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An investigation into educational and occupational differences in test performance on a battery of adaptability tests for Africans

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LABOUR POSITION:

Due to its close association with the mining industry, the labour force of S.A.P.P.I. contains a number of characteristics usually associated with the mines.

The majority of native duties fall into a menial grouping, consequently, the greater part of the native labour force is non-mechanical. While most of the mechanical duties are of a lower grade than were those of the other industries studied. European supervision is stricter, allowing the natives less scope to exercise initiative, and a great many of native workers are ex-mine boys.

The labour position within each of the main sections is as follows:

Section	Number of African Workers
Chemical	114
Cardbcard.	56
Finishing House.	133
Pulp (including Soda Recovery).	119
Paper.	114
General Duties.	192
TOTAL:	728

Isolation of duties on the various lines.

As the number of higher grade (i.e. Mechanical) duties performed by natives is extremely small, and usually under the direct supervision of a European, and as the vast majority of lower grade (i.e. Non-Mechanical) duties are of a very menial nature, no useful purpose will result from a full consideration of each separate duty shown in the "Detailed Job Sequence Diagram".

Such an analysis, due to the similarity of many of the operations and to the extremely menial nature and great number of duties in the plant, will tend to confuse rather than to establish and clarify the position of jobs in the final analysis.

Consequently, rather than follow the accepted pattern of the previous job analysis and proceed with an analysis and isolation of each line duty by using the production sequence or production flow chart as a frame of reference, a clearer perspective will be gained by considering the final job classification as the frame of reference, and attempting to justify it by stressing the most important differentiating factors existing between the main job families.

In so doing unnecessary confusion due to the number of jobs involved, and meaningless repetition caused by their similarity, will be considerably lessened.

NOTE: A word of caution should be added here, in that when viewing the attached "Photographic Job Sequence Chart", the intricate appearance of many of the machines shown tends to create a wrong impression of the native operatives actual duties, which in most cases involve only the turning of a switch or the drop of a

lover.

This being the case, the justification for the inclusion of the Photographic Job Sequence, is not, as in the previous job analyses, to act as a more graphic frame of reference when considering the final job classification, but to serve as an easy means of depicting the position and importance of the main stages within the production sequence, as well as give a concise presentation of the actual production flow, which, due to the approach to the present job analysis, will not be mentioned when discussing the various job families.

Considering the job analysis: the main divisions are as follows:

A. Mechanical Group	B. Non-Mechanical Group
1. Mechanical Higher	1. Non-Mechanical Higher
2. Mechanical Lower	2. Menial

Mechanical Higher duties:

These workers comprise a highly responsible group, they hold jobs in which definite mechanical understanding is essential, the work they do is of such a nature that carelessness or negligence can easily result in serious injury or a marked lowering in quality of the finished product.

They must be continually alert, attentive, quick, adaptable and skillful in the use of tools, with a good mechanical memory and ability to dismantle, check and reassemble fairly complicated machinery. They must be able to renew damaged parts and always be on hand to make the required adjustments and alterations to machinery in order to maintain quality standards.

These natives attend to expensive and dangerous machinery, they have to work at a steady pace to maintain this machinery, and to exhibit good mechanical understanding and dexterity when adjusting, altering or assembling these machines.

The duties classified under this group are:

1. Cell Maintenance Boss Boys
2. Wood Plant Boss Boys
3. Paper Packing Boss Boys
4. Cell Maintenance Gang.
5. Paper Machine (Wet End)

Mechanical Lower duties:

Within this division fall those workers who although employed in work of a mechanical nature, where a good degree of mechanical comprehension is essential, work under the direction supervision of, or assist, a European. They are expected to be able to handle tools and to exhibit a certain mechanical dexterity, but they are very seldom required to adjust or maintain any complicated machinery or to assemble any machine on their own.

Under this group fall such duties are:

1. Super Calender catchers and loaders
2. Damper boy
3. Liquid Chlorine Cylinder boy
4. Artisans Assistants.

In both the higher and lower grades of Mechanical work, the duties involve a definite mechanical comprehension, dexterous, coordinated movements; careful steady workmanship, and a high degree of responsibility, mechanical adaptability and skill. The difference between the two grades is one of degree rather than of kind.

Non-Mechanical Higher duties:

The twenty-eight duties falling within this division have been regrouped into four main categories, as follows:

1. Non-Mechanical Boss Boys
2. Packers
3. Checkers
4. Non-Mechanical Operatives

Considering each group separately:

1. Non-Mechanical Boss Boys (not to be confused with the type of Boss Boy found on the Mines). These boss boys require no mechanical knowledge whatsoever, they simply have to direct the natives under them in carrying out certain duties. And as the actual work performed by their subordinates is of a very menial nature, little more than a fair degree of leadership is expected of these boss boys. The menial nature of the work is obvious from the job names:

   a. Garden Boss Boy
   b. Store Yard Boss Boy
   c. Floating Gang Boss Boy
   d. Elevator Boss Boy - whose sole responsibility is in seeing that the salt elevators are kept full of salt.

These boss boys are placed on top of the Non-Mechanical Higher duties, because it is considered that effective leadership whether in a Mechanical or Non-Mechanical sphere, requires a fair degree of general intelligence. Although in the present set-up, boys for such positions appear to be selected on the basis of length of service, rather than according to general intelligence or aptitude.

2. Packers: Working under direct supervision these natives are responsible for the packing and parcelling of the finished products. They must be neat, quick, able to count and intelligent enough to recognise the various grades and textures of the finished products.

This group consists of the following jobs:

a. Ream Packers.

b. Rail Packers.

c. Reel Packers.

d. Job Lot Packers.

e. Markers.

f. C/B Sorters (i.e. cardboard sorters)

3. Checkers: A clerical group, who although falling into a Non-Mechanical category, cannot be satisfactorily differentiated on the basis of the General Adaptability Battery. A battery including tests of a more specific clerical nature would be more valid.

They include the jobs of:

a. Clerks

b. Paper Test Section

c. Checkers and Learners

d. Offloading Checkers

e. Dispatch

f. Store Counter

4. Non-Mechanical Operatives: operatives who require absolutely no mechanical comprehension or dexterity, they simply have to switch the machine on and feed it. They have been included in the Higher Non-Mechanical Group rather than in the Menial Group, because it requires a slightly higher intellect to feed material into machines at an even rate and to exercise enough care not to damage any mechanical part.

Non-Mechanical Operatives include:

a. New and Old Scott Evaporator boys

b. Dryer boys

c. Press boys

d. Wood Grinding boys

e. Glazer boys

f. Lift Operators

g. Chipper Feeder

h. Lap Handlers

i. Finishing House Guillotine helper

j. Cardboard Guillotine helper

Menial duties: such duties have been classified into three groups, not because a very marked differentiation exists within the huge number of menial duties, but more as a matter of convenience for the mechanical computation of test scores.

These three groups are:

a. Menial Grade A

b. Menial Grade B

c. Cleaners

Final Classification of Jobs:

Mechanical Jobs

Mechanical Higher

Cell Maintenance Boss Boys

Wood Plant Boss Boys

Paper Packing Boss Boys

Cell Maintenance Gang

Paper Machine (Wet End)

Mechanical Lower

Super Calender catchers and loaders

Dumper Boy

Liquid Chlorine Cylinders

Artisans Assistants

Non-Mechanical Jobs

Non-Mechanical Higher

Non-Mechanical Boss Boys:	Garden Boss Boy
	Store Yard Boss Boy
	Floating Gang Boss Boy
	Elevator Boss Boy
Packers:	Ream Packers
	Rail Packers
	Reel Packers
	Job Lot Packers
	Cardboard Sorters
Checkers:	Clerks
	Paper Test Section
	Checkers and Learners
	Off-loading Checkers
	Dispatch
	Store Counter
	New and Old Scott Evaps.
	Dryer
	Cardboard Press

Non-Mechanical Operatives: Wood Grinding
Glazer
Lift Operator
Chipper Feeder
Lap Handlers
Finishing House Guillotine
Cardboard Guillotine

Menial:

A. Grade Labourers

Brine Making Labourers
Brine and Cathedic pumping labourers
Bleach Liquor labourers
C.P. Acid labourers
Chemical messenger
Electrolytic labourers
Stencilling labourers
Commercial Acid labourers
Chemical Painter (rough)
Cutter catchers
Cutter loaders
Reels loaders
Pulp Plant messenger
Vertical Digester labourers
Soda Recovery labourers
Soda Recovery furnace labourers
3rd Floor labourers
Woodwashing labourers
Press Plate labourers
Causticisers
Waste Paper Handling labourers
Brake Beater labourers
Beater Mixer labourers
Brake Handling labourers
Mixing Beater labourers

Pulp Handling labourers

Dry End labourers

Size making labourers

Laboratory messenger

B. Grade Labourers

Gardeners

Drum closing labourers

Tale milling labourers

Salt elevator labourers

Repulper labourers

Log Conveyor labourers

Change House labourers

Store Yard Hand

Assistants on delivery vehicles

Offloading labourers

Cleaners.

Cylinder cleaners

Chemical cleaners

Finishing House cleaners

Soda Recovery cleaners

Pulp Plant cleaners

Wood Plant cleaners

Paper Section Cleaners

Office cleaners

Fire Equipment cleaners

General cleaners

Scullion.

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AN INVESTIGATION INTO EDUCATIONAL AND OCCUPATIONAL DIFFERENCES IN TEST PERFORMANCE ON A BATTERY OF ADAPTABILITY TESTS FOR AFRICANS

AN INVESTIGATION INTO EDUCATIONAL AND OCCUPATIONAL DIFFERENCES IN TEST PERFORMANCE ON A BATTERY OF ADAPTABILITY TESTS DESIGNED FOR AFRICANS

J.C. DE RIDDER



PART: 2



AFRICAN SCHOLARS BEING TESTED

AN INVESTIGATION INTO EDUCATIONAL AND OCCUPATIONAL DIFFERENCES IN TEST PERFORMANCE ON A BATTERY OF ADAPTABILITY TESTS DESIGNED FOR AFRICANS.

A THESIS

SUBMITTED IN FULFILMENT OF THE REQUIREMENTS FOR

THE DEGREE OF DOCTOR OF PHILOSOPHY

IN THE DEPARTMENT OF PSYCHOLOGY, FACULTY OF ARTS,

AT THE UNIVERSITY OF THE WITWATERSRAND,

JOHANNESBURG.

BY

Jacobus Celicourt

J.C. DE RIDDER.

JUNE 1956.



AFRICAN SCHOLARS BEING TESTED

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Thesis

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PART 2.

1. Introductory Statement to Part 2:

The following section, contains a review of certain aspects of Secondary Industrial development related to the present study, a re-statement of the basic problem and certain related problems to be considered, and the statistical analysis and presentation of results; with a summary and discussion of the research findings, plus a concluding statement embracing an overall survey of the project and including recommendations for future research into this field.

2. The African in Secondary Industry:

During the last 20 years non-European participation in South African industry has steadily increased until today non-Europeans comprise more than 70 per cent of the country's 1,000,000 workers.

Up to the late 20's the percentage of White workers employed in South African industry tended to rise, but since then the proportion of European industrial workers has steadily decreased and more and more non-Europeans have entered the field. Industrialists attribute this development to the "tremendous industrial boom" at that time.

This boom also accounted for an increase in the total number of people directly or indirectly dependant on industry for their existence. In 1925, about 480,000 men and women depended upon industry for their livelihood. Today the number is 2,500,000.

The South African secondary industrial labour force - that is, people employed in manufacturing industries and not by the gold mines or the railways - has increased almost fourfold in the last 20 years, and the consequent value of South Africa's output has gone up from £40 million to the present day figure of £1,500 million.

A graphic analysis presented on the following page, of the relative contributions of the various classes of industrial activity to the net national income of the Union, reveals the transformation of South African economic life from a mainly agricultural economy, to a more capatilistic agricultural - mineral economy with the emergence of an increasingly important secondary industrial economy: (although the graph ends at the year 1946 - i.e. 10 years ago, it serves its purpose in indicating the trend of economic development).

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The effects of the changes in the South African structure of production on the labour market have been far-reaching. The changing structure was accompanied by vital changes in both the distribution and structure of the labour force. The most striking redistribution occuring within the African working population.

There has been a very definite movement of African workers from the farming industry to the secondary industries. The number of African males engaged in farming occupations increased by only 2.2 per cent from 1936 to 1946 but there was an exceptional increase in all other industries, (e.g: Manufacturing Industry: 75.0%; Commerce and Finance: 86.2%; Professions, Entertainment and Sport; 88.1%) with the exception of the mining industry, which for the same period - 1936 to 1946 - showed an increase of only 8.6 per cent.

This movement of the African labour force from the primary to the secondary and tertiary industries is closely related to the urbanisation of the African population.

"The sharp decline in the masculinity rate of the urban African population of the Union and of all towns where this proportion is relatively high, is a clear indication that the African population in urban areas is, to an increasing measure, beginning to assume a normal family structure, which is indisputable proof of a growing tendency towards permanent urbanisation." (Report of the Industrial Legislation Commission of Enquiry, 1951).

The following table based on the 1946 Population Census Report, Volume 1, gives the comparative figures of the masculinity rate of the total urban African population of the Union and of the larger cities and towns:

MASCULINITY RATE OF URBAN NATIVE POPULATION OF THE UNICN AND OF THE PRINCIPAL TOWNS (INCLUDING SUBURBS), 1921, 1936, 1946.

Area.	1921	1936	1946
Union as a whole (urban)	299	220	186
Witwatersrand.	863	430	275
Durban.	624	337	271
Cape Town.	389	236	223
Pietermaritzburg.	328	261	245
Pretoria.	286	177	153
Kimberley.	134	101	126
East London.	130	96	97
Port Elizabeth.	127	107	102
Bloemfontein.	109	86	91

With urbanisation the African peoples have evolved from independent, hostile tribes, with a culture in many ways incompatable with that of the European, to a state of dependency on, and partial incorporation into Western culture. In this process education has been a stabilising and integrating factor, creating channels of communication, forging a basis of common interests, and preparing the African for a way of life in a common social scheme.

The diagram on the following page adapted from figures appearing in the Official Year Book of the Union of South Africa: No. 25 - 1949, illustrates the phenomenal increase in education among the Africans, in only one type of educational institution - the Public School, over the period: 1920 to 1947, and is indicative of the increasing influence exerted by education on the traditional African way of life:

YEARS SCHOLARS

1947 

1946 

1945 

1944 

1943 

1942 

1941 

1940 

1935 

1930 

1925 

1920 

EACH FIGURE = 100,000 PUPILS

AFRICAN PUBLIC SCHOOL PUPILS

Hark.

YEARS $CHOLAR$

1947 

1946 

1945 

1944 

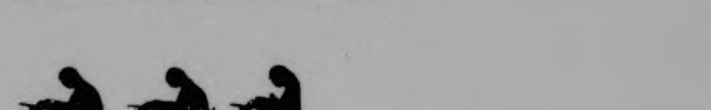
1943 

1942 

1941 

1940 

1935 

1930 

1925 

1920 

EACH FIGURE - 100,000 PUPIL$

FRICAN PUBLIC $CHOOL PUPIL$

Hawk.

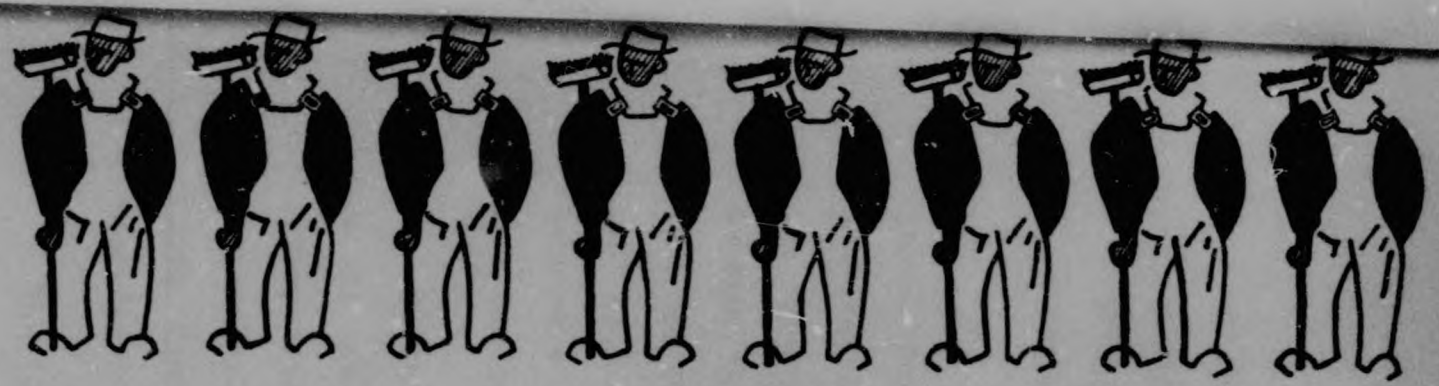
In the present study the influence of education assumes particular importance.

Until now the General Adaptability Battery has been employed only for African selection in the gold mining industry, where the vast majority of the African labour force is completely uneducated and the influence of education on test performance is virtually nil. The secondary industrial labour force, however, being recruited mainly from the urban areas, constitutes a far better educated population than mine workers and has a greater educational scatter. Education as a factor influencing test performance and consequently, worker selection, must therefore be considered in this study.

The main emphasis of this work, however, will be upon an analysis of the applicability of the General Adaptability Battery as a device for African secondary industrial selection, the influence of education will be considered only in so far as it affects the selectivity of the test battery in secondary industry.

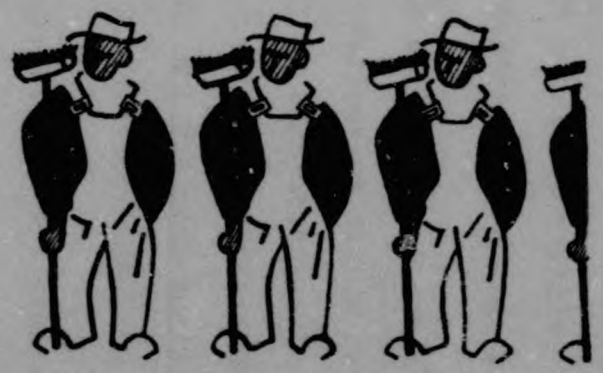


S.A.P.P.I.:



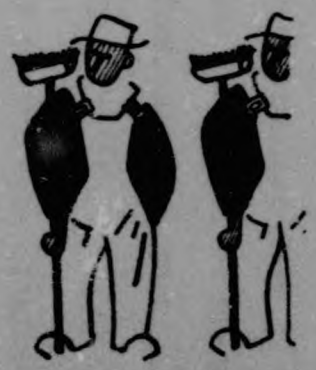


STANLEY MOTORS:





LEVER BROS.:



SCALE :



= 50 MECH. WRKS.



= 50 NON MECH. WRKS.

PROPORTION OF MECH. TO NON MECH. TESTEES

Hal Rudder

I. 1. Presentation and Analysis of Results:

<u>An assessment of the ability of the N.I.P.R. Mines test battery of differentiate between Mechanical jobs and Non-Mechanical jobs in secondary industry:</u>

the secondary industrial sample population under consideration in the analysis of this problem, is illustrated in the foregoing diagram showing the "Proportion of Mech. to Non-Mec' Testees." As can be seen the Non-Mechanical Group is considerably larger than the Mechanical Group. This is to be expected as the vast majority of the Africans in secondary industry are labourers or unskilled workers, and fall consequently, into the Non-Mechanical category.

In this analysis only subjects who were classified on the job analyses as either Mechanical or Non-Mechanical workers will be considered. All data obtained from subjects classified as Special Group Workers (i.e: Canteen Chefs, Clerks and Clerical assistants etc.) has been excluded from the final analysis of results.

The first step in the analysis of the data obtained from these two groups was to establish the degree of relationship existing between the test scores of the Mechanical workers and the Non-Mechanical workers.

The point-biserial correlations computed for this dichotomy reveal some degree of association between the variables. This can be seen from the following table:

TABLE: 1

BISERIAL CORRELATIONS OF THE MECH./NON-MECH. DICHOTOMY:

SCREWS	.20506
SORTING I	.27106
SORTING II	.10017
CUBE CONSTR.	.11312
TRIPOD	.19629
FORMBOARDS	.16682
PEGBOARD	.17050
WIGGLY BLKS.	.06314
KOHS BLKS.	.15559

An analysis of these biserials suggests that the Mechanical Group do better on the tests than do the Non-Mechanical Group. This is most evident in the case of the following tests:

SCREWS	.20506
SORTING I	.27106
TRIPOD	.19629

Following up this evidence of possible differences in test scores between the two groups of workers, the significance of the differences of the test scores of the two groups on each test was calculated.

The following table shows that with the exception of the Wiggly Blocks Test, all the tests differentiate at the 1% level of significance between the two groups of workers:

TABLE : 2

	MECHANICAL GROUP.			NON-MECHANICAL GROUP.			SIGNIFICANCE.	
	M.	N.	S.D.	M.	N.	S.D.	t	1% P.
SCREWS TEST.	12.60322	310	3.9369	11.36880	712	3.9165	4.6094	+
SORTING I	88.86935	310	45.6053	63.38343	712	46.4654	6.5555	+
SORTING II	111.13387	310	38.5923	95.26713	712	39.8405	6.97617	+
CUBE CONSTRUCTION	27.27420	310	15.4921	24.48595	712	15.2737	2.65295	+
TRIPOD	43.83870	310	15.0806	39.07160	712	14.4987	4.69665	+
FORMBOARDS	38.87500	310	13.2205	35.37190	712	12.9339	3.91410	+
PEGBOARD	44.72570	310	11.1702	41.45885	712	12.8496	4.09621	+
WIGGLY BLOCKS	9.97916	310	5.7366	9.44950	712	5.2870	1.38774	-
KOHS BLOCKS	66.61470	310	25.3755	60.05490	712	26.0271	3.76357	+

MEAN TEST SCORES, NUMBER OF SUBJECTS, STANDARD DEVIATIONS AND THE SIGNIFICANCE OF DIFFERENCES OF THE MEANS, OF THE MECHANICAL GROUP AND OF THE NON-MECHANICAL GROUP.

The significance of differences of means and the point-biserial correlations confirm one another when one takes into account the variability of the distributions.

Reference to Appendix E shows that most of the distributions from which "t" tests were calculated, are skewed. As the "t" test assumes normality of distribution, it was considered advisable to confirm the results obtained on the "t" tests by applying a further test of significance which does not assume normality of distribution, namely, the Wilcoxon Two Factor Test.

The rationale of this statistic is as follows: If we are given two sets of observations ranked in order and if one is counted each time an observation of the first exceeds one of the second group, a certain statistic called u can be obtained. It has been shown that <u>on the assumption that the two groups come from the same population</u>, u is normally distributed with a certain expected value (mean) and S.D. If we come across a case where the deviation of u from its expected value is large - so that the probability of its occurance is small - we consider our hypothesis is unlikely and reject it.

The probability of the occurence of the deviation of u from its expected value is obtained from the tables of the normal distribution. (Refer to Appendix: I for the formulae employed and an illustration of its application).

As can be seen from Table: 3, in eight of the nine tests the probability of the occurance of the deviation of u from its expected value is small, and we consequently reject the assumption that the two groups come from the same population. The observations are considered to come from two separate populations, in this case, from a mechanical population and a non-mechanical population.

Conversely, with a probability of occurence of a high order - as in the case of the Wiggly Blocks Test - we accept the assumption that the observations are drawn from the same population.

Table 3 shows that the Wilcoxon Test confirms the results obtained from the "t" tests. On eight of the tests the "t" test gives a significant difference between the groups and the Wilcoxon shows the observations to come from different populations. While on the Wiggly Blocks Test the "t" test gives a non-significant difference between groups and the Wilcoxon shows the observations to come from the same population.

TABLE: 3

	"t" TEST	WILCOXON
SCREWS	4.60770	.49%
SORTING I	6.55130	.0001%
SORTING II	5.97617	.63%
CUBE CONSTR.	2.65295	.75%
TRIPOD	4.69665	.0019%
FORMBOARDS	3.91410	.13%
PEGBOARD	4.09621	.14%
WIGGLY BLKS.	1.38711	75.57%
KOHS BLKS.	3.76351	.35%

However, although it has been proved that eight of the nine tests do differentiate significantly between the Mechanical Group and the Non-Mechanical Group, they do not discriminate between individuals in practice, as can be seen by the smallness of the difference between means to the standard deviation for each test score. The random variation of scores completely blurs the little factor of difference found between the two groups.

The graphs in Appendix E - showing the percentage efficiency of selection, indicate clearly the large overlap existing between the Mechanical and Non-Mechanical curves on all tests.

The cut-off points on these graphs, calculated from the formulae:

$$\frac{\bar{x}_1 - \bar{x}_2}{2} + \bar{x}_2$$; where $\bar{x}_1$ = group with higher mean
$\bar{x}_2$ = group with lower mean

show the difference between the way in which the test battery would select and the way industry selected - the classification of duties being based on the job analysis criterion. The overlap on the graphs gives the misplacement in terms of this criterion.

To show the best possible selection on the General Adaptability Battery with this criterion, a Discriminant Function was calculated between the Mechanical group and the Non-Mechanical group.

A linear function of test variables was computed which has the property of maximising the difference between the groups subject to a given standard deviation within each group.

In other words this is the best possible linear function for showing up a difference between the Mechanical group and the Non-Mechanical group.

Such a function can be used for placing an individual being classified in the group where the mean in terms of the function lies nearest his "battery score". The overlap in the distributions of battery scores for each group will show what proportion of errors are likely using such a method.

The function is:

$$Y = .00229 \text{ (Screws)} + .02561 \text{ (Sorting I)} - .01272 \text{ (Sorting 2)} - .00677 \text{ (Cube Construction)} + .00402 \text{ (Tripod)} + .00643 \text{ (Formboards)} - .01117 \text{ (Pegboard)} - .00908 \text{ (Wiggly Blocks)} + .00343 \text{ (Kohs Blocks)} + .01883.$$

The Multiple R calculated for the Industrial Sample is .210205.

The mean of the Mechanical Group is $\bar{x} = .048$, S.D. = .095; and mean of the Non-Mechanical Group is $\bar{x} = .004$, S.D. = .099.

The Analysis of Variance for testing whether the two sets of "battery scores" differ significantly is:

	Sum of Squares	V	Mean Square
Regression	8.3463	9	.92736
Residual	180.5421	841	.21468
Total	188.8884	850	

$$\text{F Ratio} = \frac{.92736}{.21468} = 4.320$$

Significant at the .01% level.

Consequently, this function does discriminate between the groups and represents the best possible method of doing so using a linear function of test scores.

We will now consider the selective efficiency of the battery. By this is meant the degree to which the battery will predict success.

The statistic employed for this purpose is known as the operating characteristics of the battery.

The mathematical functions whereby the multiple R of the battery is evaluated in terms of the precision with which predictions can be made, are known as its operating characteristics.

Operating characteristics are mathematical functions describing the risks involved in a selection procedure carried out by means of an aptitude test battery.

The fundamental risks involved in aptitude test selection being:

1. the selection of candidates who will fail on the job because they lack the required abilities and/or personality;

and 2. the rejection of candidates by virtue of their ability and/or personality, who had they been selected, would have succeeded on the job.

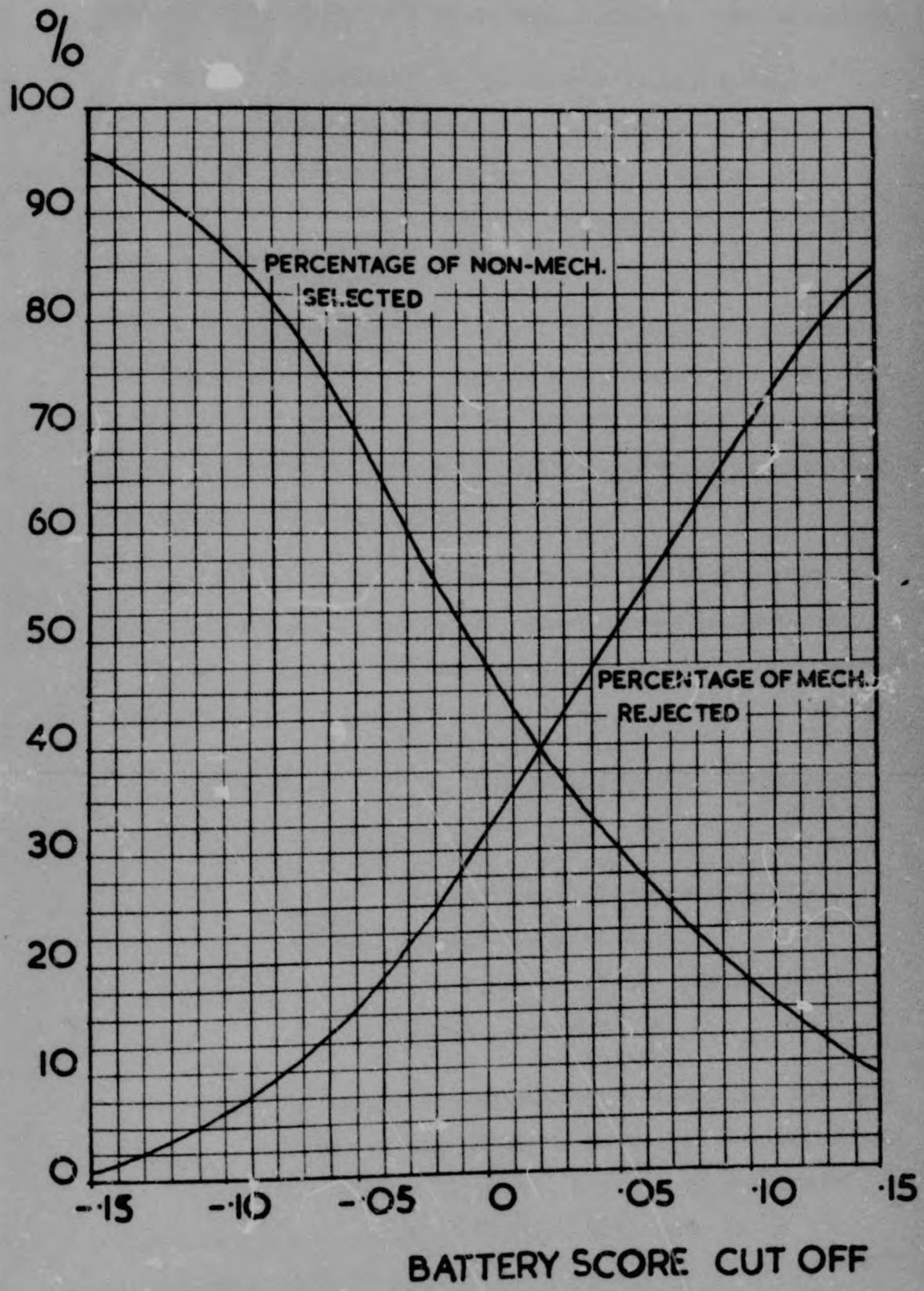
In the present study after the calculation of the multiple R of the battery, the distribution of battery scores, calculated from the regression equation, were plotted. The cut-off was set at the intersection of the resulting curves showing the percentage of satisfactory subjects rejected and unsatisfactory subjects accepted, for at this point - at .02 on the graph - the error of wrong selections is at a minimum.

At this cut-off approximately 39% of the Mechanical Group would fall below it, and 39% of the Non-Mechanical Group would fall above it.

When so used the chance of making a wrong classification is approximately 39 in a 100.

(See the graph on the following page of the "Operating Characteristics for the Discriminant Function").

OPERATING CHARACTERISTICS FOR THE DISCRIMINANT FUNCTION



It is important when considering the selective ability of the test battery in secondary industry, because of the heterogeneity of the present labour force, to explore certain factors which may influence test selection.

During the testing of the School Sample it was observed that as one progressed along the educational scale - and consequently, along the age scale as well, the correlation between age and education being .87364 - test performance tended to improve.

A graphic representation of this trend is given in the figures appearing in Appendix F, showing the mean test score for each modal age group per standard of education. These figures are intended to give an idea of the general trend observed and no more.

In all tests an increasing trend can be observed, although in certain the trend shows minor fluctuations or tends to flatten out more as one nears the Matriculation standard.

As can be seen from these figures, this increasing trend may be due to:

a) the influence of education,
or b) the influence of age,
or c) a combination of the influences of age and education.

Because of the great variations of education and age present in the Industrial Sample population, the influence that factors a), b) and c) above, exert upon the tests selectivity in secondary industry, will have to be considered.

The following section deals with the investigation of each of these problems in turn.

2. Does education affect African secondary industrial selection on the General Adaptability Battery?

an investigation of this problem will involve:

a) firstly, establishing whether education as such exerts any influence upon test performance,

b) then in the light of the above, investigating the effect that education may have upon secondary industrial selection based on the General Adaptability Battery.

In answering these questions data obtained from both the School and Industrial Samples will be utilised. The School Sample to throw light upon the influence of education on test performance, and the Industrial Sample when considering the main problem namely, the effect of education on the tests selectivity in secondary industry.

The degree of relationship between education and test performance is given in the following product-moment correlations from the School Sample: (the educational composition of this sample being shown in the diagram in Appendix F.)

TABLE : 4

SCREWS	.39059
SORTING I	.56553
SORTING 2	.61631
CUBES	.67144
TRIPOD	.46543
FORMBOARDS	.65642
PEGBOARD	.59276
WIGGLY BLKS.	.52322
KOHS BLKS.	.71288

From these correlations it is apparent that in the majority of tests the relationship between the two variables is fairly high.

This problem was further investigated by calculating firstly, the test intercorrelations for the School Sample and then by means of the Partial Correlation technique according to the following formulae:

$$r_{12.3} = \frac{r_{12} - r_{13}\, r_{23}}{\sqrt{1 - r_{13}^2}\ \sqrt{1 - r_{23}^2}}$$

where r_{12} = the intercorrelation between two tests

r_{3} = the correlation between education and test performance.

holding the influence of Education constant, and computing the intercorrelation table of partial correlations for this sample.

The difference between the Test Intercorrelation Tables (r_{12}) and the Test Partial Intercorrelation Tables ($r_{12.3}$), - shown in the tables on the following pages, is due to the influence of the heterogeneity of education within the sample.

As can be seen from these tables, by holding the influence of education constant, the test intercorrelations of the School Sample fall, an indication that education exerts an influence on test performance throughout the entire battery.

TABLE : 5

TEST INTERCORRELATIONS (SCHOOL SAMPLE):

		1.	2.	3.	4.	5.	6.	7.	8.
1.	SCREWS								
2.	SORTING I	.39411							
3.	SORTING 2	.32768	.67728						
4.	CUBE CONSTR.	.36382	.56302	.53167					
5.	TRIPOD	.45800	.55598	.43064	.60074				
6.	FORMBOARDS	.40586	.60642	.58775	.69893	.59884			
7.	PEGBOARDS	.37266	.59451	.53356	.63144	.63424	.69560		
8.	WIGGLY BLKS.	.33670	.44487	.41415	.59842	.51949	.59110	.56472	
9.	KOHS BLKS.	.36884	.59308	.62326	.73097	.58097	.76529	.69654	.58360

TABLE : 5

TEST PARTIAL INTERCORRELATIONS (SCHOOL SAMPLE): THE INFLUENCE OF EDUCATION HELD CONSTANT.

		1.	2.	3.	4.	5.	6.	7.	8.
1.	SCREW .								
2.	SORTING I	.22816							
3.	SORTING 2	.11995	.50614						
4.	CUBES	.14888	.29994	.20195					
5.	TRIPOD	.33900	.38634	.20631	.43945				
6.	FORMBOARDS	.21522	.37801	.30836	.46182	.43930			
7.	PEGBOARD	.19037	.39037	.26527	.39108	.49232	.50446		
8.	WIGGLY BLKS.	.16865	.21189	.13654	.39121	.36584	.38513	.37085	
9.	KOHS BLKS.	.1/003	32838	.33298	.48551	.41055	.56204	.48508	.35230

As the heterogeneity of education within the School Sample exerts an influence on test performance, one would expect the selective influence of successive examinations to increase the homogeneity, with respect to ability, within the successive standards as one progressed along the educational scale.

That this is in fact the case, can be seen from the intercorrelation tables appearing in Appendix G, giving the test intercorrelations for the following educational standards:

a) Sub-standards and Std. 1 combined.

b) Standard 4

c) Form 2

d) Forms 4 and 5 combined

It will be observed that the intercorrelations become smaller as subjects progress in school. This can be explained as due to increasing homogeneity brought about by the selective influence of successive examinations, causing the range of test scores to narrow down and the variability within the standard to decrease, the result being to produce smaller correlations.

The General Adaptability Battery may consequently, be said to function to some extent as a test of educational achievement.

Continuing the investigation into the influence of education on test scores, a Covariance Analysis was undertaken to consider the selectivity of the individual tests of the General Adaptability Battery in secondary industry, holding the influence of education constant.

It is usually possible in experimentation to choose, either by pairing or matching, groups that are comparable on variables judged relevant to the comparisons to be made. There are times, however, when it is more practicable to use intact groups which may differ in important

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