culture. In order to standardize the size of these differences, they may be expressed in terms of the common standard deviation (Jensen, 1980). The SED means of environmentally disadvantaged DEC students are quite similar to the SED means of DET students.

As subtests are more homogeneous with regard to item type than the total non-verbal and verbal scores, this difference was calculated separately for each subtest. In this case the unweighted mean standard deviation of the three groups under consideration was used as a common denominator in terms of which the differences between mean

scores could be expressed. The results for 16 year olds and 17 year olds are reported separately in Table 4.

As almost all of the DET students could be considered to be environmentally disadvantaged, the most important group difference to consider is probably that between this group and the environmentally disadvantaged mother tongue speakers. The DET sample is indicated by a "1" in Table 4, and the environmentally disadvantaged sample who were tested in their mother tongue, by a "2". The column indicating the difference between means for these two groups is headed by 2-1 because the score of the DET students was subtracted from the score of the DEC students. The difference is first of all expressed in raw scores and additionally as a fraction of the common standard deviation. By expressing the difference in terms of the common standard deviation it becomes possible to compare the size of the difference across subtests.

For the verbal subtests the size of the difference between means varied between 1,24 and 1,72 for 16 year olds. The largest difference occurred for Word Pairs and the smallest for Verbal Reasoning. Achievement in Word Pairs is probably more dependent on a good knowledge of the language than is the case with Verbal Reasoning. The size of the differences is considerably smaller for the non-verbal subtests and vary between 0,54 and 0,88 standard deviations. The difference is smallest for Pattern Completion and largest for Number Series. It could be argued that achievement in Number Series is more sensitive to appropriate formal educational experiences than Pattern Completion. On the whole, the difference for the verbal subtests is about 1,5 standard deviations and that for the non-verbal scores about 0,75 standard deviations. Differences for the verbal subtests are about twice as large as the difference for the non-verbal subtests. This difference could probably be attributed mainly to a language backlog.

The two DEC groups were both tested in their mother tongue. For them differences in terms of the common standard deviation ranged from 0,93 to 1,02 on the verbal subtests and from 0,77 to 0,86 on the non-verbal subtests. The differences on the verbal subtests are only slightly larger than those on the non-verbal subtests. It is possible that the differences could be related to subculture differences, differences in quality of schooling and/or environmental deprivation.

The pattern of difference scores on the various subtests for 17-year-olds is generally the same as that observed for 16-year-olds. The differences observed between the DET students and the environmentally disadvantaged mother tongue speakers appear to be slightly larger for both the verbal and the non-verbal subtests, and the difference for the verbal subtests remains about twice as large.

According to the manual all the subtests measure mainly the ***g*** factor in the target groups for which the test was standardized. This is also borne out by the fact that differences for the verbal and the non-verbal subtests respectively were more or less of the same size for DEC students. From the findings presented here, it may be deduced that the verbal subtests severely underestimate the intellectual abilities of DET students.

2.3 CONSTRUCT VALIDITY

Validity concerns that which a test measures and how well it is measured. It tells us what can be inferred from test scores. Validity always concerns the relation between test achievement and other facts known about the construct being measured that can be observed independently. Validity is linked to a particular group, although some degree of generalization is common practice in the interpretation of test scores.

2.3.1 Intercorrrelations of subtests

Although the contents of the GSAT subtests differ considerably, the aim of each of the subtests is to determine the student's problem-solving ability. High correlations between

TABLE 4

MEAN DIFFERENCES OF THE THREE GROUPS ON THE SIX SUBTESTS EXPRESSED IN TERMS OF THE MEAN STANDARD DEVIATION (16 YEARS)

	DET = 1			DEC Env Disadv = 2			DEC Non-Env Disadv = 3				2-1		3-2	
Subtest	**N**	**Mean**	**SD**	**N**	**Mean**	**SD**	**N**	**Mean**	**SD**	**Mean SD**	**Diff**	**Diff in terms of SD**	**Diff**	**Diff in terms of SD**
Word Analogies	909	8,14	3,73	365	14,11	4,77	458	17,92	3,79	4,10	5,97	**1,46**	3,81	0,93
Number Series	909	8,40	4,06	365	12,48	5,05	458	16,06	4,74	4,62	4,08	**0,88**	3,58	0,77
Verbal Reasoning	909	7,20	3,57	365	12,67	4,98	458	16,93	4,68	4,41	5,47	**1,24**	4,26	0,97
Pattern Completion	909	11,06	4,31	365	13,35	4,41	458	17,00	4,06	4,26	2,29	**0,54**	3,65	0,86
Word Pairs	909	8,37	2,98	365	15,13	4,66	458	19,14	4,13	3,92	6,76	**1,72**	4,01	1,02
Figure Analogies	909	9,67	4,21	365	13,01	4,69	458	16,82	4,35	4,41	3,34	**0,76**	3,81	0,86

MEAN DIFFERENCES OF THE THREE GROUPS ON THE SIX SUBTESTS EXPRESSED IN TERMS OF THE MEAN STANDARD DEVIATION (17 YEARS)

	DET = 1			DEC Env Disadv = 2			DEC Non-Env Disadv = 3				2-1		3-2	
Subtest	**N**	**Mean**	**SD**	**N**	**Mean**	**SD**	**N**	**Mean**	**SD**	**Mean SD**	**Diff**	**Diff in terms of SD**	**Diff**	**Diff in terms of SD**
Word Analogies	456	8,10	3,85	296	15,91	4,08	431	18,71	3,79	3,91	7,81	**2,00**	2,80	0,72
Number Series	456	8,52	4,00	296	13,73	4,84	431	17,03	4,42	4,42	5,21	**1,18**	3,30	0,75
Verbal Reasoning	456	7,56	3,66	296	14,35	4,56	431	18,08	4,20	4,20	6,79	**1,62**	3,73	0,89
Pattern Completion	456	10,87	4,47	296	14,91	4,17	431	17,58	4,09	4,09	4,04	**0,99**	2,67	0,65
Word Pairs	456	8,80	3,23	296	16,89	4,26	431	20,21	3,78	3,78	8,09	**2,14**	3,32	0,88
Figure Analogies	456	10,06	4,56	296	13,88	4,44	431	17,69	4,36	4,36	3,82	**0,88**	3,81	0,87

subtests can therefore be expected. Table 5 indicates the intercorrelation matrix of 16-year-olds. The intercorrelations of the subtests vary from 0,42 to 0,68. The highest correlation (0,68) is between Pattern Completion and Figure Analogies. The correlations between the verbal subtests and the non-verbal subtests, appear to be slightly lower than those among non-verbal and verbal subtests respectively. The intercorrelations of all the subtests are positive and fairly high, and achievement on all subtests is therefore quite probably determined mainly by a common factor.

TABLE 5
INTERCORRELATIONS OF SUBTESTS FOR 16-YEAR-OLDS (DET STUDENTS)

Form A (N = 909)	Mean	SD	WA	WP	VR	NS	PC	FA
Word Analogies (WA)	8,14	3,73	1,00					
Word Pairs (WP)	8,37	2,98	0,56	1,00				
Verbal Reasoning (VR)	7,20	3,57	0,61	0,58	1,00			
Number Series (NS)	8,40	4,06	0,54	0,42	0,54	1,00		
Pattern Completion (PC)	11,06	4,31	0,51	0,42	0,50	0,60	1,00	
Figure Analogies (FA)	9,67	4,21	0,47	0,43	0,52	0,59	0,68	1,00

2.3.2 Correlations between non-verbal and verbal scores

Table 6 shows the correlations between non-verbal and verbal scores for 16 and 17-year-olds. For DEC the correlations obtained for environmentally disadvantaged students are similar to those obtained for their non-environmentally disadvantaged counterparts. The correlations of DET students are slightly lower.

2.3.3 Principal component analysis and factor analysis

A box-test for the equivalence of variance-covariance matrices was done for 16 and 17-year-olds (Box, 1949). The variance-covariance matrices did not differ significantly. Since there was no significant difference, the 16 and 17-year-olds were treated as one group in order to carry out a factor analysis on a very large number of students.

A principal component analysis was performed on the six subtest scores, to determine the number of factors in the data space. The first principal component explained 62 % of the variance in the factor space. A second component explained 12 % of the variance, and the rest of the variance was distributed relatively evenly across the other principal components. For DEC the first principal component explained more than 70 % of the variance.

Table 7 shows the loadings on the first unrotated principal factor. All the subtests have high loadings on a general factor. The loadings do appear to be slightly lower for DET, especially the loading of Word Pairs.

Since a second principal component explained 12 % of the variance, a two-factor structure was specified and a direct quartimin oblique rotation executed (BMDP, 1979). The rotated factor loadings are presented in Table 8.

For DET students, a separate non-verbal and verbal factor could easily be distinguished. The two factors were, however, strongly correlated (0,76) and this implies the presence of a common underlying factor.

TABLE 6
BRAVAIS-PEARSON CORRELATIONS BETWEEN NON-VERBAL AND VERBAL SCORES

DET STUDENTS		N	r
16 Years	Non-environmentally disadvantaged	60	0,61
	Environmentally disadvantaged	849	0,67
	All	909	0,66
17 Years	Non-environmentally disadvantaged	49	0,71
	Environmentally disadvantaged	407	0,70
	All	456	0,70
DEC STUDENTS		**N**	**r**
16 Years	Non-environmentally disadvantaged	458	0,84
	Environmentally disadvantaged	364	0,82
	All	921	0,85
17 Years	Non-environmentally disadvantaged	426	0,81
	Environmentally disadvantaged	295	0,78
	All	786	0,83

TABLE 7
FACTOR LOADINGS ON THE FIRST UNROTATED PRINCIPAL FACTOR

Subtest	DET : 16 & 17 Years	DEC : 16 Years	DEC : 17 Years
	N = 1365	N = 921	N = 786
Word Analogies	0,738	0,836	0,831
Word Pairs	0,691	0,873	0,850
Verbal Reasoning	0,768	0,888	0,889
Number Series	0,735	0,827	0,831
Pattern Completion	0,773	0,829	0,820
Figure Analogies	0,760	0,860	0,852

For DEC students a separate non-verbal and verbal factor could be distinguished with great difficulty only. The second factor explained very little of the variance and did not correlate with the first factor.

In the case of DET students, the loading on the second factor (the non-verbal factor) is especially high for Pattern Completion and Figure Analogies. There is a similarity in the appearance of the two tests and, as was seen in Table 5, the highest correlation between two subtests was between Pattern Completion and Figure Analogies (0,68). Given the findings reported on mean differences, the deduction could be made that, in the case of DET students, achievement on those two subtests could possibly give a better indication

TABLE 8
FACTOR LOADINGS WHEN A TWO-FACTOR STRUCTURE IS SPECIFIED AND A DIRECT QUARTIMIN OBLIQUE ROTATION IS EXECUTED

Subtest	DET Students 16 & 17 Years N = 1365		DEC : Environ. disadv. 16 Years N = 713		DEC : Non-envir. disad. 16 Years N = 939	
	Factor 1	Factor 2	Factor 1	Factor 2	Factor 1	Factor 2
Word Analogies	0,756	0,025	0,824	0,152	0,783	0,259
Word Pairs	0,783	-0,053	0,849	0,238	0,829	0,246
Verbal Reasoning	0,731	0,083	0,882	0,070	0,851	0,057
Number Series	0,296	0,488	0,792	-0,059	0,818	-0,048
Pattern Completion	-0,056	0,884	0,816	-0,196	0,841	-0,226
Figure Analogies	0,026	0,787	0,859	-0,170	0,831	-0,244
Factor Correlation	0,764		0,021		0,032	

of a student's general scholastic aptitude than the GSAT as a whole, especially when the language problem and possible differences between the quality of mathematics instructions in various classrooms are taken into consideration.

2.4 PREDICTIVE VALIDITY

2.4.1 Correlation with scholastic achievement

Since the GSAT measures general scholastic aptitude and therefore by implication attempts to predict scholastic achievement, it is expected that actual achievement at school will be an appropriate external criterion for validity.

2.4.1.1 Subject percentage

Some of the schools involved provided the percentages obtained by their Standard 6 to 9 students in the various school subjects in the final examination. The correlations between GSAT raw scores and the percentages obtained for the different subjects in the final examination are reported separately for the different standards. However they are not reported when fewer than 30 students' examination marks for a particular subject were available. Correlations for Standard 6 appear in Table 9, those for Standard 7 in Table 10, those for Standard 8 in Table 11, and those for Standard 9 in Table 12.

The majority of correlations were significant at the 1 % level. The correlations with subject percentages were somewhat lower than the correlations with scholastic achievement tests. This may probably be attributed to varying standards in different schools.

Correlations between GSAT raw score and final examination marks for History and Geography were very low. This is especially true for Standards 6 and 7.

2.4.1.2 Scholastic achievement tests

Correlations As the standard of examinations may differ between schools at the Standard 7 level, scholastic achievement tests in Mathematics, Science and Geography were administered to Standard 8 students so as to serve as criteria. The tests attempted to cover the respective Standard 7 syllabuses, consequently achievement can be compared over

TABLE 9

PREDICTIVE VALIDITY OF THE GSAT IN RESPECT OF CERTAIN FINAL EXAMINATION PERCENTAGES FOR STANDARD 6

Raw score		Afrikaans	English	Mathe-matics	General Science	History	Geo-graphy	Average
		N = 295	N = 295	N = 295	N = 295	N = 200	N = 97	N = 264
Final %	Mean	45,41	42,32	34,57	40,20	37,68	40,03	42,00
	SD	11,60	10,69	13,42	13,37	13,31	17,79	9,50
Non-verbal	Mean	22,51	22,51	22,51	22,51	22,75	23,82	22,35
	SD	9,34	9,34	9,34	9,34	9,23	10,11	9,48
	r	0,20*	0,28*	0,38*	0,40*	0,08	0,03	0,41*
Verbal	Mean	17,88	17,88	17,88	17,88	17,66	18,34	17,84
	SD	5,70	5,70	5,70	5,70	5,15	5,69	5,75
	r	0,31*	0,32*	0,24*	0,35*	0,08	-0,01	0,37*
Total	Mean	40,39	40,39	40,39	40,39	40,41	42,16	40,19
	SD	13,18	13,18	13,18	13,18	12,45	14,04	13,43
	r	0,28*	0,34*	0,37*	0,44*	0,09	0,01	0,45*

* Significant at the 1 % level

TABLE 10

PREDICTIVE VALIDITY OF THE GSAT IN RESPECT OF CERTAIN FINAL EXAMINATION PERCENTAGES FOR STANDARD 7

Raw score		Afrikaans	English	Mathe-matics	General Science	History	Geo-graphy	Average
		N = 325	N = 325	N = 325	N = 325	N = 196	N = 124	N = 298
Final %	Mean	43,15	44,30	32,59	38,69	41,58	40,94	42,24
	SD	11,34	11,24	14,46	12,85	13,83	15,41	8,83
Non-verbal	Mean	27,04	27,04	27,04	27,04	26,93	25,95	26,72
	SD	9,74	9,74	9,74	9,74	10,38	10,20	9,59
	r	0,21*	0,30*	0,33*	0,20*	-0,07	-0,04	0,30*
Verbal	Mean	21,39	21,39	21,39	21,39	21,19	20,44	21,23
	SD	7,20	7,20	7,20	7,20	7,56	7,50	7,22
	r	0,31*	0,52*	0,31*	0,30*	0,02	-0,09	0,44*
Total	Mean	48,42	48,42	48,42	48,42	48,13	46,40	47,96
	SD	14,94	14,94	14,94	14,94	15,90	15,76	14,88
	r	0,29*	0,44*	0,36*	0,28*	-0,03	-0,07	0,41*

* Significant at the 1 % level

TABLE 11

PREDICTIVE VALIDITY OF THE GSAT IN RESPECT OF CERTAIN FINAL EXAMINATION PERCENTAGES FOR STANDARD 8

Raw score		Afrikaans	English	Mathe-matics	Biology	Physic. Science	History	Average
		N = 632	N = 514	N = 495	N = 527	N = 162	N = 319	N = 589
Final %	Mean	43,54	45,03	28,99	40,28	41,98	37,61	42,16
	SD	10,58	10,86	12,34	14,63	14,97	14,02	9,02
Non-verbal	Mean	31,40	31,24	32,20	31,07	35,44	29,65	31,39
	SD	9,97	9,94	9,92	9,72	9,32	9,82	9,99
	r	0,18*	0,31*	0,36*	0,28*	0,27*	0,17*	0,29*
Verbal	Mean	26,14	25,93	26,86	25,88	29,35	25,27	26,14
	SD	7,75	7,79	7,91	7,69	8,35	7,25	7,73
	r	0,37*	0,46*	0,26*	0,34*	0,28*	0,30*	0,36*
Total	Mean	57,54	57,17	59,06	56,95	64,79	54,91	57,53
	SD	15,90	15,89	16,01	15,59	16,07	15,19	15,90
	r	0,29*	0,42*	0,35*	0,34*	0,30*	0,26*	0,35*

* Significant at the 1 % level

TABLE 12

PREDICTIVE VALIDITY OF THE GSAT IN RESPECT OF CERTAIN FINAL EXAMINATION PERCENTAGES FOR STANDARD 9

Raw score		Afrikaans	English	Mathe-matics	Biology	General Science	History	Average
		N = 129	N = 122	N = 46	N = 108	N = 31	N = 58	N = 133
Final %	Mean	40,96	46,97	36,15	39,04	38,74	43,31	41,70
	SD	11,52	11,09	16,20	16,71	16,99	12,41	9,90
Non-verbal	Mean	34,81	35,43	36,61	34,63	38,52	33,62	34,94
	SD	9,95	10,12	10,20	9,56	8,68	9,87	9,82
	r	0,34*	0,04	0,30	0,43*	0,41	0,04	0,38*
Verbal	Mean	30,08	29,98	31,91	30,05	32,97	29,60	30,32
	SD	7,50	7,39	6,98	7,56	6,85	8,10	7,56
	r	0,53*	0,38*	0,32	0,39*	0,43	0,18	0,56*
Total	Mean	64,88	65,42	68,52	64,68	71,48	63,22	65,26
	SD	15,52	15,76	15,37	15,44	13,52	16,26	15,52
	r	0,47*	0,20	0,34	0,45*	0,48*	0,12	0,51*

* Significant at the 1 % level

shools. Table 13 shows the correlation between GSAT scores and scholastic achievement tests.

In Table 13, the descriptive statistics for scholastic achievement tests are given for DET students as well as DEC students, and could be compared. The mean scores in the scholastic achievement tests were not much lower for DET students than for the environmentally disadvantaged DEC students - approximately one third to a half standard deviation lower. Environmentally disadvantaged DEC students scored about one standard deviation lower than non-environmentally disadvantaged DEC students.

For environmentally disadvantaged students SA scores cannot be regarded as an estimate of intelligence, since the raw scores that are obtained are probably to an indefinite extent influenced by a lack of knowledge of and familiarity with the test content. Since most of the DET students may be regarded as environmentally disadvantaged, GSAT raw scores have not been converted to SA Scores.

In order to place the GSAT raw scores in perspective, means of raw scores have been converted to SA_2 norm scores and are presented in the shaded areas. SA_2 norm scores are norms for all English- and Afrikaans-speaking persons in the RSA. Age norms for 16 years and 6 months to 16 years and 11 months (Table 3 in the *Manual for the General Scholastic Aptitude Test Senior Series)* have been used for the conversion.

The correlations between GSAT raw scores and scholastic achievement tests are also presented in Table 13.

For DET students, the correlations between GSAT raw scores and scholastic achievement tests vary between 0,26 (Geography & GSAT Non-verbal) and 0,43 (Mathematics & GSAT Total). For DEC (environmentally disadvantaged) students, the correlations between GSAT raw scores and scholastic achievement tests vary between 0,21 (Geography & GSAT Non-verbal) and 0,47 (Mathematics & GSAT Total). For DEC (non-environmentally disadvantaged) students, the correlations between GSAT raw scores and scholastic achievement tests vary between 0,44 (Geography & GSAT Non-verbal and also Geography & GSAT Verbal) and 0,65 (Mathematics & GSAT Total). All the correlations are significant at the 1 % level. Correlations appeared to be slightly higher for the DEC non-environmentally disadvantaged group than for the others.

Regression lines for scholastic achievement tests Even though the correlations with the achievement tests are not much lower for DET students than for DEC students, it may still be the case that scholastic achievement in standardized tests is systematically over- or underpredicted for DET students by the GSAT. In order to investigate this hypothesis the regression lines of the groups were tested for equality of slopes and equality of intercepts. Non-verbal and verbal GSAT scores were respectively used as predictors. The results appear in Table 14. The percentage of variance explained by a single regression line as well as the percentage of variance explained by separate regression lines is also given.

The regression lines for the various scholastic tests are graphically represented in figures 3 to 8.

- GSAT non-verbal score as predictor

When the non-verbal score was used as predictor slopes differed significantly for all scholastic achievement tests. The percentage of variance explained by the interaction effect varied from 3,29 % for Mathematics to 1,02 % for Geography. This is rather small when compared with the variance explained by a common regression line. Strictly speaking comparison of intercepts does not make sense if slopes differ signifficantly (Jensen, 1980). The percentage of variance explained by the main effect varied from 0,76 % for Mathematics to to 5,87 % for Geography. Only 33,32 % of the variance in Geography could be explained by a common regression line whereas 40,20 % of the variance could be explained by separate regression lines. Table 15 shows that the mean Geography score of DET students will be overestimated by 1,88 points should the re-

TABLE 13

CORRELATION BETWEEN GSAT SCORES AND SCHOLASTIC ACHIEVEMENT TESTS FOR STANDARD 8 PUPILS

		DET Students			DEC : Environ. disad.			DEC : Non-envir. disad.		
		Maths	Ph. Sc.	Geog.	Maths	Ph. Sc.	Geog.	Maths	Ph.Sc.	Geog.
Scolastic Achievement Tests										
	N	495	495	496	115	115	115	279	248	274
	Max.	30	30	30	30	30	30	30	30	30
	Mean	8,75	11,34	10,47	9,78	12,42	12,69	14,63	16,15	15,85
	SD	3,20	3,46	3,08	3,40	3,34	3,25	5,09	4,45	3,55
GSAT : Raw Score										
Non-verbal	Mean	30,58	30,58	30,62	37,44	37,44	37,48	50,10	49,97	49,97
	SA_2	85	85	85	91	91	91	104	104	104
	SD	9,65	9,65	9,69	10,23	10,23	10,25	10,17	10,16	10,21
	r	0,37	0,30	0,26	0,41	0,30	0,21	0,61	0,52	0,44
Verbal	Mean	25,93	25,93	25,95	41,15	41,15	41,08	54,55	54,32	54,48
	SA_2	80	80	80	92	92	92	105	105	105
	SD	7,38	7,38	7,39	10,67	10,67	10,71	8,70	8,61	8,76
	r	0,39	0,40	0,38	0,46	0,32	0,37	0,61	0,60	0,44
Total	Mean	56,51	56,51	56,57	78,59	78,59	78,56	104,65	104,29	104,45
	SA_2	81	81	81	92	92	92	105	105	105
	SD	15,11	15,11	15,16	19,41	19,41	19,40	17,73	17,59	17,82
	r	0,43	0,39	0,35	0,47	0,34	0,31	0,65	0,60	0,47

TABLE 14

TESTS FOR THE EQUALITY OF REGRESSION LINES AS WELL AS THE PERCENTAGES OF VARIANCE EXPLAINED BY THE INTERACTION AND MAIN EFFECT TERMS

Prediction of achievement in Standard 8 with non-verbal and verbal scores as predictors									
Hypotheses regarding differences between regression lines						% of variance explained by:			
Subject	Group	Predictor	N	Slopes F	Intercepts F	Single Regression line	Group main effect	Interaction	Separate Regres. lines
Mathematics	DET	NV	498			13,69			
		V	498			15,14			
	DEC	NV	434			40,96			
		V	434			41,96			
	DET + DEC	NV	932	13,44*	12,68*	42,83	0,76	3,29	46,88
		V	932	26,93*	26,05*	44,64	1,51	1,51	47,66
Physical Science	DET	NV	498			9,36			
		V	498			16,32			
	DEC	NV	403			29,92			
		V	403			35,88			
	DET + DEC	NV	901	20,50*	14,80*	32,09	1,07	1,50	34,66
		V	901	3,95	22,58*	38,14	1,52	0,26	39,92
Geography	DET	NV	499			6,54			
		V	499			14,52			
	DEC	NV	429			23,89			
		V	429			29,48			
	DET + DEC	NV	928	15,69*	90,61*	33,32	5,87	1,02	40,20
		V	928	1,14	0,04	44,89	0,00	0,07	44,96

* Significant at the 1 % level

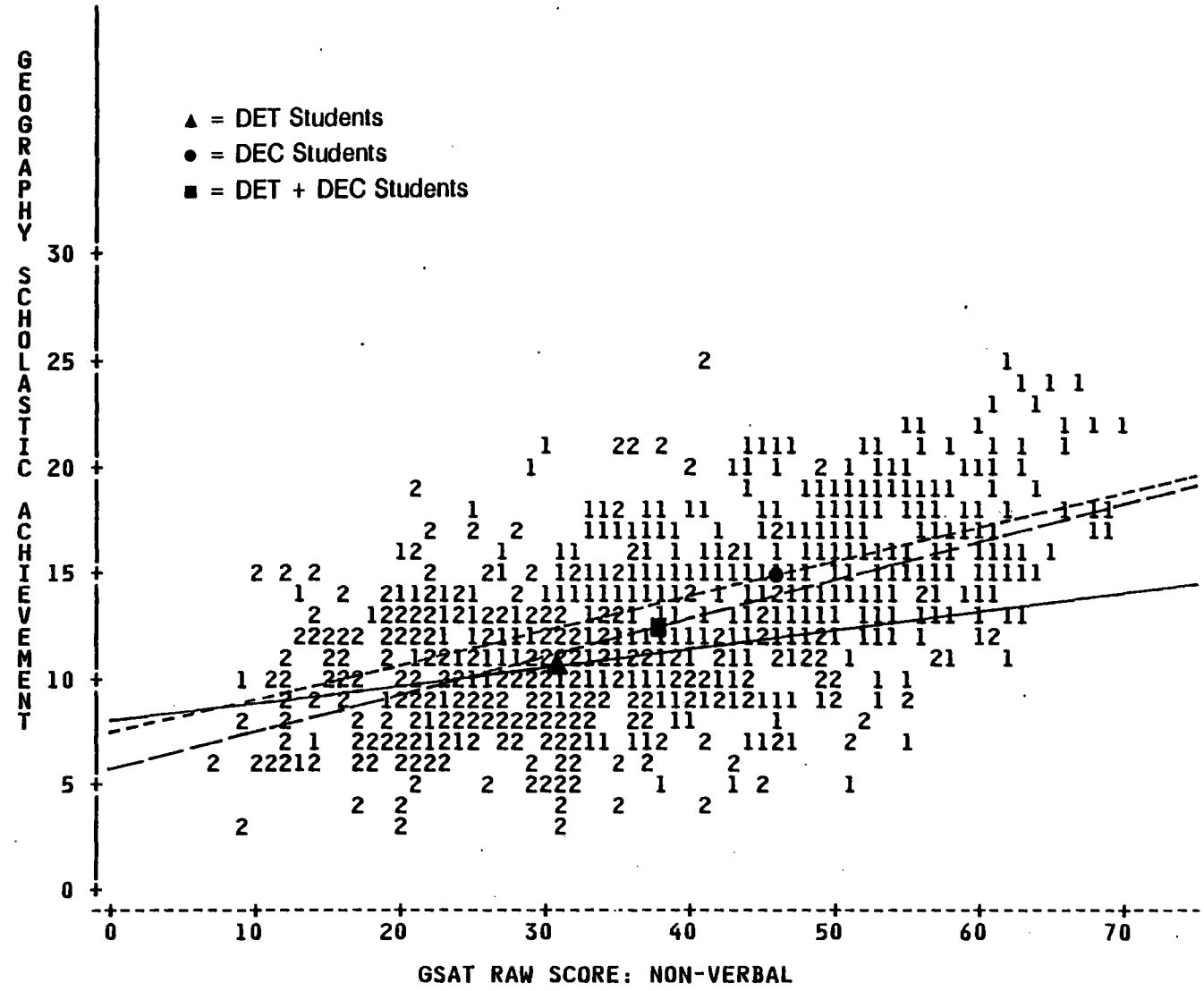

FIGURE 3
REGRESSION OF GEOGRAPHY ON NON-VERBAL GSAT SCORE FOR STANDARD 8

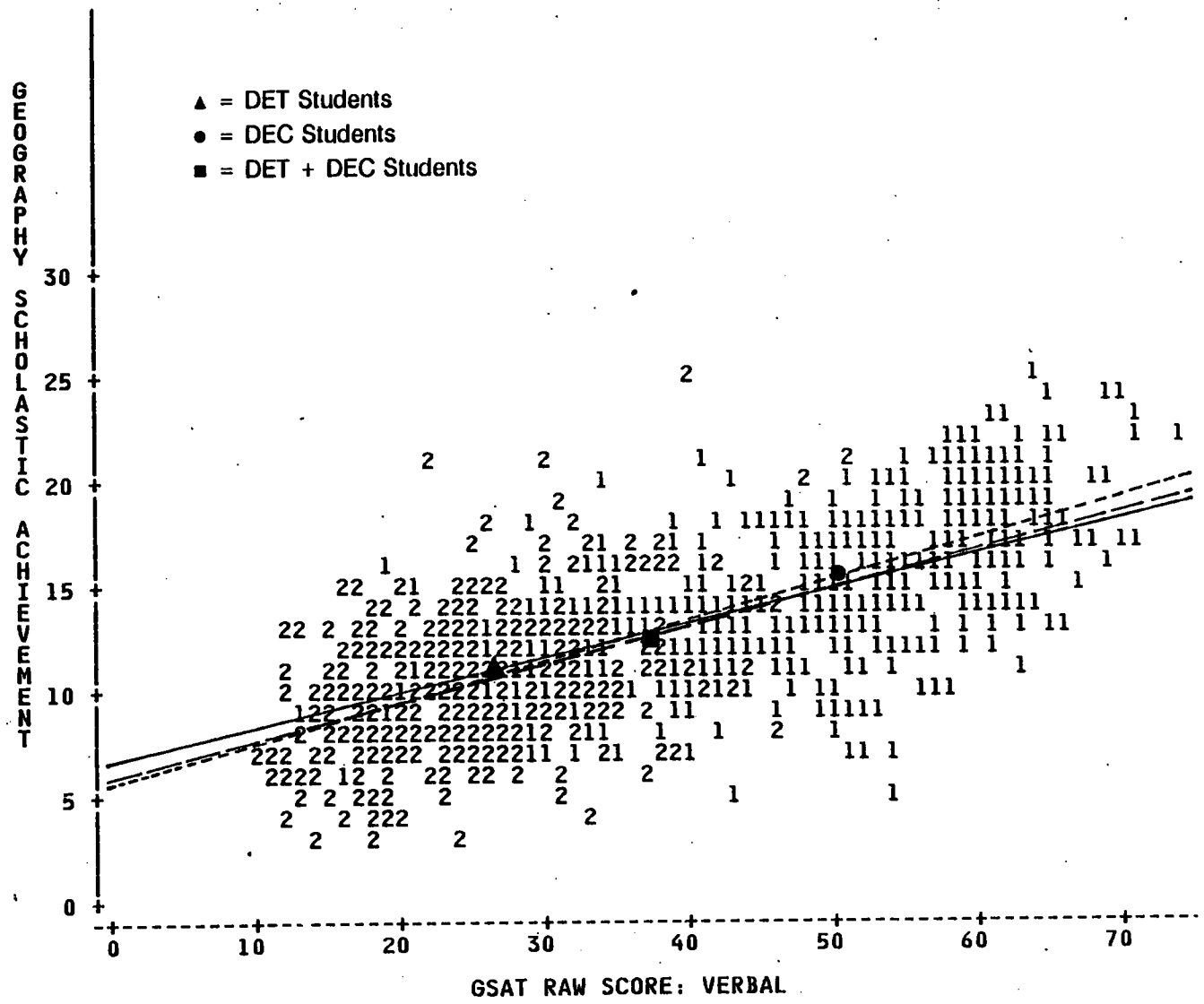

FIGURE 4
REGRESSION OF GEOGRAPHY ON VERBAL GSAT SCORE FOR STANDARD 8

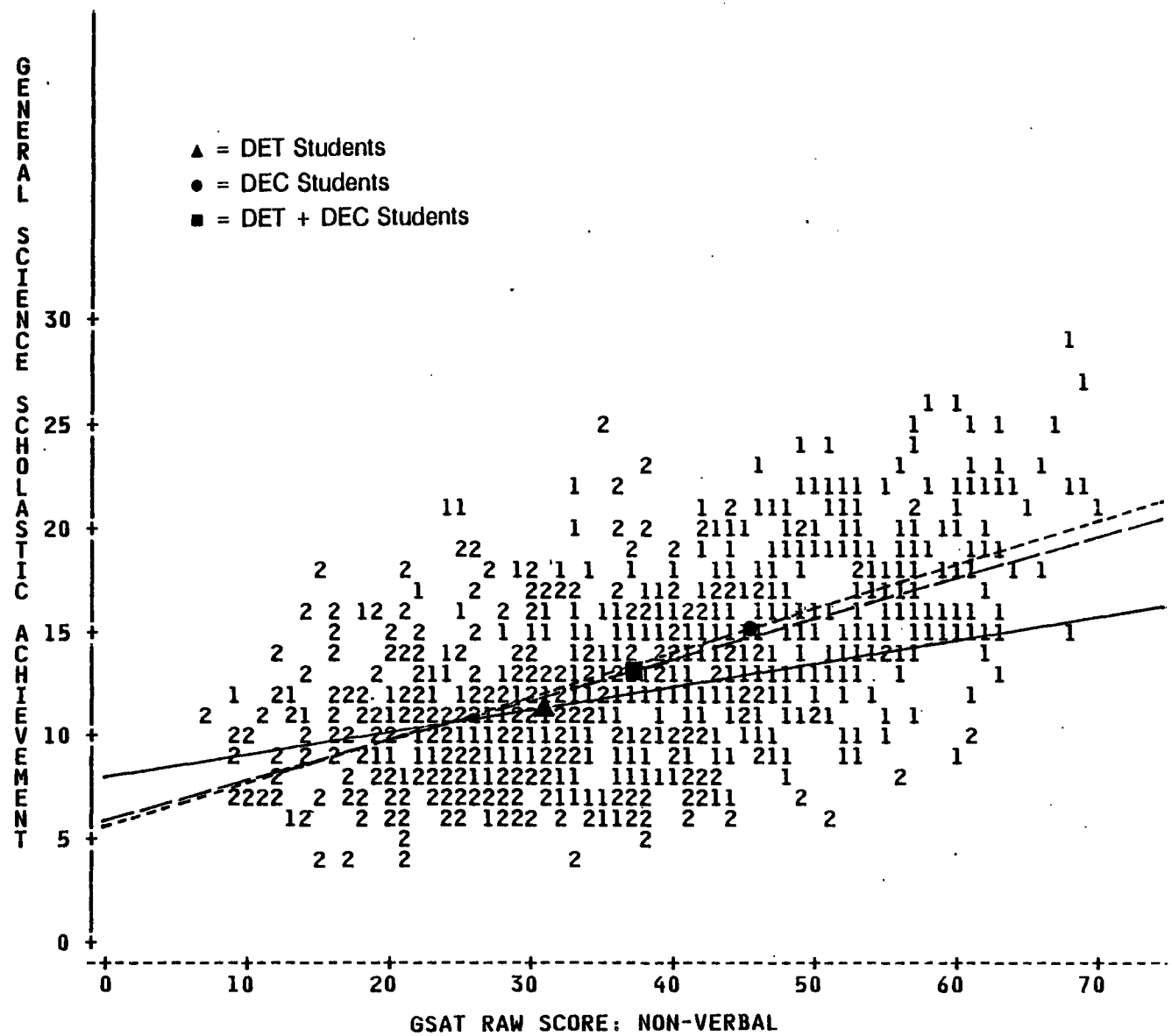

FIGURE 5
REGRESSION OF GENERAL SCIENCE ON NON-VERBAL GSAT SCORE FOR STANDARD 8

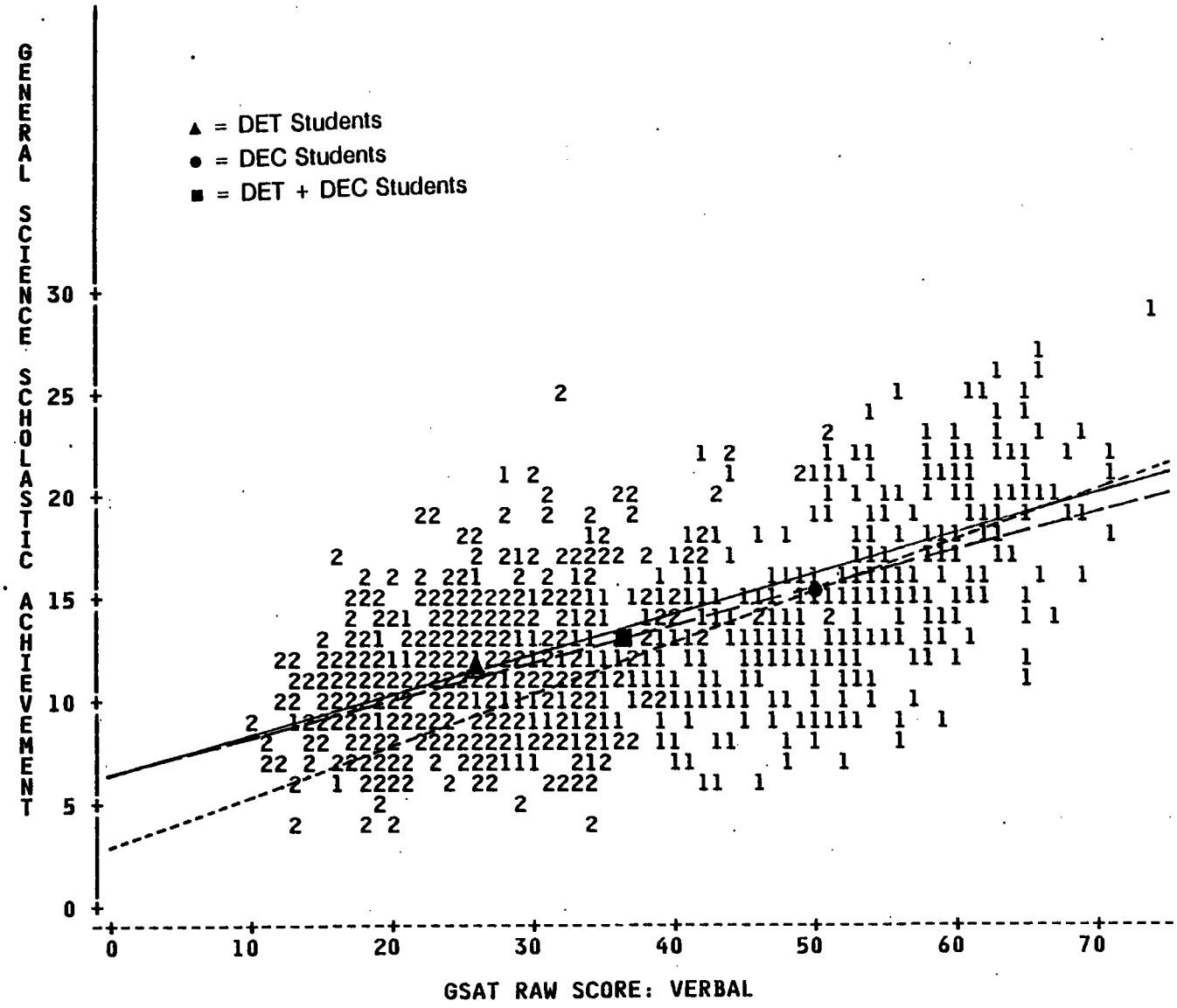

FIGURE 6
REGRESSION OF GENERAL SCIENCE ON VERBAL GSAT SCORE FOR STANDARD 8

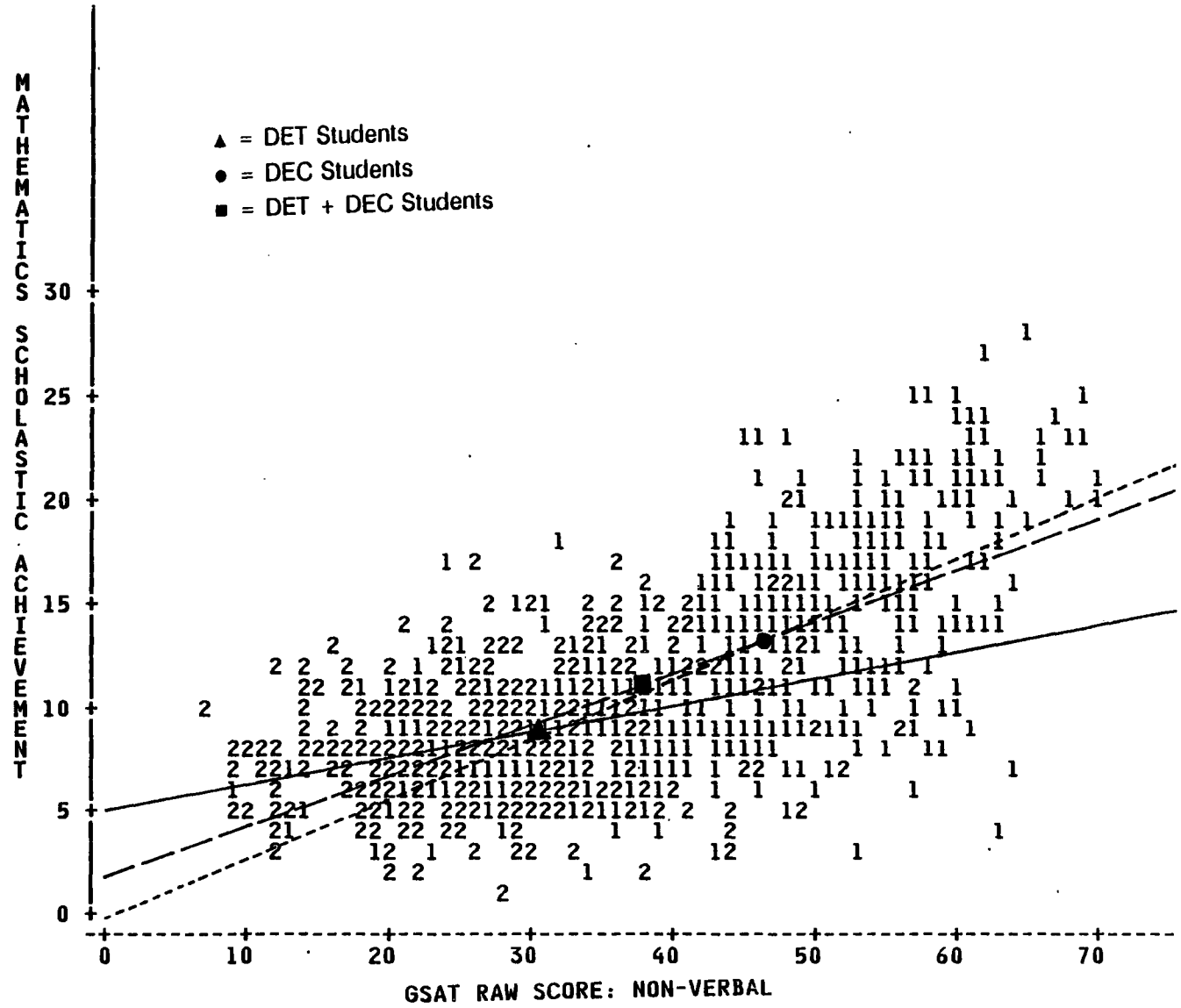

FIGURE 7
REGRESSION OF MATHEMATICS ON NON-VERBAL GSAT SCORE FOR STANDARD 8

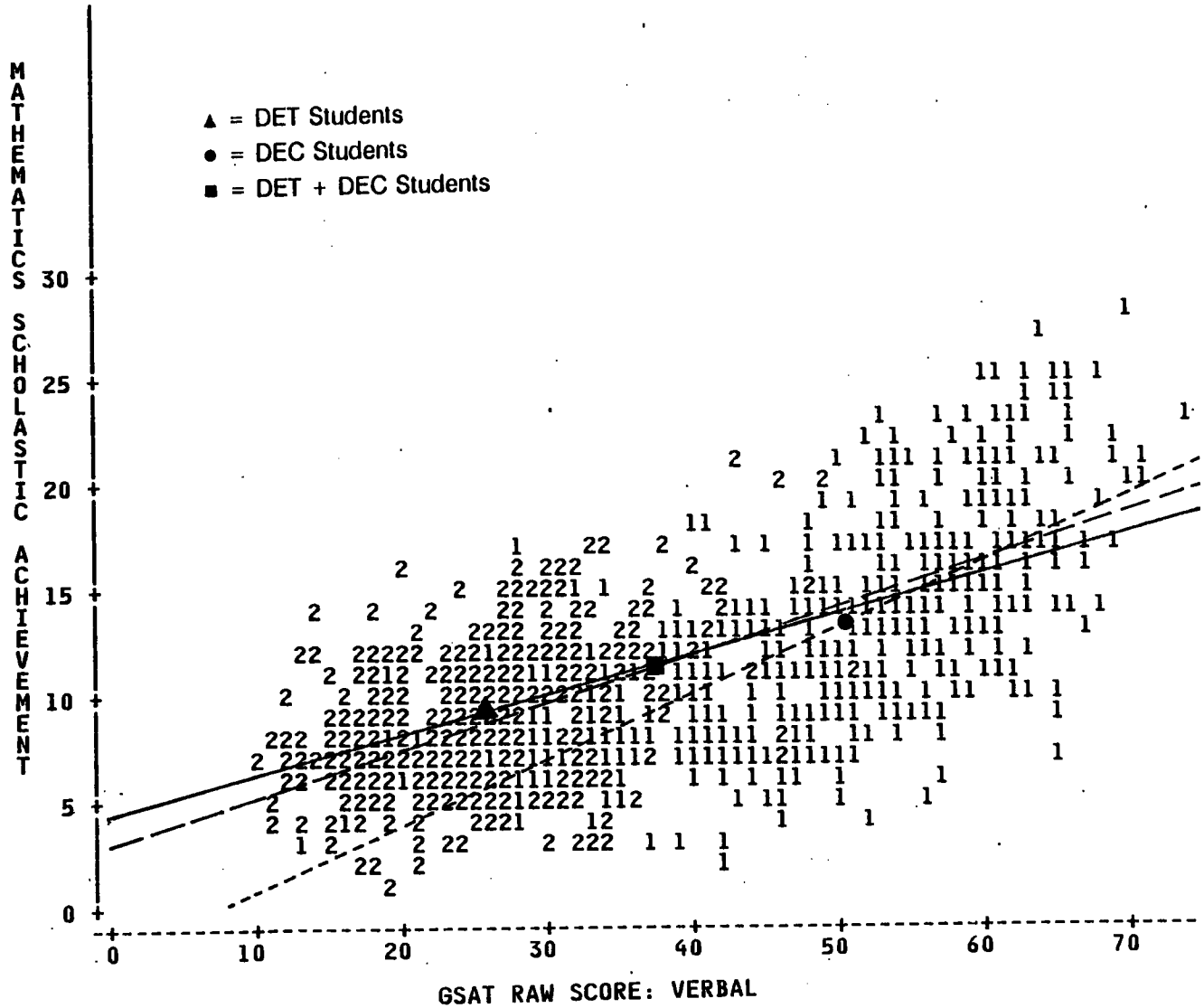

FIGURE 8
REGRESSION OF MATHEMATICS ON VERBAL GSAT SCORE FOR STANDARD 8

TABLE 15

REGRESSION EQUATIONS FOR SCHOLASTIC ACHIEVEMENT TEST SCORES ON NON-VERBAL AND VERBAL GSAT RAW SCORES

Group	N	r	Regression equation	Mean X	Mean Y	Y'
All	932	0,654	Mathematics = 0,238 x NV + 1,801	37,77	10,78	
DET	498	0,372	Mathematics = 0,123 x NV + 4,985	30,54	08,75	8,64
DEC	434	0,641	Mathematics = 0,287 x NV + (-0,120)	46,08	13,12	
All	932	0,668	Mathematics = 0,207 x V + 3,042	37,31	10,78	
DET	498	0,389	Mathematics = 0,169 x V + 4,373	25,90	08,75	5,70
DEC	434	0,648	Mathematics = 0,3027 x V + (-2,137)	50,39	13,12	
All	901	0,566	Physical Science = 0,189 x NV + 5,89	37,32	12,95	
DET	498	0,307	Physical Science = 0,110 x NV + 7,974	30,54	11,34	11,75
DEC	403	0,547	Physical Science = 0,211 x NV + 5,308	45,69	14,94	
All	901	0,618	Physical Science = 0,177 x V + 6,459	36,65	12,95	
DET	498	0,404	Physical Science = 0,190 x V + 6,412	25,90	11,34	9,16
DEC	403	0,599	Physical Science = 0,241 x V + 2,920	49,93	14,94	
All	928	0,577	Geography = 0,177 x NV + 5,780	37,69	12,46	
DET	499	0,256	Geography = 0,081 x NV + 7,988	30,60	10,47	12,35
DEC	429	0,489	Geography = 0,158 x NV + 7,517	45,96	14,77	
All	928	0,670	Geography = 0,176 x V + 5,922	37,19	12,46	
DET	499	0,381	Geography = 0,158 x V + 6,632	25,93	10,47	10,33
DEC	429	0,544	Geography = 0,182 x V + 5,613	50,28	14,77	

Y' = Mean Y predicted by DEC regression

gression equation of DEC students be used for them. This is a considerable overestimation and may possibly be due to the relevance of English language proficiency for the study of Geography.

- GSAT verbal score as predictor

When the verbal score was used as predictor, slopes differed significantly for Mathematics only. Only 1,51 % of the variance could be explained by the interaction term. For Physical Science intercepts differed significantly and 1,52 % of variance could be explained by the group main effect. For Geography no differences between regression lines were found. Should the regression equation of DEC students be used to predict the scholastic achievement of DET students, the Mathematics mean will be underestimated by 3,05 points and the Physical Science mean by 2,18 points. For Geography there will be no underestimation, possibly because this subject is also heavily dependent on language knowledge.

It appears that separate regression lines should in most cases be used for DET and DEC students, when predicting academic achievement.

2.4.2 Explaining the variance in GSAT scores

2.4.2.1 Correlation with environmental variables

As has been shown, large differences in mean scores were found between the three principal groups under investigation. The experiment was planned in order to determine which other variables were associated with GSAT variance. In the manual a correlation of 0,53 is reported between GSAT total score and an index of educational and economic environment constructed on the basis of a number of biographical questions answered by everyone in the standardization sample. This is an exceptionally large correlation and consequently information of this nature was obtained from students in this experiment. Teachers completed Van den Berg's (1985) SED-index in respect of every testee. In addition every student completed a biographical questionnaire on the basis of which an SES-index was constructed. These two indices correlated 0,55 for DET students and 0,65 for DEC students. This is a case where information of similar nature was obtained from different sources. These correlations attest to the fair validity of the SED questionnaire in both populations.

Correlations between the indices of environment and GSAT scores are presented in Table 16. In order to optimize comparability only 16-year olds were used in the calculations. DEC students were part of the norm sample that took Form A.

For DET students all the correlations of both indices with GSAT scores were extremely low even though they did reach significance in some cases whereas correlations were uniformly high for DEC students - ranging between 0,42 and 0,55. For DET students almost no variance could be explained by these particular indices, but they explain close on 25 % of variance for DEC students. As only 10 % of DET students could be considered to be non-environmentally disadvantaged according to the SED-index it may well be the case that the low correlations resulted from the uniformly low SES prevelant in this group.

2.4.2.2 Correlations with aspects of personality

It was considered possible that variance in GSAT scores could in part be attributable to personal styles. Du Toit (1983) constructed a questionnaire based on the typology of Jung. This questionnaire bears more than a passing resemblance to the well-known Myers-Briggs type indicator as both are based on the same theory and offer measurements on four scales. The Jung questionnaire of Du Toit (1983) measures the attitudes of extraversion - introversion and the psychological functions of thinking - feeling and sensing - intuition. Feeling and thinking are *rational* functions because they make use

TABLE 16
CORRELATIONS BETWEEN GSAT SCORES AND INDICES OF SED AND SES FOR 16-YEAR-OLDS

GSAT Raw score	Dept.	SED Index				SES Index	
		N	Mean	SD	r	N	r
Non-verbal	DET	909	7,72	3,82	0,03	378	0,10
	DEC	823	3,65	3,17	0,42*	914	0,52*
Verbal	DET	909	7,72	3,82	0.10*	378	0,20*
	DEC	823	3,65	3,17	0,47*	914	0,55*
Total	DET	909	7,72	3,82	0,07	378	0,16*
	DEC	823	3,65	3,17	0,46*	914	0,55*

* Significant at the 1 % level

of the faculty of judgement in order to arrive at a decision. Sensation and intuition are called *irrational* functions because a person does not use the faculty of judgement to arrive at a conclusion. The fourth scale, called judgement - perception, distinguishes between the predominance of rational and irrational functions.

Although this questionnaire was originally developed in a DEC sample, there was no known reason for it to be considered unsuitable for DET. When the GSAT Senior was normed the questionnaire was applied to a sample of Standard 10 students. In order to get a comparable age group from the DET it was decided to test a sample of Standard 8 students. Only students between 16 and 19 years were included in the analyses. The mean age for DET students turned out to be 17,42 years, and for DEC students, 17,23 years. The difference was not significant.

The percentage of GSAT variance explained by each of the four scales as well as SED and various combinations of these scales appears in Table 17 for DET students. Similar information for DEC students appears in Table 18 and the information for the groups combined appears in Table 19.

For DET students the amount of variance in GSAT scores that could be explained by the Jung scales as well as the SES-index is insignificant. This held for both the non-verbal and the verbal scores. A linear combination of all scores could explain only 7 % of the GSAT verbal score.

For DEC students the Judgement - Perception scale could explain 9 % of the variance in verbal scores. The more students relied on Judgement rather than Perception, the higher their verbal scores tended to be. The same held to a lesser degree for non-verbal scores. For this group SED could explain about 20 % of the variance in both non-verbal and verbal scores. A combination of Judgement - Perception and SED could explain 21 % of the variance in non-verbal score and 25 % of the variance in verbal score. This is a large percentage of the variance in GSAT scores.

When the two groups were combined the percentage of variance explained by the Judgement - Perception scale showed a dramatic increase. Sixteen percent of the variance in non-verbal score could be explained and 23 % of the variance in verbal score. This is a very large proportion of the variance in a cognitive test predicted by a variable

TABLE 17
VARIANCE IN GSAT SCORES EXPLAINED BY THE JUNG AND OTHER MEASURES (DET STUDENTS) N = 383

Source of variance	Percentage of variance explained in:	
	Non-verbal score	Verbal score
Extraversion - Introversion (EI)	0,21	0,69
Thinking - Feeling (TF)	0,05	0,62
Sensation - Intuition (SN)	0,50	3,68
Judgement - Perception (JP)	0,01	1,00
SED	1,20	1,40
JP + SED	1,20	2,08
EI + TF + SN + JP + SED	1,91	6,91

TABLE 18
VARIANCE IN GSAT SCORES EXPLAINED BY THE JUNG AND OTHER MEASURES (DEC STUDENTS) N = 384

Source of variance	Percentage of variance explained in:	
	Non-verbal score	Verbal score
Extraversion - Introversion (EI)	0,10	0,13
Thinking - Feeling (TF)	4,19	1,62
Sensation - Intuition (SN)	3,87	4,73
Judgement - Perception (JP)	4,96	8,95
SED	19,24	20,80
JP + SED	21,06	25,19
EI + TF + SN + JP + SED	25,27	27,31

reflecting a person's preferred approach to situations. The large differences in GSAT scores are clearly associated with group differences on this variable.

SED could explain 36 % to 50 % of the variance in GSAT scores. Again, much more of the variance in the verbal score than the non-verbal score could be explained. Group membership explained 42 % of the variance in the non-verbal score and a surprising 74 % of the variance in the verbal score.

The combination of Judgement - Perception and SED could explain 40 % of the variance in the non-verbal score and 56 % of the variance in the verbal score. It is important to note that for the non-verbal score virtually the same amount of variance could be explained by the combination of Judgement - Perception and SED (40 %) as could be explained by group membership (42 %). The degree of overlap of the explained variance can be judged from the fact that, given the variance explained by these two variables, group membership can predict only an additional 5 % of the variance. The larger percentages of the verbal scores that are explained by the variables under consideration can probably be attributed mainly to the general language deficit of the one group and the associated larger mean differences.

TABLE 19
VARIANCE IN GSAT SCORES EXPLAINED BY THE JUNG AND OTHER MEASURES FOR DET AND DEC STUDENTS TOGETHER

Source of variance	Percentage of variance explained in:	
	Non-verbal score	Verbal score
Extraversion - Introversion (EI)	2,86	4,60
Thinking - Feeling (TF)	5,24	3,87
Sensation - Intuition (SN)	1,14	0,68
Judgement - Perception (JP)	16,03	23,36
SED	35,86	49,83
Group	41,97	74,03
JP + SED	39,74	55,80
EI + TF + SN + JP + SED	41,73	57,18
JP + SED +Group	46,67	76,82

According to the manual (Du Toit, 1983 p.4):

> *The fourth scale Judgement - Perception should be considered an auxiliary scale comparing the relative strength of the stronger rational function with the stronger irrational function in order to indicate which one of these is the dominant psychological function in the personality composition.*

Not only was there a significant difference between the groups on the Judgement - Perception scale, but the difference was large: one standard deviation. With the DET students the irrational functions predominate and with the DEC students the rational functions predominate. It has been shown that a large amount of the variance in GSAT scores can be explained by the attribute measured by the Judgement - Perception scale. The more a person is oriented towards judgement rather than perception the higher his GSAT score tends to be. When attempts are made to bridge the gap between these groups on cognitive tests such as the GSAT this appears to be one of the aspects of personality that will have to be taken into account.

2.4.2.3 Correlation with study orientation

It was hypothesized that variance in GSAT scores could partly be explained by study orientation as it is measured by the Survey of Study Habits and Attitudes (SSHA). The SSHA was developed in the USA by Dr W. F. Brown and Dr W. H. Holzman. The Form H questionnaire that was used, was standardized for high school students in the RSA (Du Toit, 1974).

Measures on the following scales are obtained:

- Delay avoidance : Indicates to what extent a student promptly completes his assignment, avoids delay and is not inclined to unnecessary waste of time.
- Work methods : Gives an indication of a student's use of effective study methods, his efficiency in doing assignments and the extent to which he sets about his work in the most effective way.
- Teacher approval : Provides a measure of a student's attitude towards the teacher's classroom behaviour and methods.
- Education acceptance : Determines the extent of a student's acceptance of educational ideals, objectives, practices and requirements.

The percentages of GSAT variance explained for DET students are shown in Table 20, those for DEC students in Table 21, and the results for the two groups together in Table 22. Students between 16 and 19 years were included in the analyses.

TABLE 20
VARIANCE IN GSAT SCORES EXPLAINED BY THE SSHA AND OTHER MEASURES FOR DET STUDENTS. N = 380

Source of variance	Percentage of variance explained in:	
	Non-verbal score	Verbal score
Work methods (WM)	10,49	15,44
Delay avoidance (DA)	2,38	7,26
Teacher approval (TA)	9,00	14,14
Education acceptance (EA)	15,82	23,61
SED	0,44	2,53
EA + SED	15,85	24,60
TA + EA + DA + WM + SED	18,38	25,81

TABLE 21
VARIANCE IN GSAT SCORES EXPLAINED BY THE SSHA AND OTHER MEASURES FOR DEC STUDENTS. N = 390

Source of variance	Percentage of variance explained in:	
	Non-verbal score	Verbal score
Work methods (WM)	0,08	2,16
Delay avoidance (DA)	1,88	0,58
Teacher approval (TA)	0,18	0,00
Education acceptance (EA)	0,02	0,24
SED	17,87	20,14
EA + SED	17,96	20,55
TA + EA + DA + WM + SED	22,95	27,03

For DET students, the percentage of variance explained by the different scales separately, varied between 2 % and 16 % for the non-verbal score and between 7 % and 24 % for the verbal score. Educational acceptance explained more variance than the other subscales. For DEC students, very little variance in GSAT scores could be explained by SSHA subscales. The same kind of finding is reported in the manual (Du Toit, 1974). For the combined groups, very little variance was explained by the SSHA subscales. The largest amount of variance was explained by EA (3 %).

For DET students, SED could explain almost no variance (Table 20). For DEC students on the other hand, SED could explain 18 % of the variance in the non-verbal score and 20 % in the verbal score. When the two groups were combined, this figure rose to 32 % for non-verbal and 47 % for verbal, as shown in Table 22.

TABLE 22
VARIANCE IN GSAT SCORES EXPLAINED BY THE SSHA AND OTHER MEASURES FOR DET AND DEC STUDENTS TOGETHER. N = 770

Source of variance	Percentage of variance explained in:	
	Non-verbal score	Verbal score
Work methods (WM)	0,66	0,58
Delay avoidance (DA)	1,12	0,91
Teacher approval (TA)	1,91	2,27
Education acceptance (EA)	2,89	2,41
SED	32,21	47,24
Group	43,62	74,19
EA + SED	34,00	48,49
WM + DA + TA + EA + SED	37,75	51,12
EA + SED + Group	48,35	77,79

Group membership explained 44 % of the variance in the non-verbal score and 74 % of the variance in the verbal score. This is quite similar to the findings for groups that completed the Jung Questionnaire.

Of the 8 scales considered (Jung and SSHA) JP (Judgement - Perception) could explain by far the largest percentage of GSAT variance for the combined groups. Predominance of rational over irrational functions appears to be quite strongly associated with GSAT performance.

2.5 THE ROLE OF TIME

The percentage of students in the sample who attempted at least the first 80 % of the items in the respective subtests is shown in Table 23. For DEC students the result of the 17-year-olds is reported. For DET students the results for 16 and 17-year-olds are shown.

TABLE 23
PERCENTAGE OF STUDENTS WHO ATTEMPTED AT LEAST THE FIRST 80 % OF THE ITEMS IN THE RESPECTIVE SUBTESTS.

Subtest	DET Students		DEC : Environmentally disadvantaged	DEC : Non-environmentally disadvantaged
	16 Years N = 909	17 Years N = 456	17 Years N = 572	17 Years N = 833
Word Analogies	90,65	93,42	95,10	98,56
Number Series	91,42	91,67	75,70	84,15
Verbal Reasoning	88,12	90,13	79,72	92,08
Pattern Completion	84,16	87,94	71,33	83,19
Word Pairs	94,28	93,20	93,71	98,32
Figure Analogies	82,84	86,40	64,86	77,91

With the exception of Subtest 1, DET students attempted more items than DEC (environmentally disadvantaged) students. In all three non-verbal subtests 17-year-old DET students attempted more items than 17-year-old DEC (non-environmentally disadvantaged) students.

As the items in all the subtests are arranged in order of difficulty value, it is clear that the GSAT offers adequate time for all the students to show what they are capable of.

2.6 ITEM ANALYSIS

The overall amount of bias among non-verbal and verbal items respectively can be indicated by the Spearman correlation between the delta values (Angoff, 1982). For non-verbal items it was 0,95, and for verbal items it was 0,88. It is clear that item bias is much more prevalent among the verbal than among the non-verbal items. These two groups were analysed separately according to the method suggested by Angoff (1982).

- Most biased verbal items

Items, in order of degree of bias against DET students, are presented in Table 24.
Of the 10 most biased verbal items, 5 items were Word Analogies, 4 were Word Pairs and only 1 item came from the Verbal Reasoning subtest. Generally speaking, the Word Analogy and Word Pair items rely much more on a perfect understanding of words in isolation than does the Verbal Reasoning items. Notably the most biased item came from the Verbal Reasoning subtest. In this particular item the conjuncion was left out of the sentence and the correct conjunction had to be deduced from content. This kind of intricate linking appears to be dependent on the degree of expertise with which the testee can handle the language.

The extremely biased Word Pair items all appeared to contain words not frequently used in everyday English. In addition, conventional association in the immediate culture appeared to play a part.

As far as Word Analogies are concerned, DET students also appeared to be handicapped by experiential background. Word knowledge was once again a significant factor. A preference for a holistic approach rather than an analytical approach could also be perceived.

- Most biased non-verbal items

Items, in order of degree of bias against DET students, are presented in Table 25. Among the 10 most biased non-verbal items, 6 items were Number Series, 1 was a Pattern Completion item and 3 were Figure Analogies items. Contrary to the verbal items where certain distractors did in fact attract a much larger percentage of DET students than DEC students, the proportion of students choosing the various distractors were quite comparable.

TABLE 24

ITEMS IN ORDER OF DEGREE OF BIAS AGAINST DET STUDENTS - VERBAL

Subtest	Item	Depart-ment	Correct. Point Biserial	% Of students who chose an option					
				1	2	3	4	5	Omit
3	12	DET	0,51	29,3	37,8*	4,0	18,3	10,3	0,3
		DEC	0,21	1,7	95,8*	0,2	1,0	1,3	0,0
5	11	DET	0,33	54,9	1,6	2,1	34,4*	6,2	0,9
		DEC	0,32	1,7	0,3	1,5	94,6*	1,2	0,7
1	14	DET	0,43	35,7	27,3*	14,3	2,9	18,9	1,0
		DEC	0,37	4,5	91,3*	1,7	0,2	2,2	0,2
5	13	DET	0,47	30,7	8,2	4,0	44,2*	12,2	0,7
		DEC	0,31	1,3	1,0	0,0	96,3*	1,2	0,2
1	18	DET	0,34	50,2	12,7	9,3	21,7*	5,3	0,9
		DEC	0,47	5,7	5,9	1,5	85,9*	0,5	0,5
5	7	DET	0,37	49,5	3,7	2,3	2,4	41,2*	1,0
		DEC	0,35	3,7	0,5	0,5	0,5	94,8*	0,0
5	23	DET	0,13	18,0	28,7	23,1	14,2*	13,7	2,3
		DEC	0,59	5,7	3,9	5,0	76,5*	8,2	0,6
1	7	DET	0,25	10,9	53,6*	13,9	9,7	10,6	1,3
		DEC	0,21	0,3	96,8*	0,3	0,2	2,4	0,0
1	11	DET	0,55	1,5	10,5	47,6*	10,3	29,7	0,4
		DEC	0,39	0,3	1,3	95,3*	1,7	1,3	0,0
1	12	DET	0,42	10,8	5,4	21,3	28,1*	33,6	0,8
		DEC	0,45	1,8	2,7	4,9	87,1*	3,0	0,5

* = Correct answer

TABLE 25

ITEMS IN ORDER OF DEGREE OF BIAS AGAINST DET STUDENTS - NON-VERBAL

Subtest	Item	Depart-ment	Correct. Point Biserial	% Of students who chose an option					
				1	2	3	4	5	Omit
6	16	DET	0,46	41,7*	8,9	16,2	17,7	14,1	1,5
		DEC	0,48	87,1*	2,4	3,2	4,4	2,7	0,3
2	12	DET	0,45	18,5	41,4*	5,1	27,7	6,7	0,7
		DEC	0,50	1,3	85,7*	1,2	10,9	0,5	0,3
2	7	DET	0,46	17,0	4,4	4,1	62,0*	11,3	1,2
		DEC	0,38	3,4	0,7	0,5	94,1*	1,0	0,3
2	8	DET	0,42	16,0	3,7	9,6	2,6	66,7*	1,3
		DEC	0,30	2,0	0,3	1,3	0,5	95,3*	0,5
2	23	DET	0,17	12,1*	15,3	41,0	14,4	13,9	3,3
		DEC	0,41	51,8*	5,5	19,5	3,9	13,9	5,4
6	17	DET	0,40	13,6	30,0*	15,2	21,8	17,9	1,4
		DEC	0,53	3,9	75,3*	8,6	4,7	7,1	0,5
2	17	DET	0,32	19,5*	40,0	21,1	14,9	3,4	1,1
		DEC	0,55	63,5*	17,3	14,8	3,2	0,3	0,8
6	9	DET	0,43	6,3	61,0*	14,1	9,7	8,4	0,5
		DEC	0,30	0,7	92,9*	3,0	1,3	1,5	0,5
4	9	DET	0,51	5,4	60,3*	4,0	7,2	22,3	0,8
		DEC	0,40	1,2	92,6*	0,5	2,0	3,7	0,0
2	16	DET	0,42	27,5	28,0*	21,5	4,9	17,4	0,8
		DEC	0,45	7,1	71,9*	15,0	2,5	1,8	1,7

* = Correct answer

3.0 CONCLUSION

There were slight differences in the reliabilities for DET and DEC students. Although the K-R 8 reliability coefficients for verbal and total scores differed significantly between DET students and DEC students, the difference between non-environmentally disadvantaged and environmentally disadvantaged DEC students was not significant. For DET students the K-R 8 reliability coefficients were considerably lower for verbal than for non-verbal scores.

The raw score distributions for non-verbal and verbal scores were both positively skewed for DET students. The skewness is slight for non-verbal scores and more extreme for verbal scores. The floor effect for verbal scores was so severe for DET students that a fairly large percentage of students received scores close to a chance score. In spite of the slight positive skewness of the non-verbal scores, the distribution is not so peaked that it will not be able to distinguish between DET students at various levels of ability.

For all subtests the differences in scores between DET and environmentally disadvantaged DEC students were expressed in terms of the common standard deviation in order to compare the size of the differences. It was found that the difference for non-verbal scores was about 0,75 standard deviations and for verbal scores about 1,5 standard deviations (twice as large). This difference should probably be attributed mainly to a language deficit. It is clear that verbal scores were depressed by lack of expertise in the handling of English.

The correlations between non-verbal and verbal scores were lower for DET students than for any group of DEC students. For DET students a two-factor structure could be distinguished rather than the one that was found for DEC students. The loading on the second factor, (the non-verbal factor), is especially high for Pattern Completion and Figure Analogies.

In most cases correlations between GSAT scores and school subjects were significant. Correlations for DET students were generally considerably lower than those reported in the manual for DEC students. Regression lines for the prediction of scholastic achievement differed for DET and DEC students. When verbal score was the predictor and the regression equation of DEC students was used for DET students, Mathematics and Physical Science scores were underpredicted.

Extremely low correlations with environmental variables were found for DET students. Almost no GSAT variance could be explained by the SED-index or the SES-index for this group. This ties in with similar findings reported by Irvine and Berry (1988) with regard to studies conducted elsewhere in Africa. This also holds for the various scales of the Jung Personality Questionnaire and the Survey of Study Habits and Attitudes. On the other hand the Judgement-Perception scale of the Jung questionnaire correlated strongly with GSAT scores when DET and DEC students were collapsed. It was shown that the more a person is orientated towards judgement rather than perception, the higher his GSAT-score tends to be.

It was shown that differences in means can hardly be attributed to the time limits set for the test since about 85 % of both DEC students and DET students were able to attempt at least 80 % of the items in the time allowed.

Of the ten items most biased against DET students, nine were from Word Analogies and Word Pairs. Bias could usually be attributed to unknown words and word meanings and

to the possibility that all the concepts are not a part of the pupils' frame of reference. Fewer meanings of the same word appeared to be known to many DET students.

The non-verbal GSAT score proved to be a fair predictor of scholastic achievement for DET students, provided that the criterion is not closely dependent on language skills. The verbal score, however, will frequently underpredict achievement if language does not play an important part in criterion achievement. It must be concluded that the GSAT as a whole is less suitable for the prediction of academic achievement of DET students than for the prediction of academic achievement of DEC students.

3.1 RECOMMENDATIONS

For reasons mentioned above, it is clear that in its present form the GSAT is not a suitable measure of intelligence for students not tested in their mother tongue. Even the non-verbal score can not be used to compare the intelligence of students differing as regards culture and experience. However, when the need arises to obtain an estimation of a student's general scholastic aptitude, the non-verbal subtests provide a fairly good indication of expected academic achievement relative to others in a similar teaching situation.

Two of the non-verbal subtests, namely Figure Analogies and Pattern Completion, proved to be a better indication of general scholastic aptitude than the other subtests for the following reasons:

- The mean differences between DET students and DEC students seemed to be the smallest for Figure Analogies and Pattern Completion.
- The highest intercorrelation between any two subtests was between Figure Analogies and Pattern Completion. That indicates that a common factor is probably measured.
- A separate non-verbal and verbal factor could easily be distinguished when a factor analysis was done. The loading on the second factor (the non-verbal factor) was especially high for Figure Analogies and Pattern Completion. The fact that the two factors were strongly correlated, implied the presence of a common underlying reasoning factor.

Throughout this project, there was no doubt that the majority of students not tested in their mother tongue were severly handicapped by a lack of knowledge of the language. Since the possibility of vernacular testing does, at this stage, not appear to be feasible for all students, it is therefore recommended that the two figural subtests discussed previously, Figure Analogies and Pattern Completion, may be used as a measuring instrument for students not tested in their mother tongue. These tests were, however, developed with a particular school population in mind and at present they do not contain enough items at a level where a large number of DET students perform. Indications are that a test spanning a wider range of ability than the GSAT can be constructed. It is true that a test of this nature may end up to be extremely lengthy and time consuming, but computerized adaptive versions of such a test will offer the ability to present only those items suitable to a particular testee. Modern equating techniques can make possible easier and more difficult versions of the same test, yet the same reference group may be used.

It is recommended that a more elaborated test similar in nature to the figural subtests of the GSAT should be developed. This test should rely on the use of verbal instructions to a very limited extent only in order that testers who are not familiar with the home language of testees can administer the test approriately. In spite of certain disadvantages the possibility for having all instructions in mime should receive serious consideration as this kind of an absence of all formal language may be a way to equalize opportunity for all. Needless to say such a test will have to demonstrate acceptable predictive validity in appropriate academic contexts.

Appendix A. LIST OF SCHOOLS IN THE SAMPLE

A.1 CIRCUIT 2 : DIAMOND FIELDS

Vaal Reefs Technical
Gatelapele
Monwabisi
Ratangthuto
Thabane

A.2 CIRCUIT 3 : OFS

Bahale
Ikaelelo
Lerelatoto
Tshepang
Rearabetswe
Vulamasango

A.3 CIRCUIT 4 : CAPE

Itembelihle
Kwakomani
Kwamagxaki
Kwenxura
Malcomess
Nomsama
Ndlovukazi
Somerset East

A.4 CIRCUIT 5 : NATAL

Chesterville
Eminyezanenii
Filidi
Mazizakhe
Mehlokazulu

A.5 CIRCUIT 6 : NORTHERN TRANSVAAL

A B Phokompe
Flavius Mareka
Lethabong
Mabogopedi
Mohlamme
Musina
Tsako Thabo

A.6 CIRCUIT 7 : ORANGE VAAL

Evungwini
Ithabiseng
Falesizwe
Nkgopoleng
Residensia
Thabang

A.7 CIRCUIT 8 : JOHANNESBURG

Lavela
Mafori Mphahlele Comprehensive
Minerva
Mokgome
Seana Marena
Selelekela

A.8 CIRCUIT 9 : HIGHVELD

Alafang
Hulwasi
N N Ndebele
Phulong
Siswakele
Thuto Ke Maatla
Vosloorus

Appendix B. REFERENCES

Angoff, W.H. (1982). Use of difficulty and discrimination indices for detecting item bias. In R.A. Berk (Ed.), *Handbook of methods for detecting test bias* (pp.96-116). London: Johns Hopkins University Press.

BIOMEDICAL computer programmes : p-series. Berkeley : University of California press, 1979.

Box, G.E. A general distribution theory for a class of likelyhood criteria. *Biometrica* 36, 1949 : 317-346.

Claassen, N.C.W., De Beer, M., Hugo, H.L.E. & Meyer, H.M. (1991). *Manual for the General Scholastic Aptitude Test: Senior Series.* Pretoria: Human Sciences Research Council.

Cronbach, L.J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika*, 16:297-334.

Du Toit, L.B.H. (1974). *Manual for the Survey of Study Habits and Attitudes.* Pretoria: Human Sciences Research Council.

Du Toit, L.B.H. (1983). *Manual for the Jung Personality Questionnaire.* Pretoria: Human Sciences Research Council.

Irvine, S.H. & Berry, J.W. (1988). The abilities of mankind. In S.H. Irvine & J.W. Berry (Eds), *Human Abilities in cultural context.* (pp. 3-59). New York: Cambridge.

Jensen, A.R. (1980). *Bias in mental testing.* London: Methuen.

Reynolds, C.R. (1982). Methods for detecting construct and predictive bias. In R.A. Berk (Ed.), *Handbook of methods for detecting test bias* (pp. 199-227). Baltimore: John Hopkins University Press.

Van den Berg, A.R. (1985). *Using the Junior South African Individual Scales (JSAIS) (1981) for testees from South African population groups which were not included in the norm population.* Pretoria: HSRC. (2385)

doc no: 294151
cop no 294152

R22,00