Distributors of Psytech International

Assessment Instrument and Software

Technical Test Battery (TTB2)

South African User Guide and Research Reference

Psytech South Africa
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Introduction

Table of contents: Introduction

This guide is for users and potential users of the Technical Test Battery (TTB2). It should be used in conjunction with the Technical Manual for the TTB2 published by Psytech International.

This guide does not replace the Technical Manual, but it is intended to provide the additional information on the TTB2 that South African users need.

Psytech manuals are distributed on CD at nominal cost, and extracts and updates are published on the company's website from time to time. It is recommended that users print the manuals and update sections as new studies become available. Printed copies of the latest versions of the user guides can also be purchased from the company if users prefer not to download the document themselves.

Structure of this manual

The manual is divided into the following sections:

- **Introduction**
  - This section covers the background to the questionnaire, administration instructions and general advice on its use in South Africa.
- **Norms**
  - This section contains descriptions of the various norm groups available for the various subtests of the Technical Test Battery – the composition of the norm groups, basic statistics on TTB2 subtests and stanine tables.
- **Reliability**
  - This section contains reports on the reliability studies done on the Technical Test Battery in South Africa – the composition of the groups, reliability coefficients and Standard Error of Measurement where suitable data exists.
- **Validity**
  - This section contains reports on the validation studies done on the Technical Test Battery in South Africa
- **Differential item functioning**
  - This section reports on the differential item functioning for the tests in the Technical Test Battery.

Studies will be added to the various sections as they are completed. The date when it was last updated appears on every study.

Every section has its own table of contents and introductory section.

Classification status of the Technical Test Battery

The TTB2 was submitted to the Psychometrics Committee of the Health Professions Council of South Africa in April 2001. The process of evaluation and classification is a lengthy one. Feedback reports received from the test reviewers indicate that the TTB2 meets the requirements for classification as a psychological test and a classification certificate was issued in August 2010. The test is currently on the list of provisionally classified tests.

Conditions of use and professional responsibilities

The TTB2 must be used under the control of a Psychologist, Psychometrist (Independent Practice), or Registered Counsellor.

Purchasing Technical Test Battery materials and scoring services

When purchasing test materials or scoring services relating to the TTB2, the signature and registration number of a Psychologist or Psychometrist (Independent Practice) or Registered Counsellor is required.

Constructing of test batteries

Only a Psychologist, Psychometrist (Independent Practice) or a Registered Counsellor may decide which tests or questionnaires to use for a particular purpose. Psychometrists registered for supervised practice or other role players such as HR Practitioners or line managers may not act independently of the Psychologist, and may not overrule the Psychologist's decisions.

Administration of the Technical Test Battery

- The tests may be administered by a Psychologist, Psychometrist (Supervised Practice), Psychometrist (Independent Practice) or Psychotechnician.

- Psychometrists (Supervised Practice) have to be supervised by a Psychologist.

Scoring of the Technical Test Battery

The TTB2 may be scored by

- A Psychologist,
- A Psychometrist (Independent Practice),
- A Psychometrist (Supervised Practice),
- A Registered Counsellor, or
- A Psychotechnician,
-

The scoring of the TTB2 is always done by computer. The act of scoring is pure data capture and no interpretation is involved.

Detailed instructions for scoring the TTB2 by computer can be found on the GeneSys Online platform, under tutorials. There are videos and downloadable PDFs. Special training in the use of the software is available and we strongly recommend attending this.

Reporting on the Technical Test Battery

The choice of which computerised report to use should be made by:

- A Psychologist, a Psychometrist (Independent Practice) or Registered Counsellor.

Psychometrists (Supervised Practice) and Psychotechnicians should consult with a Psychologist about the most suitable report to use.

The choice of which norm group to use should be made by:

- A Psychologist, a Psychometrist (Independent Practice) or a Registered Counsellor.

Psychometrists and Psychotechnicians should consult with a Psychologist about the most suitable norm group to use.

Feedback on Technical Test Battery reports

Feedback on TTB2 reports may be done by Psychologists Psychometrists (Independent Practice) or Registered Counsellors. Psychometrists registered for supervised practice may give feedback on the TTB2 within clearly circumscribed guidelines laid down by a Psychologist, and provided proper supervision, with regular consultation, is maintained.

What the Technical Test Battery measures

The TTB2 consists of three tests that can be administered separately or together.

Mechanical Reasoning Test (MRT2)

Measures the ability to understand mechanical concepts and physical principles in operation.
The items were selected from a wide range of areas (including optics, electricity, fluids and mechanics).

Spatial Reasoning Test (SRT2)

Measures spatial ability from two perspectives

- Visually constructing a three dimensional object.
- Visually relating an object to its pre-constructed patterned form.

The test consists of a number of diagrams which assess the ability to visualise shapes and objects in three dimensions.
The items were selected to represent a wide range of shapes like cubes, pyramids, cones, rhomboids and a variety of other multifaceted shapes.

Visual Acuity Test (VAC)

The Visual Acuity Test was specifically designed to be administered on computer.
It measures the ability (and disposition) to work with highly detailed technical material such as wiring or circuit diagrams. Respondents have to follow a single pathway through a complex maze.
The test assesses visual and attentional capacity which is relatively independent of general ability. The VAC2 was specifically developed to assess apprentices in roles which involve checking, repairing and replacing electrical/electronic circuitry and components**.**
For detailed information about the constructs measured by the Technical Test Battery, please consult the TTB2 technical manual. The technical manual gives an overview of the theoretical basis for the constructs, as well as a more in-depth discussion regarding the development rationale and the relationship of the TTB2 to other measures of ability.

Administration options for the Technical Test Battery

The subtests of the TTB2 can be administered separately or together, and may be combined with other measures, such as measures of personality, learning potential or abstract reasoning, to form a customised battery. The table below should help with the planning of a test battery:

Test	Time Limit	Pencil and Paper administration available	Computerised administration available
Mechanical Reasoning	15 minutes	Yes	Yes
Spatial Reasoning	15 minutes	Yes	Yes
Visual Acuity	15 minutes	No	Yes

Respondents for whom the Technical Test Battery is suitable

Level of Education

The TTB2 is intended for respondents with an educational level of Grade 12, or an equivalent technical qualification. For the Mechanical Reasoning Test, some background in science or technical subjects is required – we recommend that the test not be used on persons who have not done at least grade 9 Science.

One must be sensitive to the fact that educational standards have differed considerably in South Africa. People from impoverished backgrounds are not likely to have had an education of the same standard as people from privileged backgrounds. The Psychology professional in charge of the assessment should evaluate the situation with care, taking into account the intended respondent's background, fluency in English and so forth.

It is also possible that a person who has not had formal education up to Grade 12 level, may in fact have acquired sufficient fluency in English, scientific background and Technical skills to complete the TTB2 to good effect. Every situation must be evaluated on its merits.

Proficiency in English

It may be necessary to test for proficiency in English. Some standardised measures of English language skills are available, and users could avail themselves of these. It is not recommended that persons with functional English levels below grade 10 should be required to complete the TTB2.

Considering the socio-economic history of South Africa, it is reasonable to suppose that there are many people who should not be tested with group-administered structured tests, because they have not had sufficient exposure to formal testing situations or their language proficiency is inadequate. The Psychology professional should be realistic about this.

A history of the Technical Test Battery in South Africa

The Technical Test Battery was introduced in South Africa in 1995. Initially its use was very limited. As data become available, the use of the TTB2 is increasing.

The effect of affirmative action recruitment and selection practices on test statistics

Many employers in South Africa are adopting affirmative action recruitment and selection practices. Because most of the data available to Psytech SA come from recruitment projects, this has an effect on the reported test statistics.

A very common strategy when recruiting candidates for affirmative action positions, is as follows:

- Seriously consider every applicant from a formerly disadvantaged background who may possibly meet the requirements of the position.
- Only consider applicants from formerly advantaged backgrounds once a quota of formerly disadvantaged individuals has been met, or when the supply of suitable disadvantaged applicants has been exhausted.

Assessing candidates with psychometric tests incurs a cost for the employer, and employers usually try to minimise costs. Thus testing occurs fairly late in the selection profess. Frequently candidates are evaluated on application forms, CVs and interviews before they are tested. Often this means that the candidates from formerly advantaged backgrounds, who are tested, have been more rigorously pre-screened than the candidates from formerly disadvantaged backgrounds. This serves to aggravate the reported group differences on the tests, and can make a test appear more biased than it otherwise would be.

Users are advised to bear this in mind when evaluating the reported figures in this manual. Test users are also welcome to approach Psytech SA when large recruitment projects are being undertaken, so that the project can be planned in such a way as to render less distorted information about the tests. If necessary and justifiable in the interest of research, Psytech SA is willing to subsidise such projects.

Some cautionary notes:

- No subtest of the TTB2 should be used on its own as a selection instrument. The tests should always form part of an assessment battery that includes other measures, and preferably some non-test information as well.
- It is strongly recommended that a validation/integration interview should follow any assessment by means of tests or questionnaires. The interviewer should use this opportunity to put the test results into perspective relative to the respondent's background and the purpose of the assessment.
- Users should pay attention to the reliability and validity data available relating to the population group on which they intend to use the questionnaire.
- Users should use norm groups that are appropriate for the test person being assessed, also bearing in mind the demands of the situation for which the person is being assessed.
- Bearing in mind that the Technical Test Battery tests are all very short, users should bear in mind that they are not in-depth measures, and they should therefore not be interpreted in isolation.

Computer-assisted reports

Psytech tests and questionnaires are all supported by computer-assisted reports. Some of the tests have a range of computer-assisted reports, allowing instant interpretation of the test results from a variety of perspectives. For the TTB2, a standard report and a feedback report are available, either as a battery or individually for each subtest. In addition, a results summary spreadsheet is available to generate which is particularly useful as a summarised version of the individual candidates scores, or scores of a group of candidates that have completed the TTB2.

How do the computer-generated reports work?

The reports represent an expert system, drawing on numerous built-in relationships between patterns of scores and human behaviour. It would normally take a user many years of experience to gain the knowledge and insight that are contained in this reporting system.

What are the advantages of computer-generated reports?

Computer-generated reports ensure that the complete pattern of scores is interpreted every time. No score or combination of scores is overlooked. Everyone is treated in exactly the same way, irrespective of whether the person interpreting the results is having an 'off day' or is pressed for time. This helps to ensure fairness and consistency. Moreover, computer-generated reports save a lot of time, freeing the professional up to add value in the interview, integration of results from other sources and feedback processes.

Are computer-assisted reports open to abuse?

Like any powerful tool, computer-assisted reports can be misused. They should not be used to substitute for professional expertise, but rather to supplement and support it.

One must remember that these reports are generic-the standard reports do not know anything about the requirements of the positions that the respondent may have applied for. They are also completely unaware of the respondent's background and personal circumstances. They can usually not stand on their own, but must be used as one source of information in the assessment process, and be integrated with other information. This integration and interpretation is highly skilled professional work, and it should not be left to persons who have not had the required training.

In some situations, handing out unaltered computer-generated reports to respondents or line managers without any counselling or explanation, could be considered abuse of these reports. We recommend that the technical appendix in a report, which gives a graphic summary of raw scores and profiles, not be given to untrained persons.

What about competency-based reports?

You need not be limited to the reports supplied with the GeneSys online platform. Special reports can be written for clients based on their own competency models, or based on the results of validation studies. Psytech SA undertakes to do these as consulting projects, and the cost is dependent on the length and complexity of the report that the client requires.

Instructions for administering tests on computer

All three tests in the Technical Test Battery can be administered on computer.

For instructions on how to operate the software for test administration, please refer to the please refer to the GeneSys Online platform, under tutorials via https://eu.genesysonline.net/. There are videos and downloadable PDFs. Special training in the use of the software is available, which is strongly recommend.. Do not attempt to use computer software for test administration if you are not completely comfortable with how the software works. Familiarise yourself with the process of setting up a testing session with the software, creating the data record and entering the respondent's biographical information into the system, or assisting the respondent in doing so themselves.

Make sure that the respondent is physically able to operate the keyboard and the mouse, and can see the screen clearly.

Welcome the respondents (you may use a standard introduction), set them at ease and ensure that every respondent has given informed consent for the assessment.

Provide respondents who are completing tests on computer, with blank notepaper and a pencil, in case they want to make a note of an item they might want to revise when they reach the end of the test. Respondents may also make some rough calculations during the test.

Stay with the respondents while they start the test, and read through the instructions with them. If the respondents have any questions about the operation of the computer, or the example questions, answer those.

Once the respondent has completed the instruction section and started on the actual test items, do not provide any further help with the items, although you can assist if there are any actual computer problems (such as the mouse or the keyboard not responding correctly). Do not allow respondents to talk among themselves during testing.

Do not leave respondents to complete a battery of tests unsupervised. Remain in the room, and when the respondent reaches the end of the first test, provide support for the subsequent tests by reading through the instructions with them again.

At the end of the test battery, a screen will appear telling the respondent to call the test administrator. At this stage you need to enter the PIN you have chosen (when opening an account with Psytech SA) to exit the test administration program and save the responses. Do not allow the respondents to do this themselves.

Mechanical Reasoning Test pencil and paper administration instructions

If this is the first or only questionnaire being administered give an introduction welcoming the respondents, setting them at ease and ensuring that every respondent has given informed consent for the assessment.

Continue by using the instructions **EXACTLY** as given. Say:

"From now on, please do not talk among yourselves, but ask me if anything is not clear. We shall be doing the Mechanical Reasoning Test which takes 15 minutes. During the test I shall be checking to make sure you are not making any accidental mistakes when filling in the answer sheet. I will not be checking your responses to see if you are answering correctly or not."

Distribute the answer sheets

Then ask:

"Has everyone got two sharp pencils, an eraser, some rough paper and an answer sheet?

Rectify any omissions, then say:

"Print your last name, first name, age, title and sex clearly on the line provided. Please insert today's date which is [ ]."

If biographical information is required, ask respondents to complete the biodata section. If the answer sheets are to be scanned, explain and demonstrate how the ovals are to be completed, emphasising the importance of fully blackening the oval. Walk round the room to check that the instructions are being followed.

WARNING: It is vitally important that test booklets do not go astray. They should be counted out at the beginning of the session and counted in again at the end.

Distribute the booklets with the instruction:

"Please do not open the booklet until instructed."

Remembering to read slowly and clearly, go to the front of the group and say:

"Please open the booklet at Page 2 and follow the instructions for this test as I read them aloud." (Pause to allow booklets to be opened).

"This is a test of your understanding of mechanical principles. Each problem consists of a question which refers to one or more pictures. You have to look at each problem and select the correct answer and mark the appropriate box on the answer sheet."

"On Page 3 of this booklet there are some example questions. Once you have fully read the instructions you will have a chance to complete the example questions in order to make sure that you understand the test."

"Please attempt the example questions now."

While the candidates are doing the examples, walk around the room to check that everyone is clear about how to fill in the answer sheet. Make sure that no-one is looking at the actual test items during the example session. When all have finished (allow a maximum of one and a half minutes) give the answers as follows:

"The answer to Example 1 is number 1, as this chain alone will hold up the sign. The answer to Example 2 is number 2, as the load and height combined on a slope will turn this truck over more easily."

Then say:

"Time is short so when you begin the timed test work as quickly and as accurately as you can.

If you want to change an answer, fully erase your first choice, and fill in your new answer.

There are a total of 45 questions. You have 15 minutes in which to answer the questions.

*If you reach the **'End of Test'** before time is called you may review your answers if you wish.*

If you have any questions please ask now, as you will not be able to ask questions once the test has started."

Then say very clearly:

"Is everyone clear about how to do this test?"

Deal with any questions, appropriately, then, starting stop-watch or setting a count-down timer on the word **BEGIN** say:

"Please turn over the page and begin"

Answer only questions relating to procedure at this stage, but enter in the Administrator's Test Record any other problems which occur. Walk around the room at appropriate intervals to check for potential problems.

At the end of the 15 minutes, say:

"Stop now please and close your booklet"

You should intervene if candidates continue after this point.

COLLECT ANSWER SHEETS AND TEST BOOKLETS, ENSURING THAT ALL MATERIALS ARE RETURNED (COUNT BOOKLETS AND ANSWER SHEETS)

Then say:

"Thank you for completing the Mechanical Reasoning Test"

Spatial Reasoning Test (SRT2) pencil and paper Administration Instructions

If this is the first or only questionnaire being administered give an introduction welcoming the respondents, setting them at ease and ensuring that every respondent has given informed consent for the assessment.

Continue by using the instructions **EXACTLY** as given. Say:

"From now on, please do not talk among yourselves, but ask me if anything is not clear. We shall be doing the Spatial Reasoning Test which takes 15 minutes. During the test I shall be checking to make sure you are not making any accidental mistakes when filling in the answer sheet. I will not be checking your responses to see if you are answering correctly or not."

Distribute the answer sheets

Then ask:

"Has everyone got two sharp pencils, an eraser, some rough paper and an answer sheet?

Rectify any omissions, then say:

"Print your last name, first name, age, title and sex clearly on the line provided. Please insert today's date which is [ ]."

If biographical information is required, ask respondents to complete the biodata section. If the answer sheets are to be scanned, explain and demonstrate how the ovals are to be completed, emphasising the importance of fully blackening the oval. Walk round the room to check that the instructions are being followed.

WARNING: It is vitally important that test booklets do not go astray. They should be counted out at the beginning of the session and counted in again at the end.

Distribute the booklets with the instruction:

"Please do not open the booklet until instructed."

Remembering to read slowly and clearly, go to the front of the group and say:

"Please open the booklet at Page 2 and follow the instructions for this test as I read them aloud." (Pause to allow booklets to be opened).

"This is a test of your ability to visualise objects in three dimensions. Each problem consists of a question which refers to one or more pictures. You have to look at each problem, select the correct answer and mark the appropriate box on the answer sheet.

Now work through the examples questions on page 3 and mark the appropriate boxes on the answer sheet in the section marked 'Example' on the answer sheet. Please note each figure should be visually folded into the page".
"Please attempt the example questions now".

While the candidates are doing the examples, walk around the room to check that everyone is clear about how to fill in the answer sheet. Make sure that no-one is looking at the actual test items during the example session. When all have finished (allow a maximum of one and a half minutes) give the answers as follows:

"The answer to Example 1 is number 2, and the answer to Example 2 is number 4, as these shapes could be made from the patterns shown. The other three shapes in each of the two examples all have a blank side but the patterns do not.

Then say:

"Time is short so when you begin the timed test work as quickly and as accurately as you can.

If you want to change an answer, fully erase your first choice, and fill in your new answer.

There are a total of 30 questions and you have 15 minutes in which to attempt them.

*If you reach the **'End of Test'** before time is called you may review your answers if you wish.*

If you have any questions please ask now, as you will not be able to ask questions once the test has started."

Then say very clearly:

"Is everyone clear about how to do this test?"

Deal with any questions, appropriately, then, starting stop watch or setting a count-down timer on the word **BEGIN** say:

"Please turn over the page and begin"

Answer only questions relating to procedure at this stage, but enter in the Administrator's Test Record any other problems which occur. Walk around the room at appropriate intervals to check for potential problems.

At the end of the 15 minutes, say:

"Stop now please and close your booklet"

You should intervene if candidates continue after this point.

COLLECT ANSWER SHEETS AND TEST BOOKLETS, ENSURING THAT ALL MATERIALS ARE RETURNED (COUNT BOOKLETS AND ANSWER SHEETS)

Then say:

"Thank you for completing the Spatial Reasoning Test"

The Technical Test Battery (TTB2)

Norms Introduction

South African Norms available for the Technical Test Battery (TTB2)

Different types of norms available

There are two kinds of norms available for Psytech tests. Many of the norm groups are based on means and standard deviations obtained through research. These means and standard deviations are used by the GeneSys reporting software to calculate standard scores. In the case of the Technical Test Battery (TTB2), stanines are used.

Users of the test do not need to look up raw scores to find the corresponding standard scores, because the software does it for them. For this manual, however, stanine tables have been specially calculated from means and standard deviations to facilitate comparison between norm groups, so that users can more easily choose which norm group is most suitable for a given situation. This allows users to make a more informed choice rather than simply relying on automatic choices made by the online platform.

The second type of norm is the frequency norm. In this case, more information is stored internally, and it is possible to add additional cases to the norm group as more data are collected. The GeneSys online platform is able to create tables of standard scores for frequency norms. The tables of standard scores are provided for interest and information, which would assist when comparing one norm group with another. For the purpose of generating a report, the online system does the calculations internally, and doesn't refer to any tables.

Biographical data

The GeneSys online platform offers the facility to collect comprehensive biographical information on respondents. Unfortunately, test users very seldom collect these data. Having this information incomplete poses a serious concern for us as Psytech SA obtains most of its information from clients who use the assessments.

Users are advised to make an effort to capture full biographical information on the respondents. This will help to enable them to adhere to best practice and compliance with legal requirements.

SA Norms and international norms

The GeneSys online platform contains international norms on all Psytech tests, in addition to the South African norms that have been collected by Psytech South Africa.

Unless you have a very good reason to do otherwise, we recommend the use of South African norms rather than international norms. The South Africa norms are clearly marked with 'SA' in the heading. All other norms that do not include 'South Africa' or 'SA' in the heading are international norms. If you are assessing a person for placement overseas and you have a suitable international norm available, you could consider using the international norm in conjunction with a South African norm.

Outdated or unsuitable norms are subject to removal from the GeneSys online platform, but would still be reflected in the South African User Guide as it serves as a repository of all research that has been done to date.

User-developed norms

The GeneSys online platform offers users the facility to generate their own norms on the data they have collected. These norms will only appear on your online account and will not be available to other online accounts. Users must ensure that the data included in these in-house norms are “clean” – that they contain no dummy cases resulting from experimenting with the software, duplicates or other data that could interfere with the interpretation of the results. Psytech SA offers assistance in the creation of in-house norms for users who need it. If the norm group was generated on your own computer and not shared with Psytech SA, it will not appear in the documentation.

The norms we recommend and have calculated are based on standard deviations and means and are only added to the online system after they have done through an elaborate process of cleaning the data by removing duplicates, dummy and test cases and other data to make sure that users are using norms that were calculated on uncontaminated data (as far as is possible).

Choose the comparison group with care. Bear in mind factors such as race, language, level of education and level of proficiency in English.

List of South African norm groups for the Technical Test Battery

Description	Study number
SA Workers in and applicants to a South African Tobacco manufacturing company	N1
SA Apprentice applicants	N2
SA Workers in and applicants to a South African construction company	N3
SA Senior technical officers (electricians)	N4
SA General Population updated 2008	N5
SA Aggregate Population 2016	N6
SA Afrikaans 2016	N7
SA English 2016	N8
SA Indigenous 2016	N9
SA isiXhosa 2016	N10
SA isiZulu 2016	N11
SA Sepedi 2016	N12
SA Sesotho 2016	N13
SA Setswana 2016	N14

The context of the new Aggregate norm:

Previously, when selecting a norm group on the GeneSys online platform, there was a 'General Population' norm available. The name of this norm has been changed from 'General Population' to the 'Aggregate Population'. Due to the nature of the data, aggregate population is more appropriate.

The technicalities:

When creating a norm, there are various ways of collecting data. In creating the updated norms, convenience sampling was done, which means that we used the data that were available to us. Specifically, the data from the GeneSys for Windows system were collated with the data from all our clients that have submitted data, for the period up to June 2015. The norm is best described as an aggregate norm when this sampling technique is utilised. This norm contains newer data, and represents a very substantial sample. To ensure the data were useful, the data were processed and 'cleaned' whereby duplicates and demonstration samples, and people who had not completed the entire assessment or subtest were removed, as well as all retests. Additionally, common names may have been removed in this process as we filtered data using Name, Surname, Sex, Age, Education, First Language and Race. In the initial process of merging data from all sources, (the GeneSys for Windows data merged with data from other GeneSys systems), duplicates were also set to be removed. This process has left us with a set of data that we are fairly confident about in terms of content and usefulness.

How to select a norm:

When selecting a norm it is important to consider who the respondent will be compared to, and choose the appropriate norm accordingly.

1. When to use the Aggregate Population norm (previously the General Population norm)

This norm consists of a large number of respondents and enables the individual's score to be compared to a representative average of this specific population. Using this norm enables the practitioner to know where the respondent lies in comparison to (in this context) the general population. Even when the norm is used in different situations, the basis for comparison stays the same. The requirements of the position should be borne in mind when interpreting the scores. It is much more defensible to use the same gauge and appropriately adjust your cut-offs as per various situations.

2. When to use an Indigenous Language or Smaller language group norm

Preferential treatment, to allow fairness for smaller language groups. This norm can be used to avoid discriminating against speakers of indigenous/smaller language groups and allow for potential educational deficits (as may be the case with the Verbal and Numerical subtests), as well as language interference.

3. Occupation Specific norms

These norms are used in specific contexts. They are useful for when the requirements of the job are unknown/assumed/ have not been examined, but the occupation group is known and there is access to a volume of data.

Additional points

Employment Equity

One of the legacies of apartheid is that South Africa is a country characterised by imbalances of distribution of opportunities and resources which permeates all spheres of society. The differences are mostly felt in educational and occupational environment and they still shape the wellbeing and future of the previously oppressed Black majority. One of the mechanisms put in place is Affirmative Action (AA) aimed at correcting the imbalances of the pasts by giving the Black majority an opportunity to advance and develop. However, the inferior quality of education and other factors that resulted from institutionalised discrimination makes it difficult for most Black candidates to meet the requirements. This extends to their ability to perform above the cut-off point on psychometric tests necessary for joining, promotions and attending high profile courses. The situation is aggravated by the bad reputation of psychometric tests in SA, making it difficult for some leaders to accept the result. Some perceive them as tools to frustrate processes such as AA, consequently suggesting the exclusion of psychometric tests in any selection processes.

If an organisation/employer wants to make a special effort to accommodate advancement of previously disadvantaged groups, one way of doing this would be to use a norm group tailored to the biographical background of the candidate. This would mean that you would be comparing English speakers with English speakers or speakers of Indigenous languages to other speakers of Indigenous language, for instance. It needs to be recognised that this may be seen as unfair by people who do not belong to the formerly disadvantaged

groups. It is, however, defensible in terms of the Employment Equity Act. When concessions of this nature are made, it would be advisable for them to be followed up with training and development.

The means and standard deviations for all the norms are available in the documentation for that norm group. In order to make an informed and fair decision, which is fair both to the candidate and to the employing organisation, practitioners are advised to compare the means for the different groups to the Aggregate Norm. To enable them to know how much of a concession they are making in the interest of Affirmative Action.

Biographical data

When creating norms, biographical data is of the utmost importance. Not only is it vital to ensure adequate validity and reliability is present in all demographic groups in South Africa, but it aids in building specific norm groups too. More than simply generating an overall norm group, additional data adds to building other useful norms based around education level, occupation level and language groups. Without this vital information, less information is available for the creation of such norms, which means that less norms are available for use. While it may appear to be time-consuming to fill in biographical data, it is of extreme importance. This also assists in making fair and proper norm selection decisions, for a specific individual.

Importance of using updated norms

Data can be obsolete if it is old enough to no longer reflect the population it is intended to represent. It is therefore in the best interest to use recently updated norms to ensure that candidates are compared to a representative group in order for results to be interpreted in a meaningful way.

Should an organisation want an in-house or specific norm, please feel free to contact us and we would be happy to help you in this regard.

TTB Norm Group: SA Tobacco Company Workers and Applicants

Sample Composition

The sample consisted of workers and applicants in a company manufacturing tobacco products. Data were collected between 2002-2003.

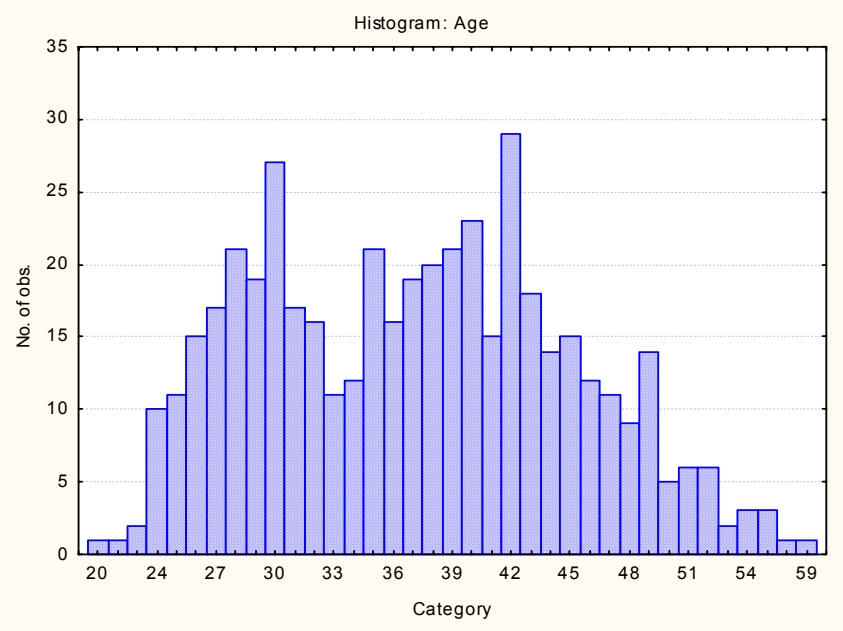
Category	Frequency table: Sex			
	Count	Cumulative Count	Percent	Cumulative Percent
Male	455	455	98.06034	98.0603
Female	9	464	1.93966	100.0000
Missing	0	464	0.00000	100.0000

Category	Frequency table: First Language			
	Count	Cumulative Count	Percent	Cumulative Percent
Afrikaans	55	55	11.85345	11.8534
Sesotho	171	226	36.85345	48.7069
isiZulu	168	394	36.20690	84.9138
English	11	405	2.37069	87.2845
Setswana	5	410	1.07759	88.3621
Other - N Sotho	1	411	0.21552	88.5776
Xitsonga	4	415	0.86207	89.4397
Sepedi	10	425	2.15517	91.5948
isiNdebele/Tshivenda	5	430	1.07759	92.6724
isiXhosa	15	445	3.23276	95.9052
siSwati	2	447	0.43103	96.3362
Missing	17	464	3.66379	100.0000

Category	Frequency table: Race			
	Count	Cumulative Count	Percent	Cumulative Percent
European	50	50	10.77586	10.7759
African	385	435	82.97414	93.7500
Asian	6	441	1.29310	95.0431
Coloured	7	448	1.50862	96.5517
Missing	16	464	3.44828	100.0000

Category	Frequency table: Education			
	Count	Cumulative Count	Percent	Cumulative Percent
Vocational Training	10	10	2.15517	2.1552
Grade 12 - N2	1	11	0.21552	2.3707
Grade 10 or 11	35	46	7.54310	9.9138
University entrance matri	2	48	0.43103	10.3448
Technikon	8	56	1.72414	12.0690
Std 7	36	92	7.75862	19.8276
Std 5	17	109	3.66379	23.4914
Grade 12	147	256	31.68103	55.1724
Std 6	46	302	9.91379	65.0862
Technikon (N2)	1	303	0.21552	65.3017
Std 8	63	366	13.57759	78.8793
Vocational Training - N2	4	370	0.86207	79.7414
Std 9	27	397	5.81897	85.5603
Technikon - N2	1	398	0.21552	85.7759
Degree	1	399	0.21552	85.9914
Technikon - N5	1	400	0.21552	86.2069
Grade 12 + N5 Fitter and	1	401	0.21552	86.4224
Vocational Training - N3	5	406	1.07759	87.5000
Grade 12 + ND in Fitting	1	407	0.21552	87.7155
Vocational Training - NTC	1	408	0.21552	87.9310
Grade 8	2	410	0.43103	88.3621
Grade 12 + Technikon Cert	1	411	0.21552	88.5776
Vocational Training - N4	5	416	1.07759	89.6552
Std 4	6	422	1.29310	90.9483
Grade 11	3	425	0.64655	91.5948
NTC 3	1	426	0.21552	91.8103
Vocational Training (Mill	1	427	0.21552	92.0259
Grade 12 + Teaching Diplo	1	428	0.21552	92.2414
University diploma	1	429	0.21552	92.4569
Grade 10	1	430	0.21552	92.6724
Grade 11 + BAdmin Diploma	1	431	0.21552	92.8879
Grade 9	2	433	0.43103	93.3190
Form 2	1	434	0.21552	93.5345
Vocational Training - Fit	1	435	0.21552	93.7500
Grade 12 & A+	1	436	0.21552	93.9655
Grade 12 + Fitter & Turne	2	438	0.43103	94.3966
Technikon - N3	1	439	0.21552	94.6121
Technikon - Marketing	1	440	0.21552	94.8276
Std 1	1	441	0.21552	95.0431
Grade 10 or 11 + Ind Refr	1	442	0.21552	95.2586
Vocational Training - N5	1	443	0.21552	95.4741
Vocational Training (N3)	1	444	0.21552	95.6897
Grade 12 + HRM Diploma	1	445	0.21552	95.9052
Vocational Training - N1	1	446	0.21552	96.1207
Grade 10 or 11 + Fitting	1	447	0.21552	96.3362
Missing	17	464	3.66379	100.0000

Variable	Descriptive Statistics					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases Missing
Age	37.12500	7.879869	20.00000	59.00000	464	0



Descriptive statistics on TTB subtests

Variable	Descriptive Statistics					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases Missing
Mechanical Reasoning	11.84267	5.072161	0.00	30.00000	464	0
Spatial Reasoning	7.65517	3.686654	0.00	22.00000	464	0

Stanine Table

	1 S9_1	2 S9_2	3 S9_3	4 S9_4	5 S9_5	6 S9_6	7 S9_7	8 S9_8	9 S9_9
Mechanical Reasoning	0-2	3-5	6-8	9-10	11-13	14-15	16-18	19-20	21-45
Spatial Reasoning	0-1	2-3	4-4	5-6	7-8	9-10	11-12	13-14	15-30

TTB Norm Group: SA Apprentice Applicants

Sample composition

The sample consisted of individuals applying for apprentice training in a variety of trades with a local government body.

Educational levels ranged from grade 9 to N3 diplomas.

Some of the respondents were from a special educational institution for persons with learning problems.

	Frequency table: Race			
Category	Count	Cumulative Count	Percent	Cumulative Percent
Whites and coloureds	68	68	29.82456	29.8246
Blacks	156	224	68.42105	98.2456
Missing	4	228	1.75439	100.0000

	Frequency table: GENDER			
Category	Count	Cumulative Count	Percent	Cumulative Percent
Male	205	205	89.91228	89.9123
Female	18	223	7.89474	97.8070
Unknown	5	228	2.19298	100.0000
Missing	0	228	0.00000	100.0000

Descriptive statistics on TTB Subtests

	Descriptive Statistics					
Variable	Mean	Std.Dev	Minimum	Maximum	N	No.cases Missing
Mechanical Reasoning	16.82379	5.000421	7.000000	35.00000	227	1
Spatial Reasoning	9.20614	3.456024	2.000000	20.00000	228	0

Stanine table

	1 S9_1	2 S9_2	3 S9_3	4 S9_4	5 S9_5	6 S9_6	7 S9_7	8 S9_8	9 S9_9
Mechanical Reasoning	0-8	9-10	11-13	14-15	16-18	19-20	21-23	24-25	26-45
Spatial Reasoning	0-3	4-4	5-6	7-8	9-10	11-11	12-13	14-15	16-30

TTB Norm Group: SA Construction Company workers and Applicants

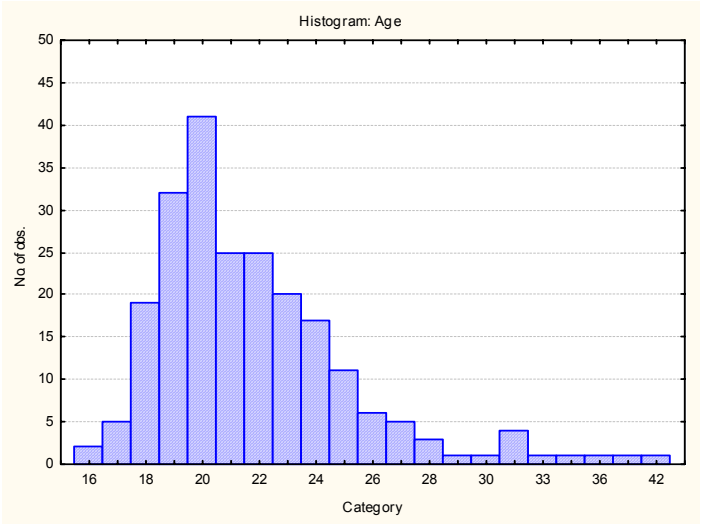
Sample Composition

Workers and applicants to a construction company based in the Western Cape.
Data were collected during 2002-2003.

Category	Frequency table: Race			
	Count	Cumulative Count	Percent	Cumulative Percent
BLACKS	124	124	55.60538	55.6054
ASIANS	2	126	0.89686	56.5022
WHITES/COLOUREDS	95	221	42.60090	99.1031
Missing	2	223	0.89686	100.0000

Category	Frequency table: Sex			
	Count	Cumulative Count	Percent	Cumulative Percent
MALE	204	204	91.47982	91.4798
FEMALE	18	222	8.07175	99.5516
UNKNOWN	1	223	0.44843	100.0000
Missing	0	223	0.00000	100.0000

Variable	Descriptive Statistics					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases Missing
Age	21.83784	3.751417	16.00000	42.00000	222	1



Descriptive statistics on TTB subtests

Variable	Descriptive Statistics					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases Missing
Mechanical Reasoning	17.14798	6.466169	5.000000	37.00000	223	0
Spatial Reasoning	11.97758	5.320743	0.000000	28.00000	223	0

Stanine table

	1 S9_1	2 S9_2	3 S9_3	4 S9_4	5 S9_5	6 S9_6	7 S9_7	8 S9_8	9 S9_9
Mechanical Reasoning	0-5	6-9	10-12	13-15	16-18	19-21	22-25	26-28	29-45
Spatial Reasoning	0-2	3-5	6-7	8-10	11-13	14-15	16-18	19-21	22-30

TTB Norm group: Senior technical officers (electricians)

Sample composition

Senior technical officers tested as part of a validation study.
Data were collected in 2003.

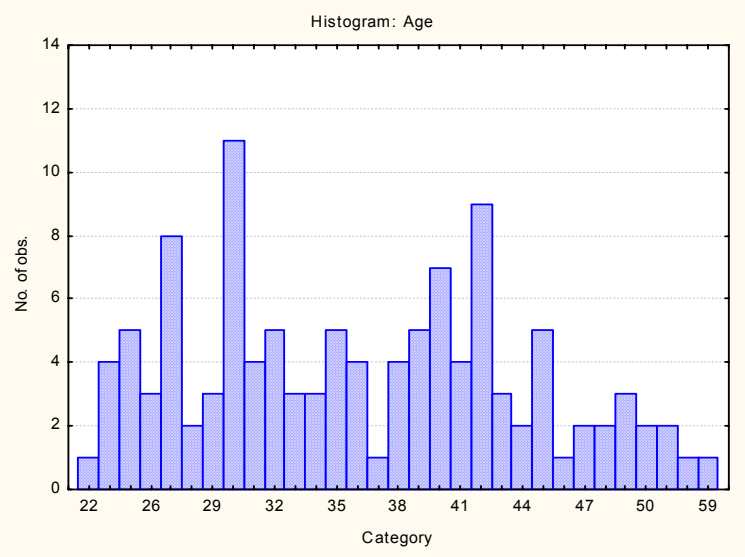
Category	Frequency table: Sex			
	Count	Cumulative Count	Percent	Cumulative Percent
Male	118	118	100.0000	100.0000
Missing	0	118	0.0000	100.0000

Category	Frequency table: Education			
	Count	Cumulative Count	Percent	Cumulative Percent
Technikon	4	4	3.38983	3.3898
Vocational Training	42	46	35.59322	38.9831
Grade 12	31	77	26.27119	65.2542
Grade 10 or 11	4	81	3.38983	68.6441
N5	1	82	0.84746	69.4915
Missing	36	118	30.50847	100.0000

Category	Frequency table: First Language			
	Count	Cumulative Count	Percent	Cumulative Percent
isiZulu	17	17	14.40678	14.4068
isiXhosa	3	20	2.54237	16.9492
Afrikaans	34	54	28.81356	45.7627
English	17	71	14.40678	60.1695
Sesotho	8	79	6.77966	66.9492
Xitsonga	1	80	0.84746	67.7966
Setswana	1	81	0.84746	68.6441
isiNdebele	1	82	0.84746	69.4915
Missing	36	118	30.50847	100.0000

Category	Frequency table: Race			
	Count	Cumulative Count	Percent	Cumulative Percent
African	31	31	26.27119	26.2712
European	45	76	38.13559	64.4068
Coloured	6	82	5.08475	69.4915
Missing	36	118	30.50847	100.0000

Variable	Descriptive Statistics					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases Missing
Age	36.16522	7.997730	22.00000	59.00000	115	3



Descriptive statistics on TTB subtests

Variable	Descriptive Statistics					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases Missing
Mechanical Reasoning	20.08547	6.687060	6.00000	35.00000	117	1
Spatial Reasoning	11.70940	5.319223	2.00000	28.00000	117	1
Visual Acuity	7.46610	3.280823	0.00000	14.00000	118	0

Stanine table

	1 S9_1	2 S9_2	3 S9_3	4 S9_4	5 S9_5	6 S9_6	7 S9_7	8 S9_8	9 S9_9
Mechanical Reasoning	0-8	9-11	12-15	16-18	19-21	22-25	26-28	29-31	32-45
Spatial Reasoning	0-2	3-5	6-7	8-10	11-13	14-15	16-18	19-21	22-30
Visual Acuity	0-1	2-3	4-5	6-6	7-8	9-9	10-11	12-13	14-15

Technical Test Battery Norm group: SA General Population updated 2008

Sample composition

Respondents tested by Psytech SA and collaborators during 2001-2008. Not all respondents completed all the tests, therefore the biographical information is reported by subtest.

Sample composition: Mechanical Reasoning Test (MRT2)

Category	Frequency table: Sex			
	Count	Cumulative	Percent	Cumulative
M	2139	2139	87.44890	87.4489
F	300	2439	12.26492	99.7138
U	7	2446	0.28618	100.0000
Missing	0	2446	0.00000	100.0000

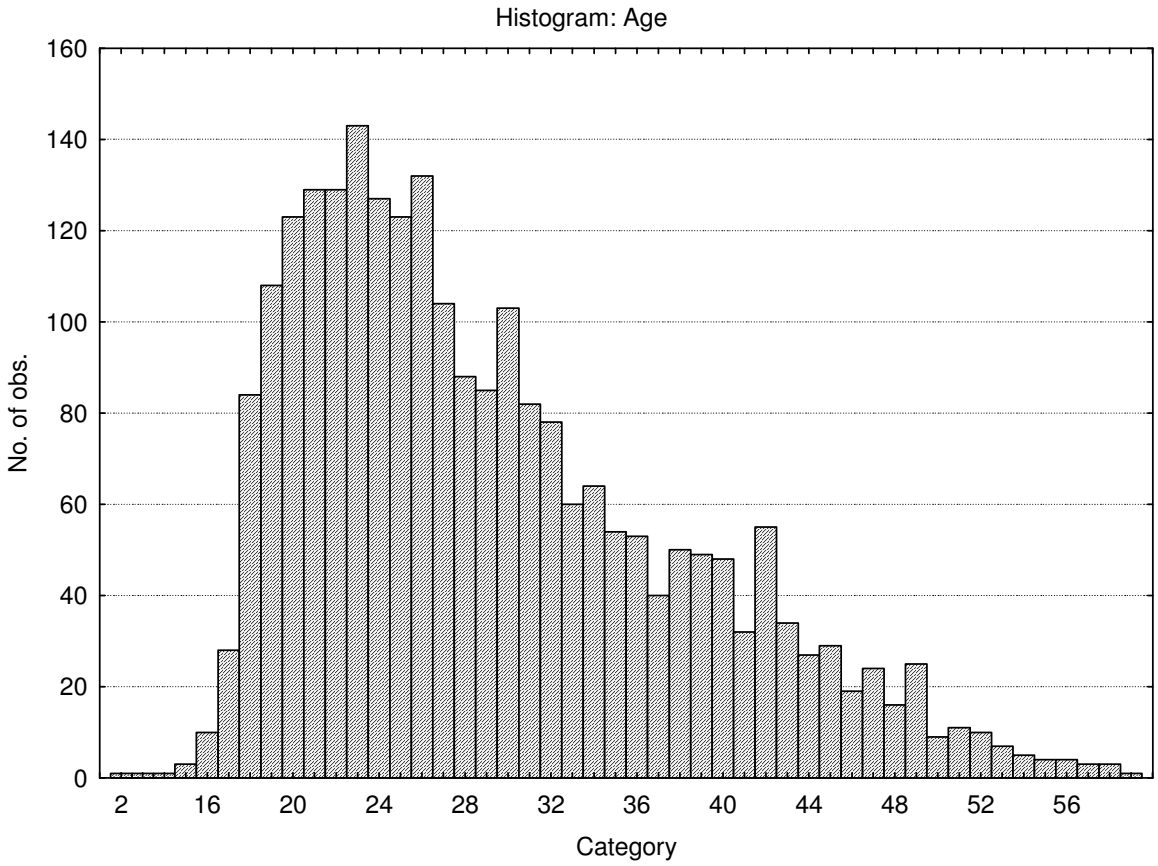
Category	Frequency table: Education			
	Count	Cumulative	Percent	Cumulative
Technikon	228	228	9.32134	9.3213
Grade 12	675	903	27.59608	36.9174
Grade 10 or 11	167	1070	6.82747	43.7449
Degree	11	1081	0.44971	44.1946
Post Graduate	4	1085	0.16353	44.3581
Matric	1	1086	0.04088	44.3990
Grade 9	38	1124	1.55356	45.9526
Vocational Training	77	1201	3.14800	49.1006
University diploma	17	1218	0.69501	49.7956
Grade 7	17	1235	0.69501	50.4906
Grade 8	46	1281	1.88062	52.3712
Missing	1165	2446	47.62878	100.0000

Category	Frequency table: Language			
	Count	Cumulative	Percent	Cumulative
isiZulu	464	464	18.96975	18.9697
English	175	639	7.15454	26.1243
Afrikaans	214	853	8.74898	34.8733
Setswana	39	892	1.59444	36.4677
Sesotho	236	1128	9.64841	46.1161
Xitsonga	23	1151	0.94031	47.0564
Sepedi	59	1210	2.41210	49.4685

Category	Frequency table: Language			
	Count	Cumulative	Percent	Cumulative
siSwati	8	1218	0.32706	49.7956
isiXhosa	122	1340	4.98774	54.7833
Missing	1106	2446	45.21668	100.0000

Category	Frequency table: Race			
	Count	Cumulative	Percent	Cumulative
African	1096	1096	44.80785	44.8078
European	249	1345	10.17989	54.9877
Coloured	74	1419	3.02535	58.0131
Asian	70	1489	2.86182	60.8749
Missing	957	2446	39.12510	100.0000

Variable	Descriptive Statistics : Age					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases Missing
Age	29.26468	8.812735	2.000000	69.00000	2418	28



Sample composition: Spatial Reasoning Test (SRT2)

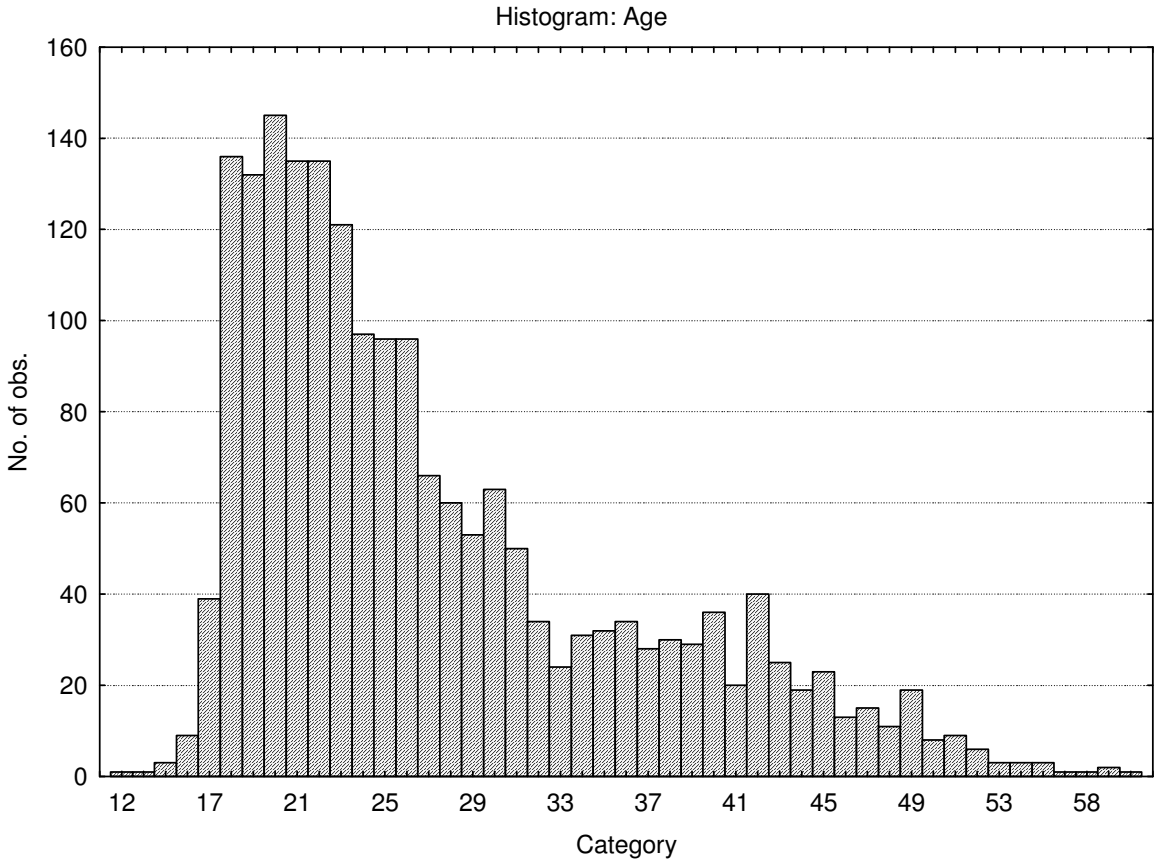
Category	**Frequency table: Sex**			
	Count	Cumulative	Percent	Cumulative
M	1731	1731	88.09160	88.0916
F	230	1961	11.70483	99.7964
U	4	1965	0.20356	100.0000
Missing	0	1965	0.00000	100.0000

Category	Frequency table: Education			
	Count	Cumulative	Percent	Cumulative
Technikon	229	229	11.65394	11.6539
Grade 12	713	942	36.28499	47.9389
Grade 10 or 11	150	1092	7.63359	55.5725
Degree	8	1100	0.40712	55.9796
Post Graduate	1	1101	0.05089	56.0305
Matric	19	1120	0.96692	56.9975
Grade 9	39	1159	1.98473	58.9822
Vocational Training	88	1247	4.47837	63.4606
University diploma	9	1256	0.45802	63.9186
Grade 7	17	1273	0.86514	64.7837
Grade 8	46	1319	2.34097	67.1247
Missing	646	1965	32.87532	100.0000

Category	Frequency table: Language			
	Count	Cumulative	Percent	Cumulative
isiZulu	414	414	21.06870	21.0687
English	212	626	10.78880	31.8575
Afrikaans	224	850	11.39949	43.2570
Setswana	41	891	2.08651	45.3435
Sesotho	231	1122	11.75573	57.0992
Xitsonga	26	1148	1.32316	58.4224
Sepedi	40	1188	2.03562	60.4580
siSwati	7	1195	0.35623	60.8142
isiXhosa	233	1428	11.85751	72.6718
Missing	537	1965	27.32824	100.0000

Category	Frequency table: Race			
	Count	Cumulative	Percent	Cumulative
African	1095	1095	55.72519	55.7252
European	215	1310	10.94148	66.6667
Coloured	145	1455	7.37913	74.0458
Asian	66	1521	3.35878	77.4046
Missing	444	1965	22.59542	100.0000

Variable	Descriptive Statistics : Age					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases Missing
Age	27.43860	8.865693	12.00000	69.00000	1938	27



Sample composition: Visual Acuity Test (VAC)

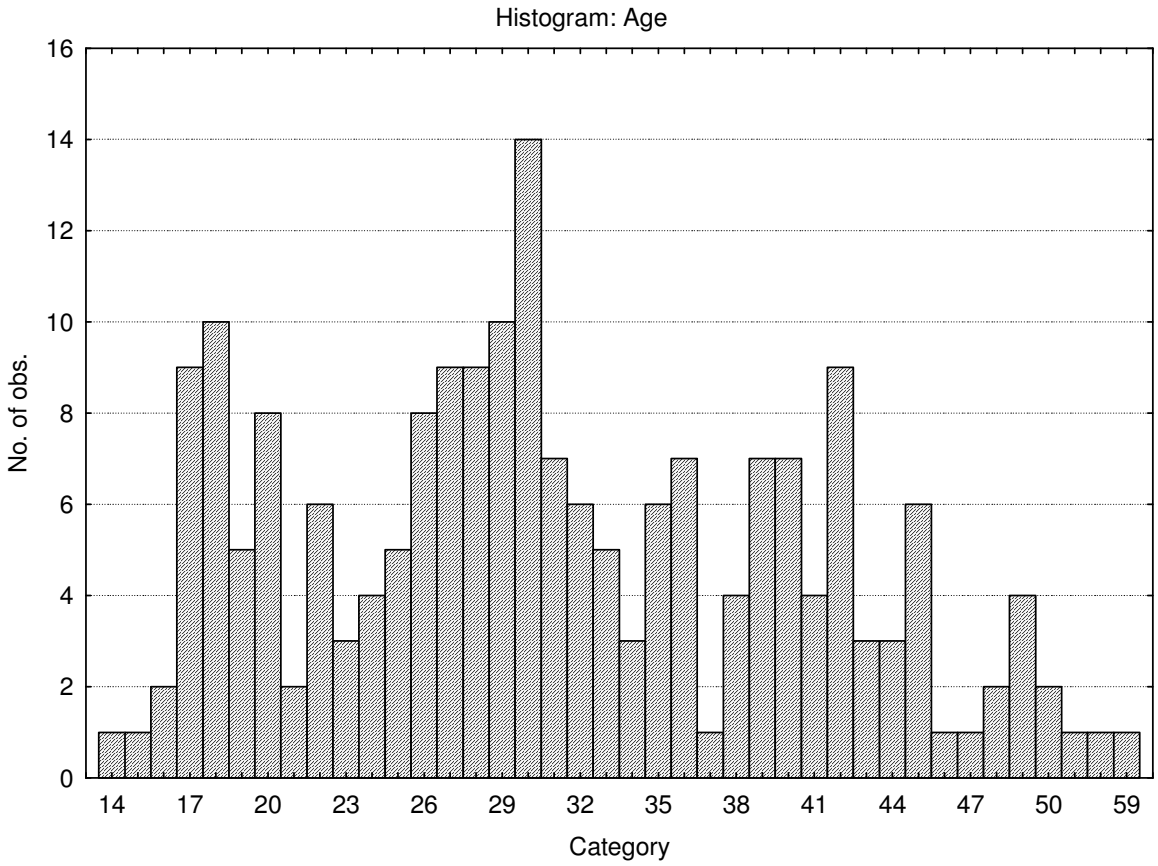
Category	Frequency table: Sex			
	Count	Cumulative	Percent	Cumulative
M	168	168	83.58209	83.5821
F	32	200	15.92040	99.5025
U	1	201	0.49751	100.0000
Missing	0	201	0.00000	100.0000

Category	Frequency table: Education			
	Count	Cumulative	Percent	Cumulative
Technikon	4	4	1.99005	1.9900
Grade 12	32	36	15.92040	17.9104
Grade 10 or 11	6	42	2.98507	20.8955
Post Graduate	1	43	0.49751	21.3930
Vocational Training	42	85	20.89552	42.2886
Missing	116	201	57.71144	100.0000

Category	Frequency table: Language			
	Count	Cumulative	Percent	Cumulative
isiZulu	21	21	10.44776	10.4478
English	20	41	9.95025	20.3980
Afrikaans	34	75	16.91542	37.3134
Setswana	1	76	0.49751	37.8109
Sesotho	7	83	3.48259	41.2935
Xitsonga	1	84	0.49751	41.7910
isiXhosa	3	87	1.49254	43.2836
Missing	114	201	56.71642	100.0000

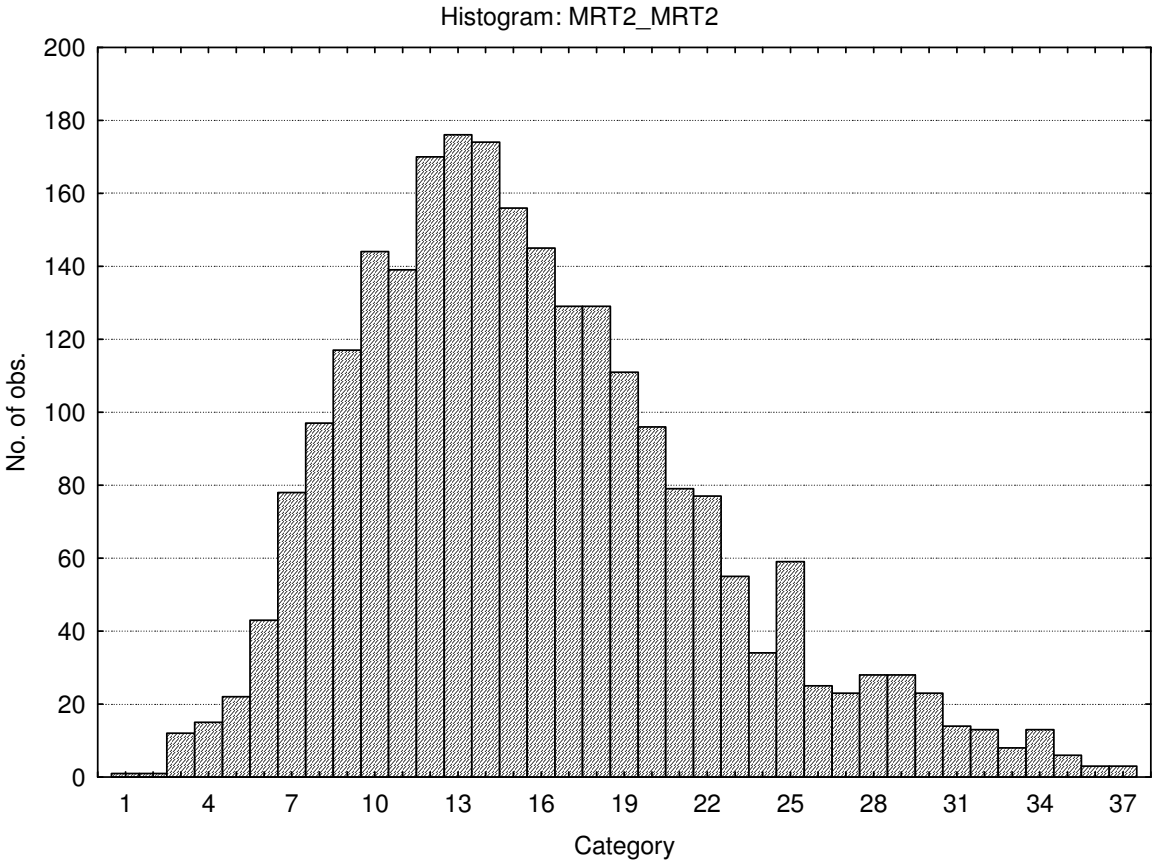
Category	Frequency table: Race			
	Count	Cumulative	Percent	Cumulative
African	34	34	16.91542	16.9154
European	47	81	23.38308	40.2985
Coloured	6	87	2.98507	43.2836
Asian	1	88	0.49751	43.7811
Missing	113	201	56.21891	100.0000

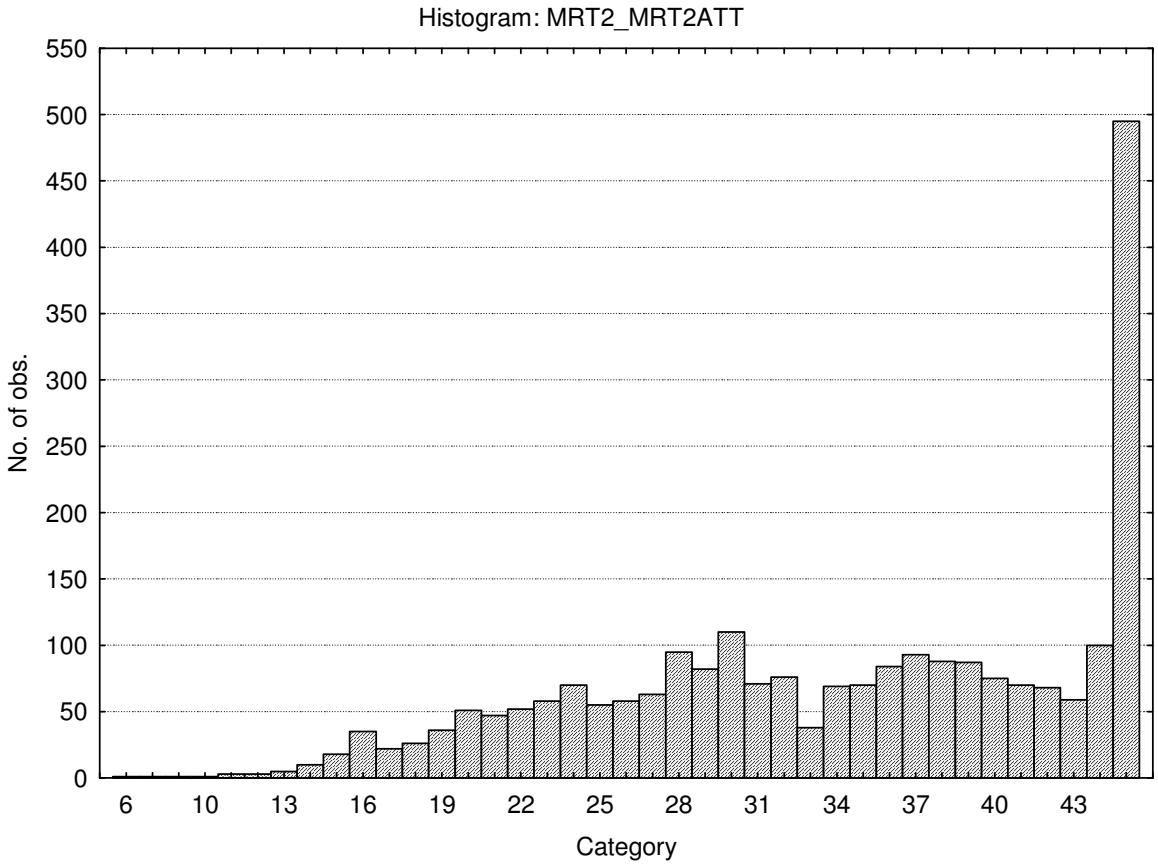
Variable	Descriptive Statistics : Age					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases missing
Age	31.10152	9.526539	14.00000	59.00000	197	4



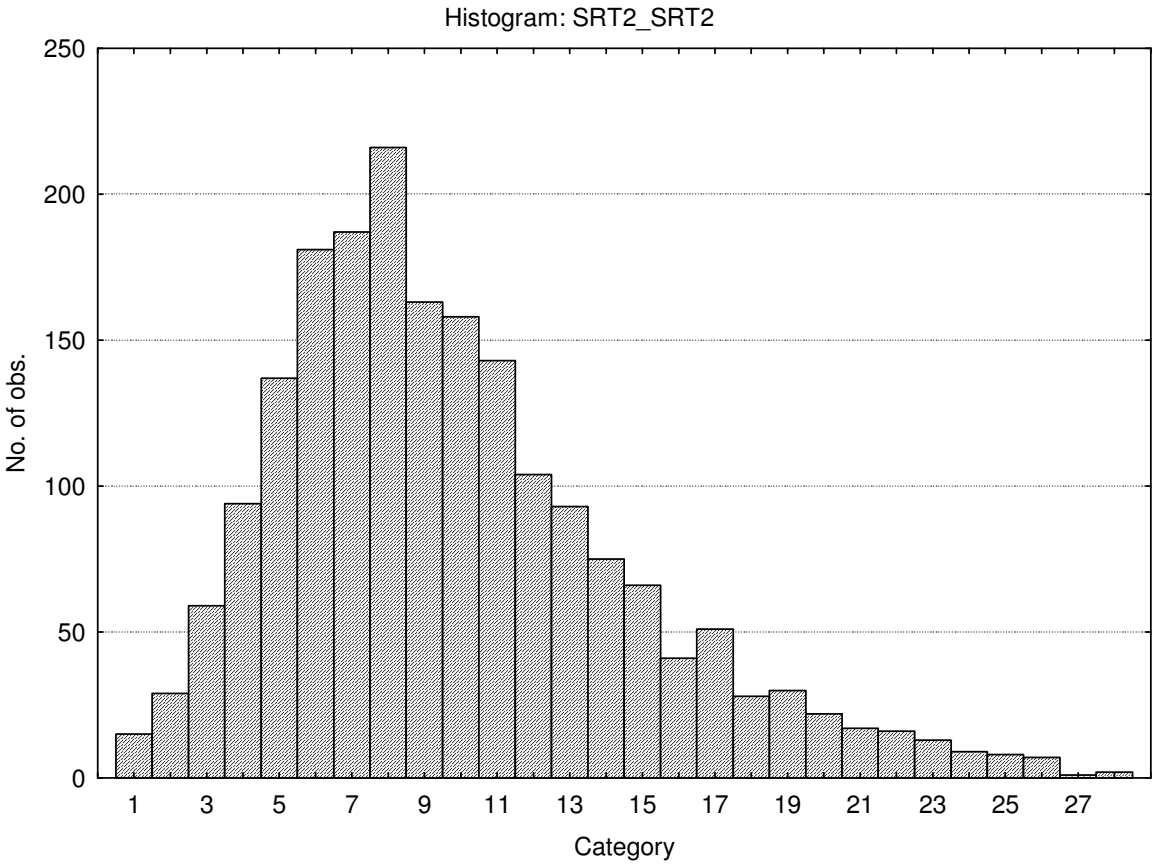
Descriptive statistics on TTB subtests

Variable	**Descriptive Statistics : Mechanical Reasoning Test**					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases
Mechanical Reasoning	15.62960	6.302933	1.000000	37.00000	2446	0
Mechanical Reasoning items attempted	34.16721	9.037088	6.000000	45.00000	2446	0


Histogram: MRT2_MRT2
No. of obs.
Category
0
20
40
60
80
100
120
140
160
180
200
1
4
7
10
13
16
19
22
25
28
31
34
37



Variable	**Descriptive Statistics : Spatial Reasoning Test**					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases
Spatial Reasoning	9.81018	4.829064	1.000000	28.00000	1965	0
Spatial Reasoning items attempted	24.68601	5.161312	7.000000	30.00000	1965	0


Histogram: SRT2_SRT2
No. of obs.
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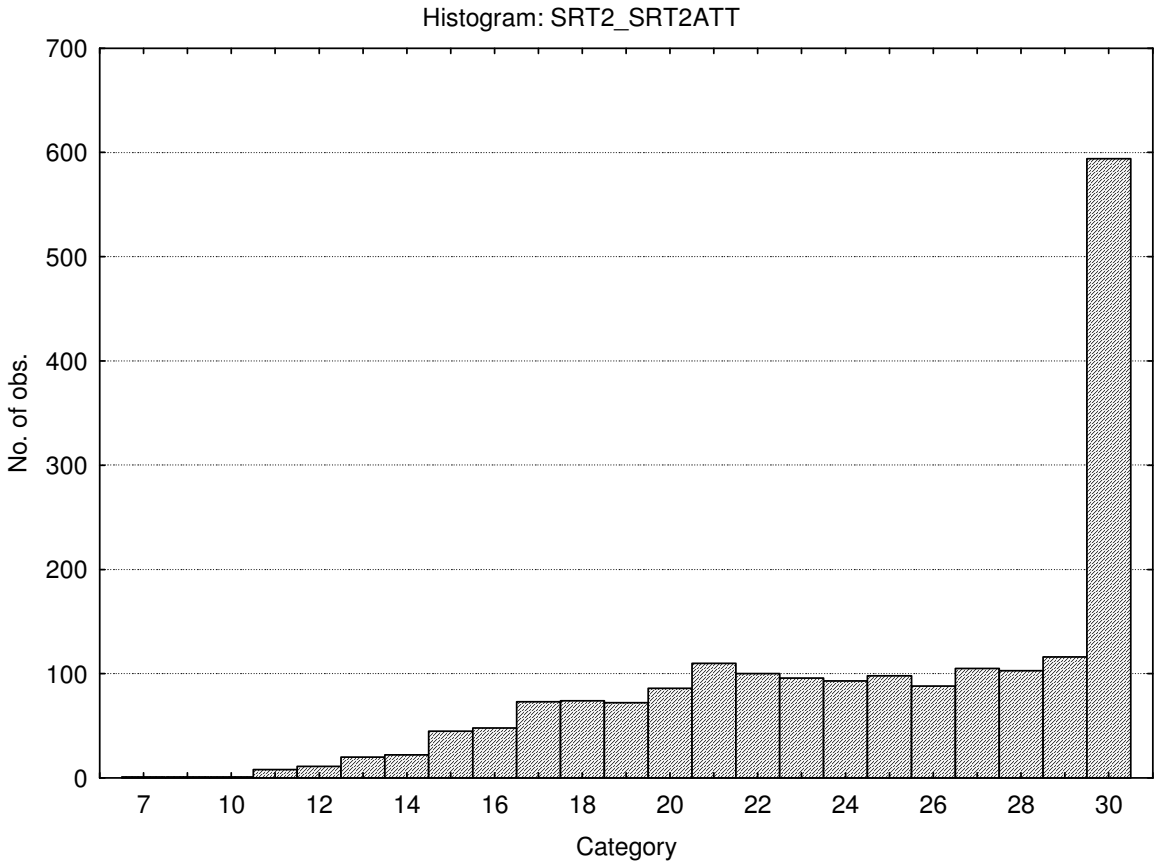
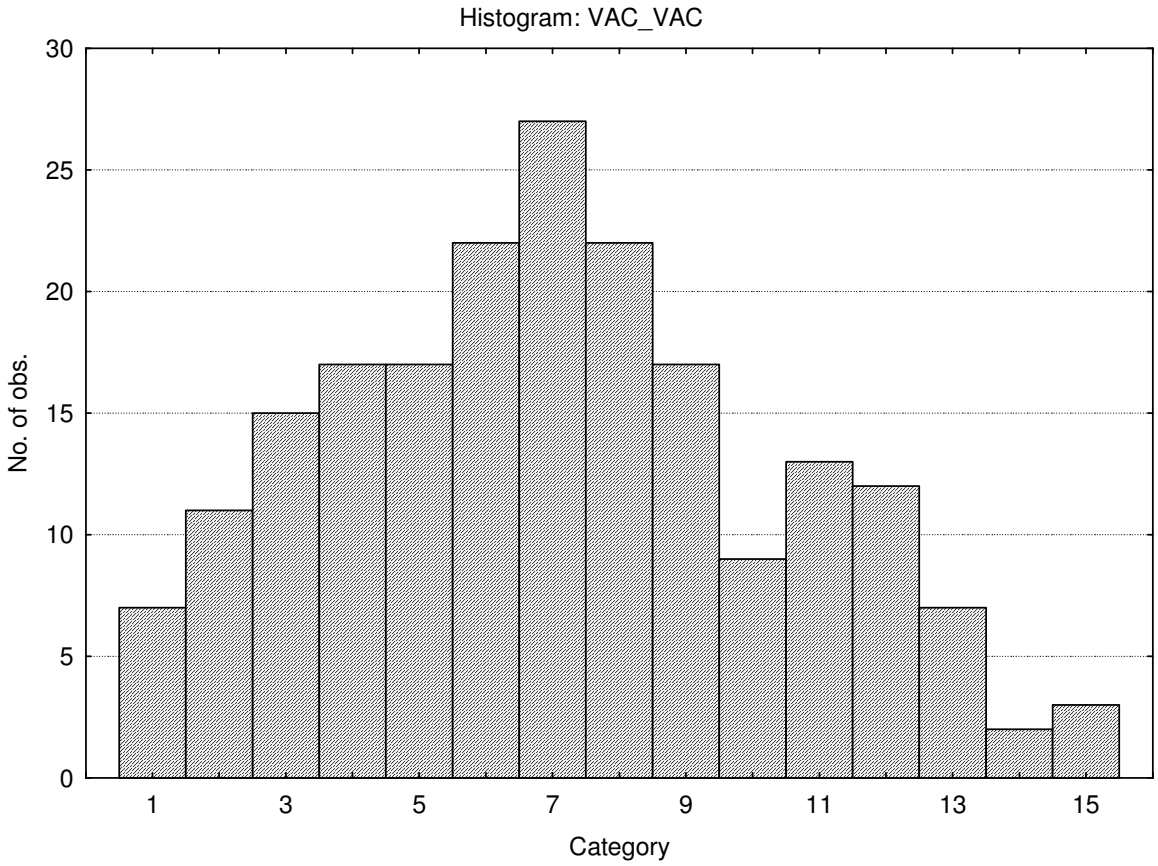
200
150
100
50
0
1
3
5
7
9
11
13
15
17
19
21
23
25
27
Category



Variable	**Descriptive Statistics: Visual Acuity test**					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases
Visual Acuity	7.05473	3.339460	1.000000	15.00000	201	0
Visual Acuity items attempted	10.65174	3.279956	3.000000	15.00000	201	0


Histogram: VAC_VAC
No. of obs.
Category
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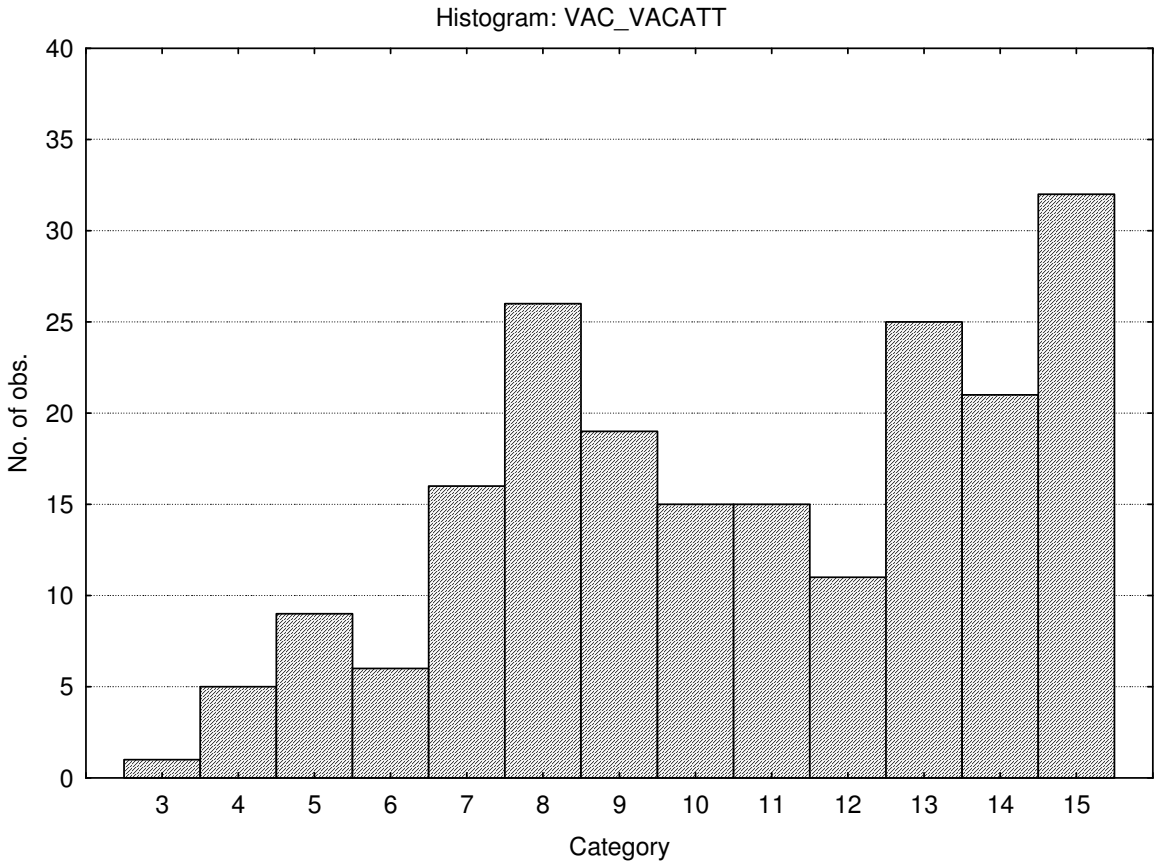
5
10
15
20
25
30
1
3
5
7
9
11
13
15



Stanine table

	S9_1	S9_2	S9_3	S9_4	S9_5	S9_6	S9_7	S9_8	S9_9
Mechanical Reasoning	1-4	5-7	8-10	11-14	15-17	18-20	21-23	24-26	27-37
Spatial Reasoning	1-1	2-3	4-6	7-8	9-11	12-13	14-15	16-18	19-28
Visual Acuity	1-1	2-2	3-4	5-6	7-7	8-9	10-11	12-12	13-15

Technical Test Battery (TTB2)

Norm Group: SA Aggregate Population, Updated 2016

Norm Type:

Standard Deviation Norm

Sample Composition

The sample consisted of respondents who had completed any of the subtests of the Technical Test Battery (TTB2) battery in the period up to June 2015, via GeneSys for Windows. Since not all the respondents completed all the subtests, biographical information is reported separately for the three tests.

Mechanical Reasoning Test: Biographical Composition

Category	Frequency table: Sex			
	Count	Cumulative Count	Percent	Cumulative Percent
M	2785	2785	66,69061	66,6906
F	1378	4163	32,99808	99,6887
U	13	4176	0,31130	100,0000
Missing	0	4176	0,00000	100,0000

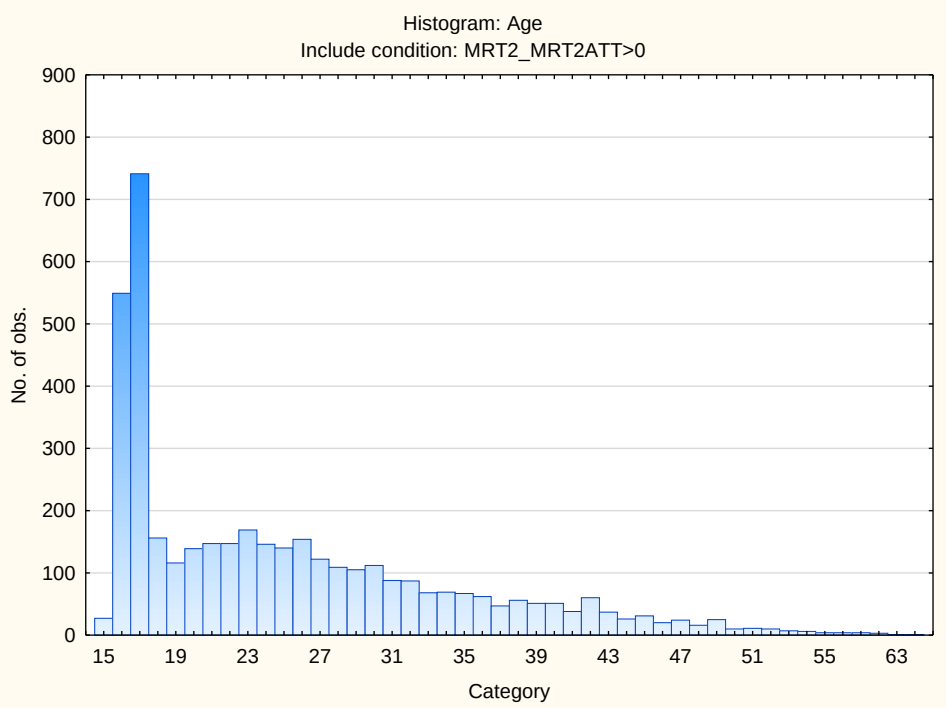
Category	Frequency table: Education			
	Count	Cumulative Count	Percent	Cumulative Percent
Tertiary	359	359	8,59674	8,5967
< Matric	1562	1921	37,40421	46,0010
Grade 12	854	2775	20,45019	66,4511
Post Graduate	6	2781	0,14368	66,5948
Missing	1395	4176	33,40517	100,0000

Category	Frequency table: Language			
	Count	Cumulative Count	Percent	Cumulative Percent
isiZulu	688	688	16,47510	16,4751
English	380	1068	9,09962	25,5747
isiXhosa	288	1356	6,89655	32,4713
Afrikaans	270	1626	6,46552	38,9368
Sepedi	434	2060	10,39272	49,3295
siSwati	99	2159	2,37069	51,7002
isiNdebele	25	2184	0,59866	52,2989
Setswana	158	2342	3,78352	56,0824
Xitsonga	81	2423	1,93966	58,0220
Sesotho	350	2773	8,38123	66,4033
Tshivenda	47	2820	1,12548	67,5287
Missing	1356	4176	32,47126	100,0000

Category	Frequency table: Language Group			
	Count	Cumulative Count	Percent	Cumulative Percent
Indigenous	2170	2170	51,96360	51,9636
English	380	2550	9,09962	61,0632
Afrikaans	270	2820	6,46552	67,5287
Missing	1356	4176	32,47126	100,0000

Category	Frequency table: Race			
	Count	Cumulative Count	Percent	Cumulative Percent
African	2513	2513	60,17720	60,1772
European	311	2824	7,44732	67,6245
Coloured	160	2984	3,83142	71,4559
Asian	131	3115	3,13697	74,5929
Missing	1061	4176	25,40709	100,0000

Variable	Descriptive Statistics: Age					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases Missing
Age	25,01354	9,203432	15,00000	69,00000	4063	113



Spatial Reasoning Test: Biographical Composition

Category	Frequency table: Sex			
	Count	Cumulative Count	Percent	Cumulative Percent
M	1898	1898	87,62696	87,6270
F	264	2162	12,18837	99,8153
U	4	2166	0,18467	100,0000
Missing	0	2166	0,00000	100,0000

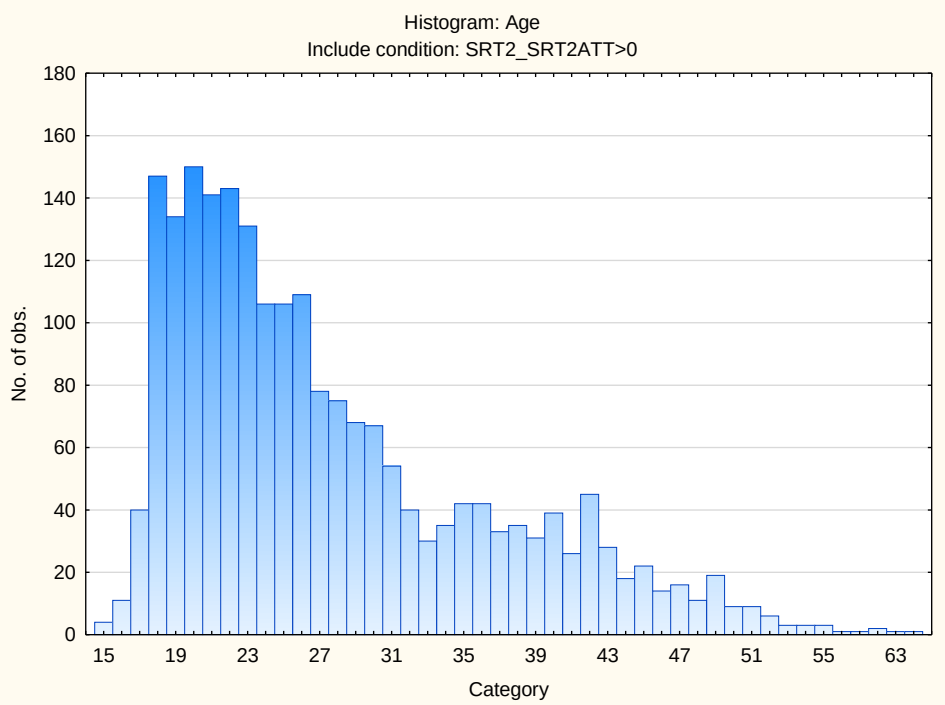
Category	Frequency table: Education			
	Count	Cumulative Count	Percent	Cumulative Percent
Tertiary	360	360	16,62050	16,6205
< Matric	216	576	9,97230	26,5928
Grade 12	821	1397	37,90397	64,4968
Post Graduate	1	1398	0,04617	64,5429
Missing	768	2166	35,45706	100,0000

Category	Frequency table: Language			
	Count	Cumulative Count	Percent	Cumulative Percent
isiZulu	424	424	19,57525	19,5753
English	230	654	10,61865	30,1939
isiXhosa	273	927	12,60388	42,7978
Afrikaans	244	1171	11,26500	54,0628
Sepedi	92	1263	4,24746	58,3102
siSwati	11	1274	0,50785	58,8181
isiNdebele	11	1285	0,50785	59,3259
Setswana	43	1328	1,98523	61,3112
Xitsonga	33	1361	1,52355	62,8347
Sesotho	252	1613	11,63435	74,4691
Tshivenda	14	1627	0,64635	75,1154
Missing	539	2166	24,88458	100,0000

Category	Frequency table: Language Group			
	Count	Cumulative Count	Percent	Cumulative Percent
Indigenous	1153	1153	53,23176	53,2318
English	230	1383	10,61865	63,8504
Afrikaans	244	1627	11,26500	75,1154
Missing	539	2166	24,88458	100,0000

Category	Frequency table: Race			
	Count	Cumulative Count	Percent	Cumulative Percent
African	1244	1244	57,43306	57,4331
European	238	1482	10,98800	68,4211
Coloured	149	1631	6,87904	75,3001
Asian	67	1698	3,09326	78,3934
Missing	468	2166	21,60665	100,0000

Variable	Descriptive Statistics: Age					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases Missing
Age	27,59418	8,749419	15,00000	69,00000	2129	37



Visual Acuity Test: Biographical Composition

Category	Frequency table: Sex			
	Count	Cumulative Count	Percent	Cumulative Percent
M	200	200	84,03361	84,0336
F	38	238	15,96639	100,0000
Missing	0	238	0,00000	100,0000

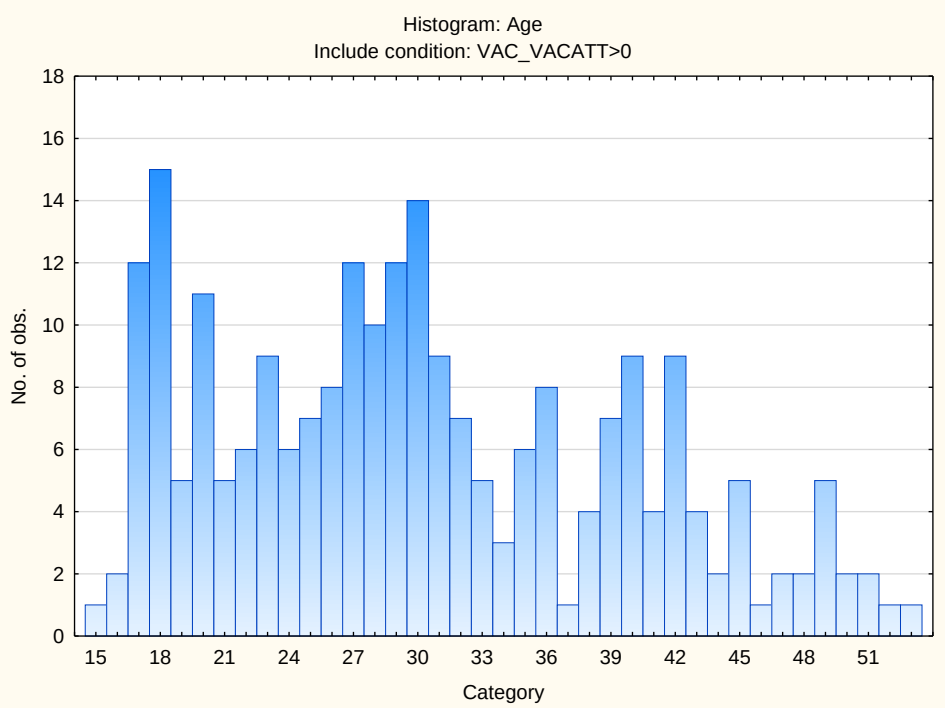
Category	Frequency table: Education			
	Count	Cumulative Count	Percent	Cumulative Percent
Tertiary	59	59	24,78992	24,7899
< Matric	6	65	2,52101	27,3109
Grade 12	42	107	17,64706	44,9580
Post Graduate	1	108	0,42017	45,3782
Missing	130	238	54,62185	100,0000

Category	Frequency table: Language			
	Count	Cumulative Count	Percent	Cumulative Percent
isiZulu	26	26	10,92437	10,9244
English	22	48	9,24370	20,1681
isiXhosa	7	55	2,94118	23,1092
Afrikaans	37	92	15,54622	38,6555
Setswana	1	93	0,42017	39,0756
Xitsonga	1	94	0,42017	39,4958
Sesotho	13	107	5,46218	44,9580
Missing	131	238	55,04202	100,0000

Category	Frequency table: Language Group			
	Count	Cumulative Count	Percent	Cumulative Percent
Indigenous	48	48	20,16807	20,1681
English	22	70	9,24370	29,4118
Afrikaans	37	107	15,54622	44,9580
Missing	131	238	55,04202	100,0000

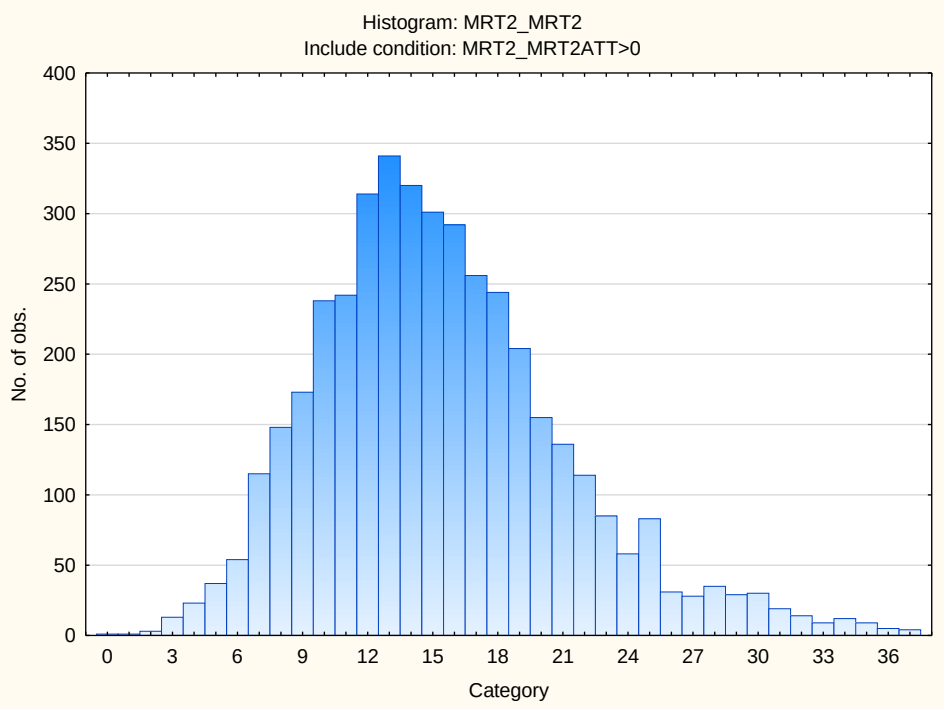
Category	Frequency table: Race			
	Count	Cumulative Count	Percent	Cumulative Percent
African	51	51	21,42857	21,4286
European	51	102	21,42857	42,8571
Coloured	6	108	2,52101	45,3782
Asian	1	109	0,42017	45,7983
Missing	129	238	54,20168	100,0000

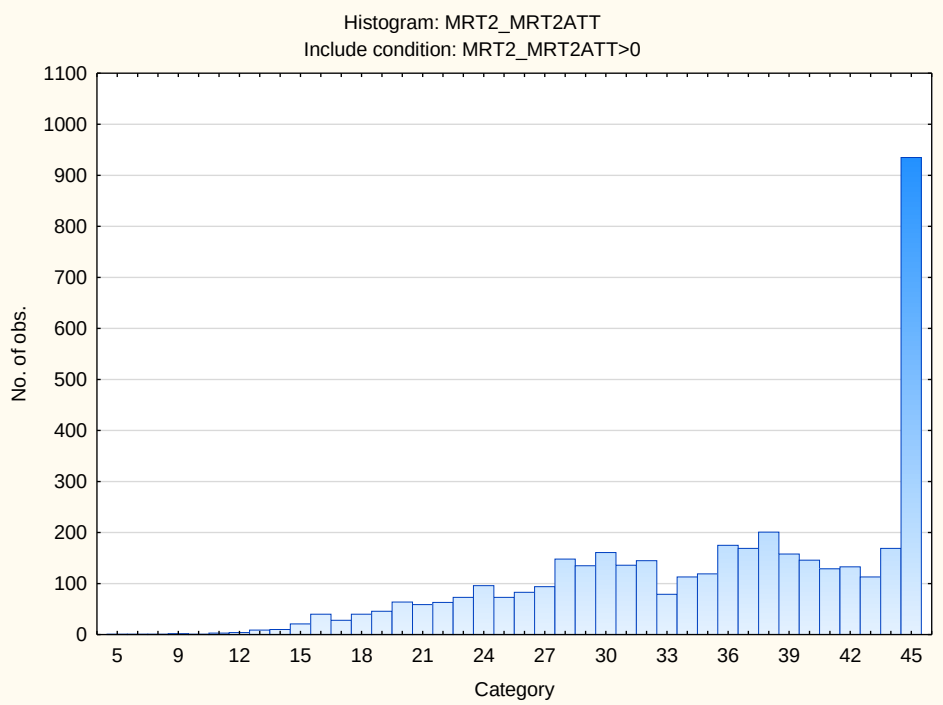
Variable	Descriptive Statistics: Age					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases Missing
Age	30,30342	9,504789	15,00000	59,00000	234	4



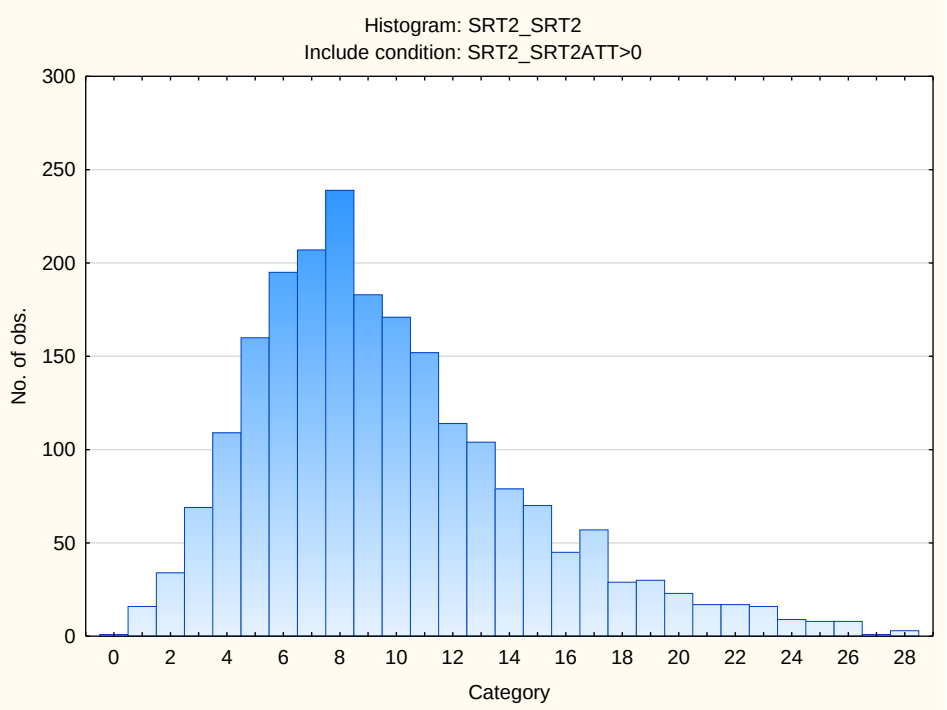
Descriptive Statistics on Technical Test Battery Subtests

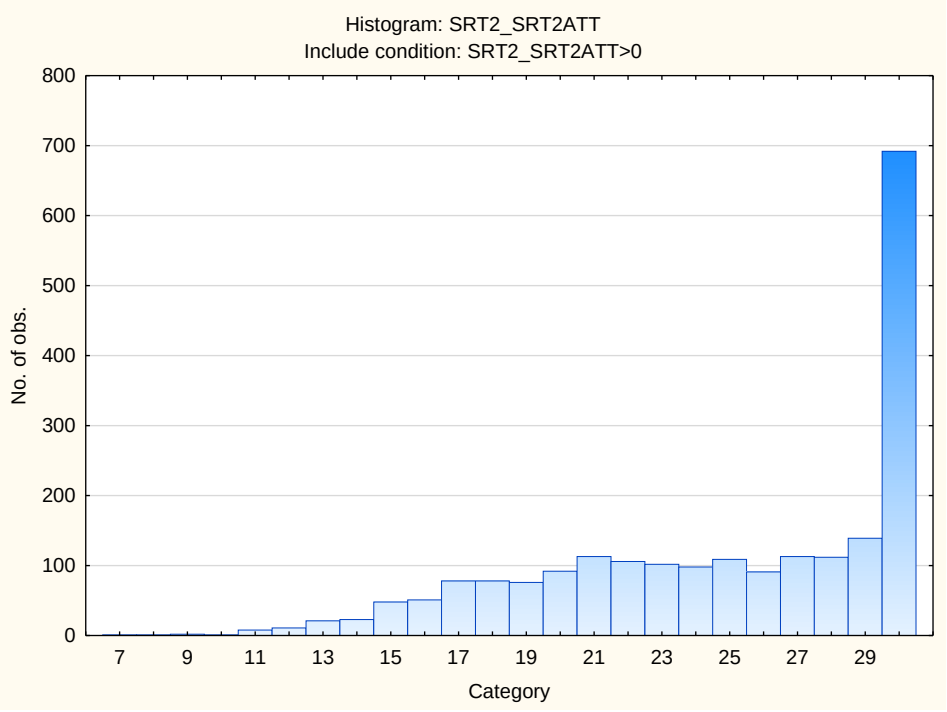
Variable	Descriptive Statistics: Mechanical Reasoning Test					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases
Mechanical Reasoning	15,39200	5,744861	0,000000	37,00000	4176	0
Mechanical Reasoning Items Attempted	35,34866	8,547750	5,000000	45,00000	4176	0



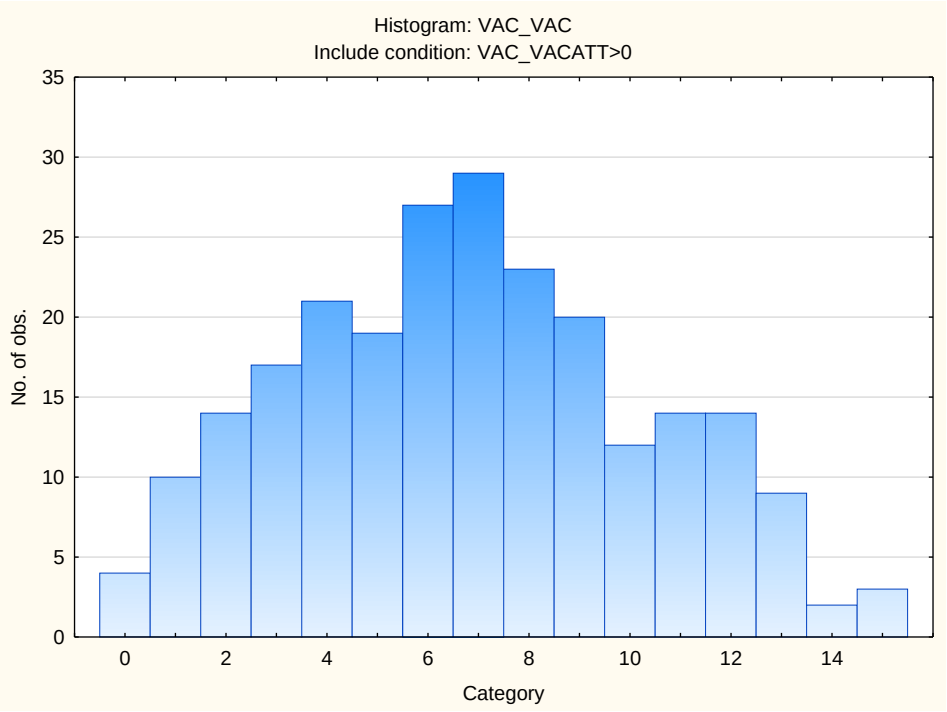


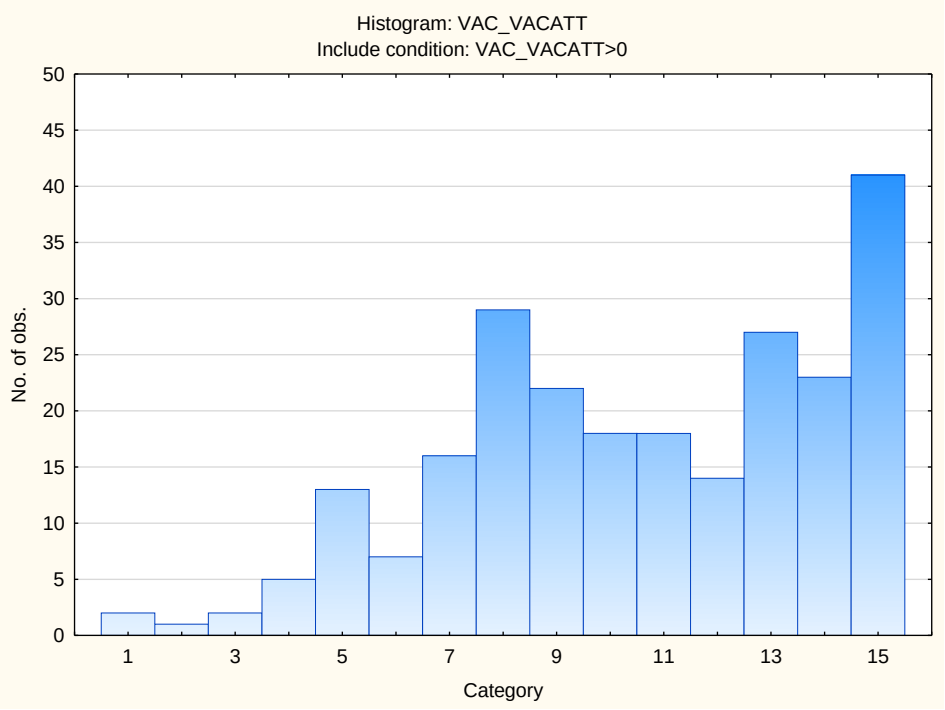
Variable	Descriptive Statistics: Spatial Reasoning Test					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases
Spatial Reasoning	9,71283	4,827719	0,000000	28,00000	2166	0
Spatial Reasoning Items Attempted	24,87535	5,161339	7,000000	30,00000	2166	0





Variable	Descriptive Statistics: Visual Acuity test					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases
Visual Acuity	6,84454	3,475804	0,000000	15,00000	238	0
Visual Acuity items attempted	10,55882	3,473028	1,000000	15,00000	238	0




Histogram: VAC_VACATT
Include condition: VAC_VACATT>0
No. of obs.
Category
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5
10
15
20
25
30
35
40
45
50
1
3
5
7
9
11
13
15

Stanine Table

Scales	Stanine Groups								
	S9_1	**S9_2**	**S9_3**	**S9_4**	**S9_5**	**S9_6**	**S9_7**	**S9_8**	**S9_9**
Mechanical Reasoning	0-5	6-8	9-11	12-13	14-16	17-19	20-22	23-25	26-37
Spatial Reasoning	0-1	2-3	4-6	7-8	9-10	11-13	14-15	16-18	19-28
Visual Acuity	0-0	1-2	3-4	5-5	6-7	8-9	10-11	12-12	13-15

Technical Test Battery (TTB2)

Norm Group: SA Afrikaans Speakers, Updated 2016

Norm Type:

Standard Deviation Norm

Sample Composition

The sample consisted of respondents who had completed any of the subtests of the Technical Test Battery (TTB2) battery in the period up to June 2015, via GeneSys for Windows. Since not all the respondents completed all the subtests, biographical information is reported separately for the three tests.

Sample Composition: Mechanical Reasoning Test (MRT2)

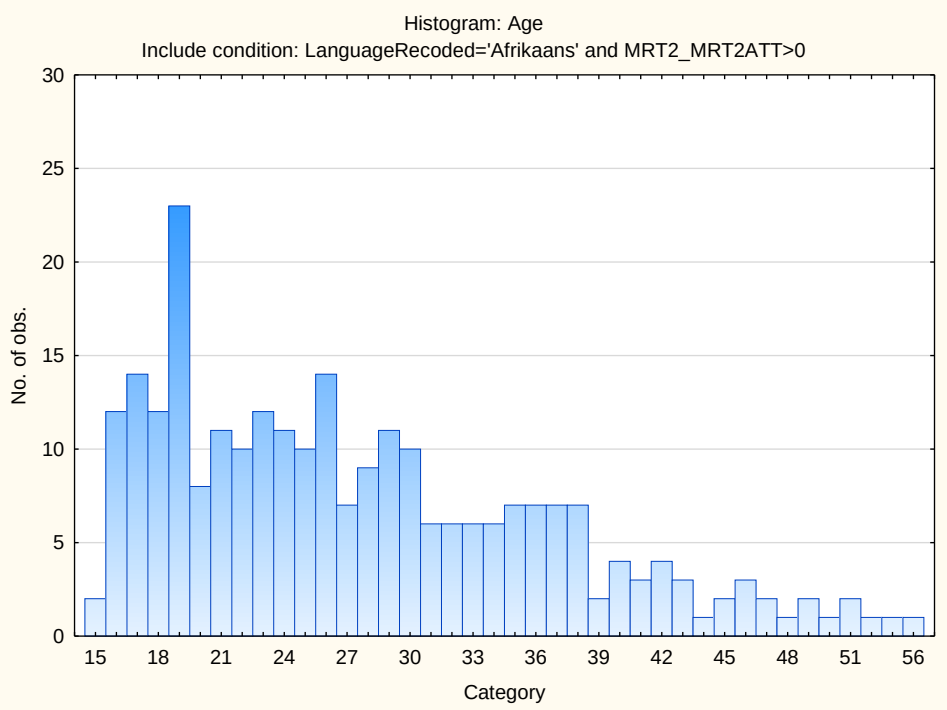
Category	Frequency table: Sex			
	Count	Cumulative Count	Percent	Cumulative Percent
M	232	232	85,92593	85,9259
F	38	270	14,07407	100,0000
Missing	0	270	0,00000	100,0000

Category	Frequency table: Education			
	Count	Cumulative Count	Percent	Cumulative Percent
Tertiary	61	61	22,59259	22,5926
< Matric	48	109	17,77778	40,3704
Grade 12	124	233	45,92593	86,2963
Post Graduate	3	236	1,11111	87,4074
Missing	34	270	12,59259	100,0000

Category	Frequency table: Language			
	Count	Cumulative Count	Percent	Cumulative Percent
Afrikaans	270	270	100,0000	100,0000
Missing	0	270	0,0000	100,0000

Category	Frequency table: Race			
	Count	Cumulative Count	Percent	Cumulative Percent
African	11	11	4,07407	4,0741
European	212	223	78,51852	82,5926
Coloured	39	262	14,44444	97,0370
Asian	1	263	0,37037	97,4074
Missing	7	270	2,59259	100,0000

Variable	Descriptive Statistics: Age					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases Missing
Age	27,67816	9,121607	15,00000	56,00000	261	9



Sample Composition: Spatial Reasoning Test (SRT2)

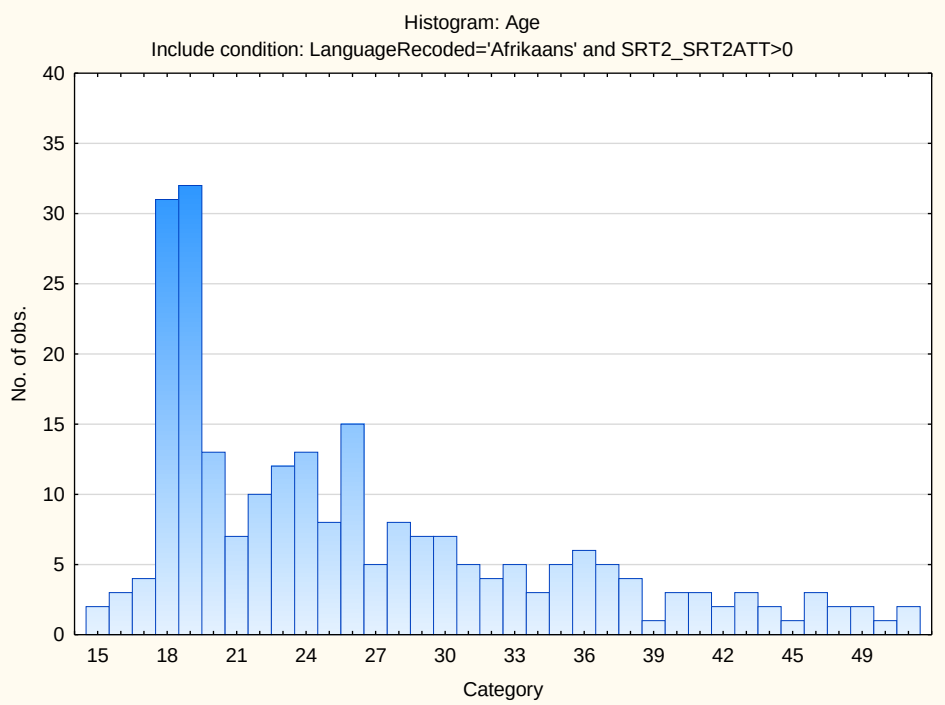
Category	Frequency table: Sex			
	Count	Cumulative Count	Percent	Cumulative Percent
M	224	224	91,80328	91,8033
F	20	244	8,19672	100,0000
Missing	0	244	0,00000	100,0000

Category	Frequency table: Education			
	Count	Cumulative Count	Percent	Cumulative Percent
Tertiary	57	57	23,36066	23,3607
< Matric	34	91	13,93443	37,2951
Grade 12	130	221	53,27869	90,5738
Missing	23	244	9,42623	100,0000

Category	Frequency table: Language			
	Count	Cumulative Count	Percent	Cumulative Percent
Afrikaans	244	244	100,0000	100,0000
Missing	0	244	0,0000	100,0000

Category	Frequency table: Race			
	Count	Cumulative Count	Percent	Cumulative Percent
African	4	4	1,63934	1,6393
European	167	171	68,44262	70,0820
Coloured	64	235	26,22951	96,3115
Missing	9	244	3,68852	100,0000

Variable	Descriptive Statistics: Age					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases Missing
Age	26,26360	8,516517	15,00000	51,00000	239	5



Sample Composition: Visual Acuity Test (VAC)

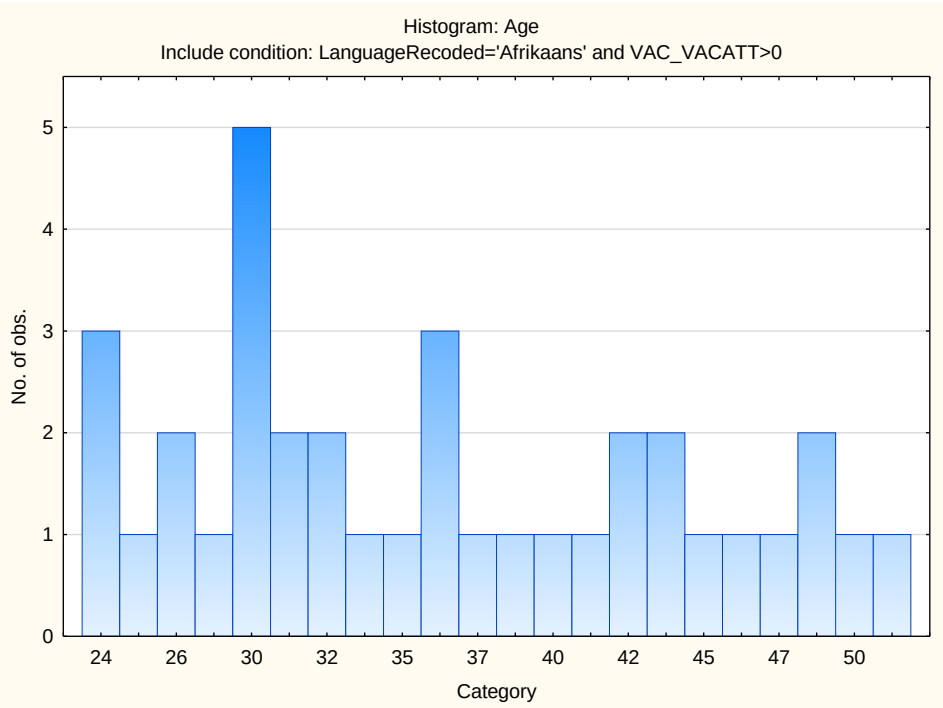
Category	Frequency table: Sex			
	Count	Cumulative Count	Percent	Cumulative Percent
M	36	36	97,29730	97,2973
F	1	37	2,70270	100,0000
Missing	0	37	0,00000	100,0000

Category	Frequency table: Education			
	Count	Cumulative Count	Percent	Cumulative Percent
Tertiary	26	26	70,27027	70,2703
< Matric	3	29	8,10811	78,3784
Grade 12	8	37	21,62162	100,0000
Missing	0	37	0,00000	100,0000

Category	Frequency table: Language			
	Count	Cumulative Count	Percent	Cumulative Percent
Afrikaans	37	37	100,0000	100,0000
Missing	0	37	0,0000	100,0000

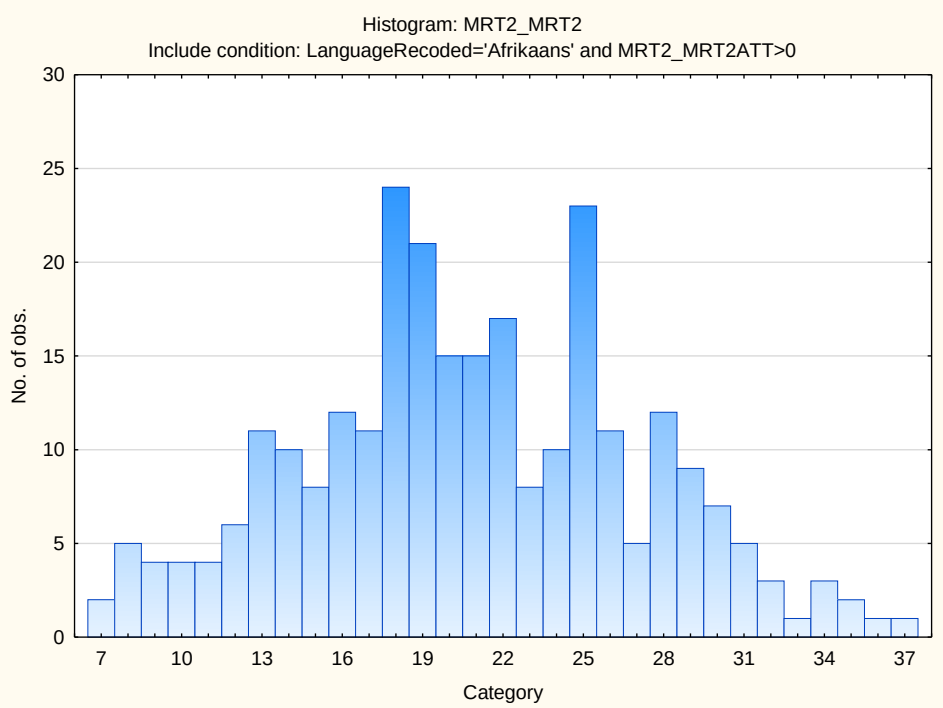
Category	Frequency table: Race			
	Count	Cumulative Count	Percent	Cumulative Percent
European	34	34	91,89189	91,8919
Coloured	3	37	8,10811	100,0000
Missing	0	37	0,00000	100,0000

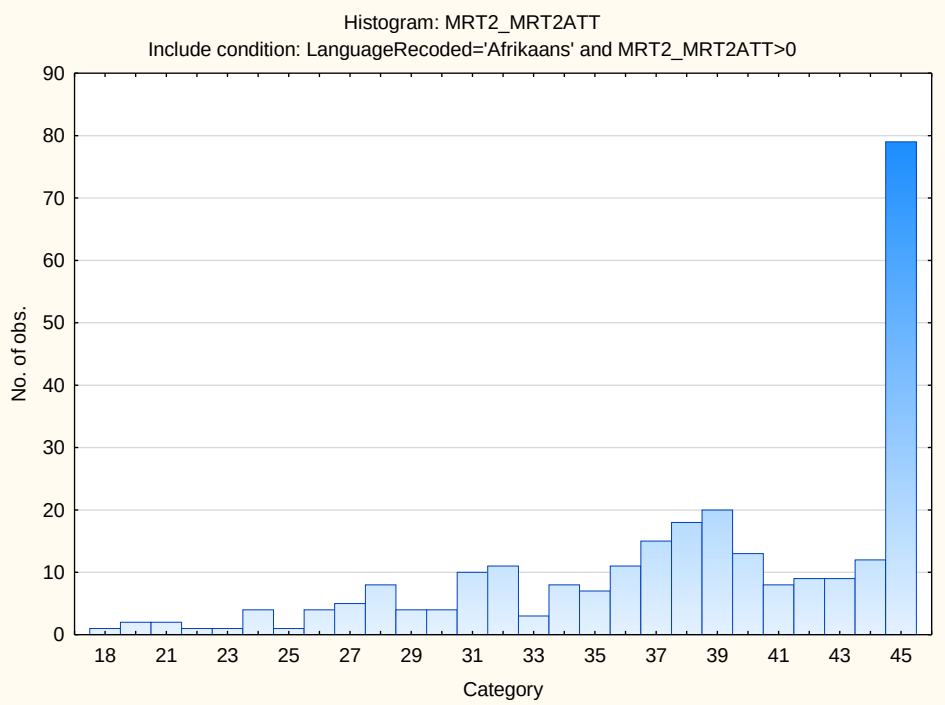
Variable	Descriptive Statistics: Age					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases Missing
Age	35,94444	8,221729	24,00000	51,00000	36	1



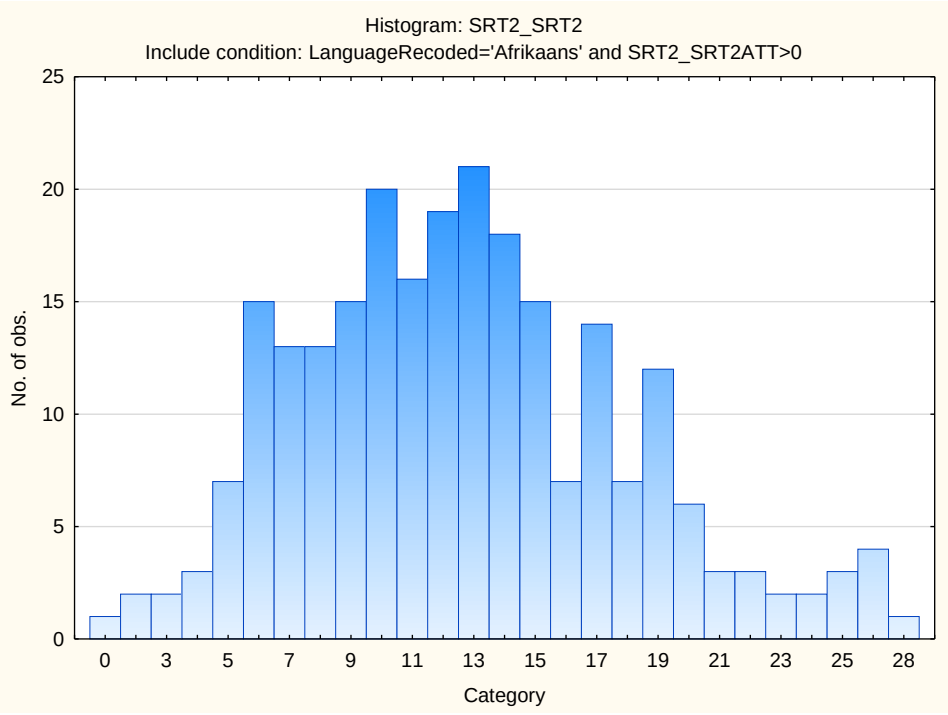
Descriptive Statistics on Technical Test Battery Subtests

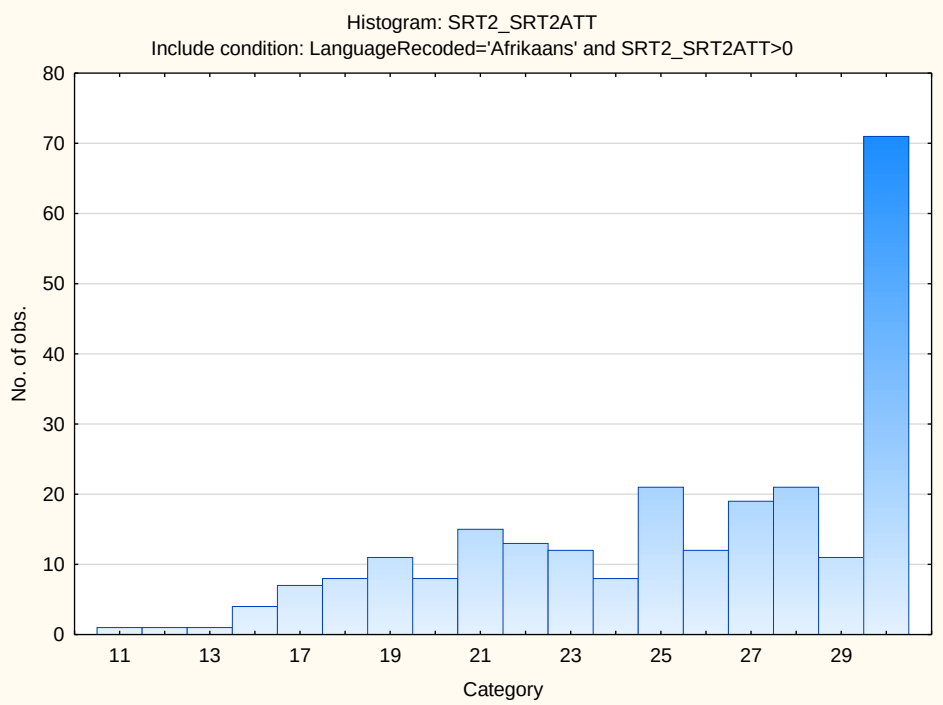
Variable	Descriptive Statistics: Mechanical Reasoning Test					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases
Mechanical Reasoning	20,75556	6,253584	7,00000	37,00000	270	0
Mechanical Reasoning Items Attempted	38,34815	6,571108	18,00000	45,00000	270	0





Variable	Descriptive Statistics: Spatial Reasoning Test					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases
Spatial Reasoning	12,64344	5,281375	0,00000	28,00000	244	0
Spatial Reasoning Items Attempted	25,34426	4,516582	11,00000	30,00000	244	0




Histogram: SRT2_SRT2ATT
Include condition: LanguageRecoded='Afrikaans' and SRT2_SRT2ATT>0
No. of obs.
Category
0
10
20
30
40
50
60
70
80
11
13
17
19
21
23
25
27
29

Stanine Table

Scales	Stanine Groups								
	S9_1	**S9_2**	**S9_3**	**S9_4**	**S9_5**	**S9_6**	**S9_7**	**S9_8**	**S9_9**
Mechanical Reasoning	7-9	10-12	13-16	17-19	20-22	23-25	26-28	29-31	32-37
Spatial Reasoning	0-3	4-6	7-8	9-11	12-13	14-16	17-19	20-21	22-28

There was insufficient data to provide a norm for the VAC.

Technical Test Battery (TTB2)

Norm Group: SA English Speakers, Updated 2016

Norm Type:

Standard Deviation Norm

Sample Composition

The sample consisted of respondents who had completed any of the subtests of the Technical Test Battery (TTB2) battery in the period up to June 2015, via GeneSys for Windows. Since not all the respondents completed all the subtests, biographical information is reported separately for the three tests.

Mechanical Reasoning Test: Biographical Composition

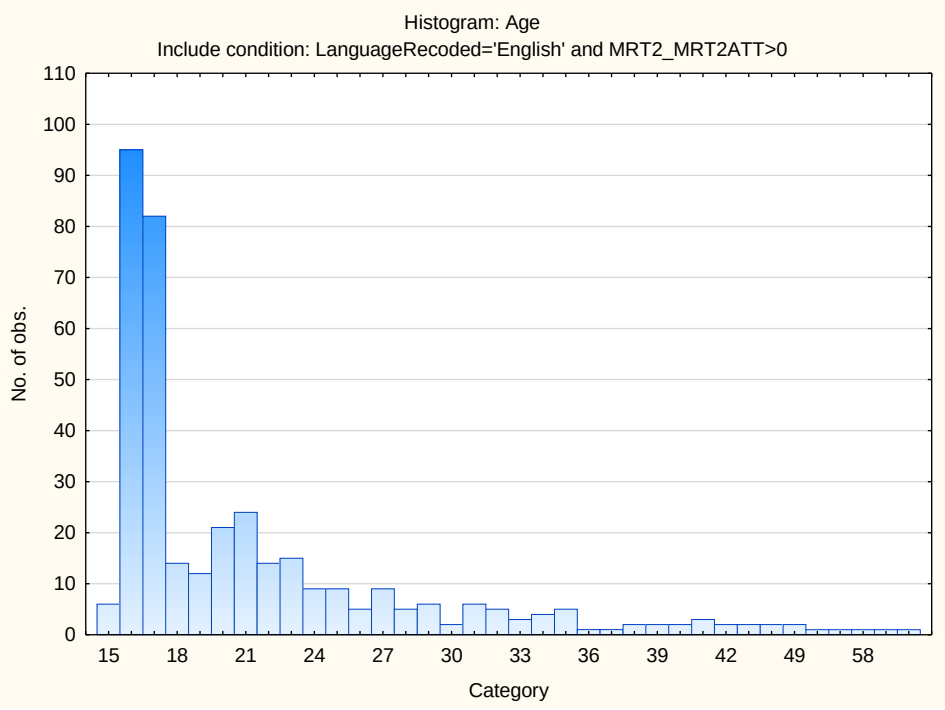
Category	Frequency table: Sex			
	Count	Cumulative Count	Percent	Cumulative Percent
M	237	237	62,36842	62,3684
F	142	379	37,36842	99,7368
U	1	380	0,26316	100,0000
Missing	0	380	0,00000	100,0000

Category	Frequency table: Education			
	Count	Cumulative Count	Percent	Cumulative Percent
Tertiary	51	51	13,42105	13,4211
< Matric	195	246	51,31579	64,7368
Grade 12	118	364	31,05263	95,7895
Post Graduate	1	365	0,26316	96,0526
Missing	15	380	3,94737	100,0000

Category	Frequency table: Language			
	Count	Cumulative Count	Percent	Cumulative Percent
English	380	380	100,0000	100,0000
Missing	0	380	0,0000	100,0000

Category	Frequency table: Race			
	Count	Cumulative Count	Percent	Cumulative Percent
African	53	53	13,94737	13,9474
European	82	135	21,57895	35,5263
Coloured	110	245	28,94737	64,4737
Asian	119	364	31,31579	95,7895
Missing	16	380	4,21053	100,0000

Variable	Descriptive Statistics: Age					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases Missing
Age	21,53600	7,914865	15,00000	63,00000	375	5



Spatial Reasoning Test: Biographical Composition

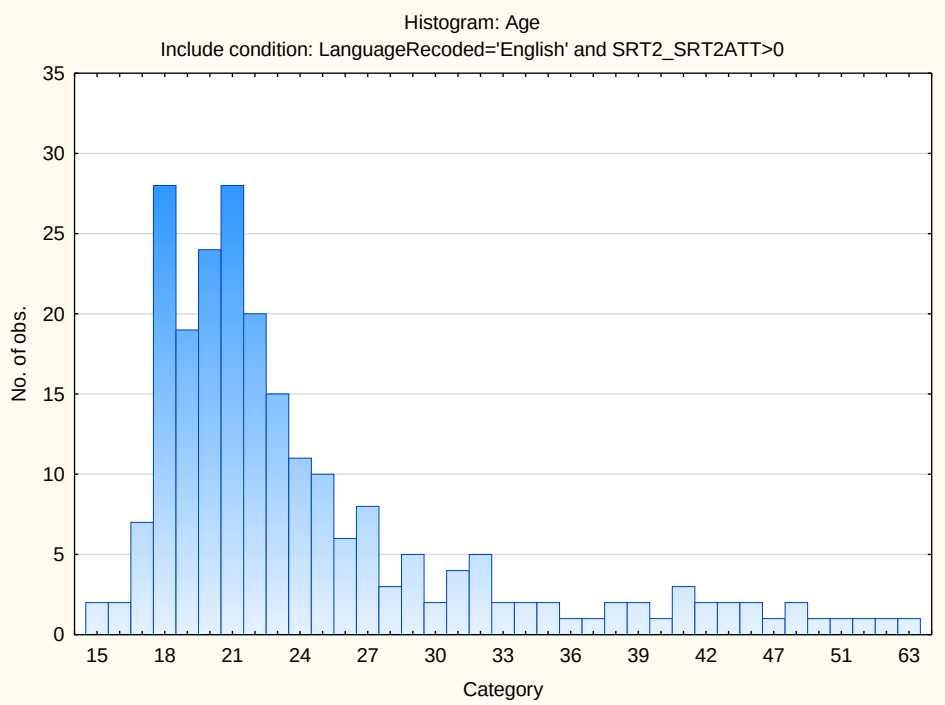
Category	Frequency table: Sex			
	Count	Cumulative Count	Percent	Cumulative Percent
M	206	206	89,56522	89,5652
F	24	230	10,43478	100,0000
Missing	0	230	0,00000	100,0000

Category	Frequency table: Education			
	Count	Cumulative Count	Percent	Cumulative Percent
Tertiary	50	50	21,73913	21,7391
< Matric	23	73	10,00000	31,7391
Grade 12	143	216	62,17391	93,9130
Post Graduate	1	217	0,43478	94,3478
Missing	13	230	5,65217	100,0000

Category	Frequency table: Language			
	Count	Cumulative Count	Percent	Cumulative Percent
English	230	230	100,0000	100,0000
Missing	0	230	0,0000	100,0000

Category	Frequency table: Race			
	Count	Cumulative Count	Percent	Cumulative Percent
African	21	21	9,13043	9,1304
European	64	85	27,82609	36,9565
Coloured	76	161	33,04348	70,0000
Asian	63	224	27,39130	97,3913
Missing	6	230	2,60870	100,0000

Variable	Descriptive Statistics: Age					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases Missing
Age	24,62009	8,322435	15,00000	63,00000	229	1



Visual Acuity Test: Biographical Composition

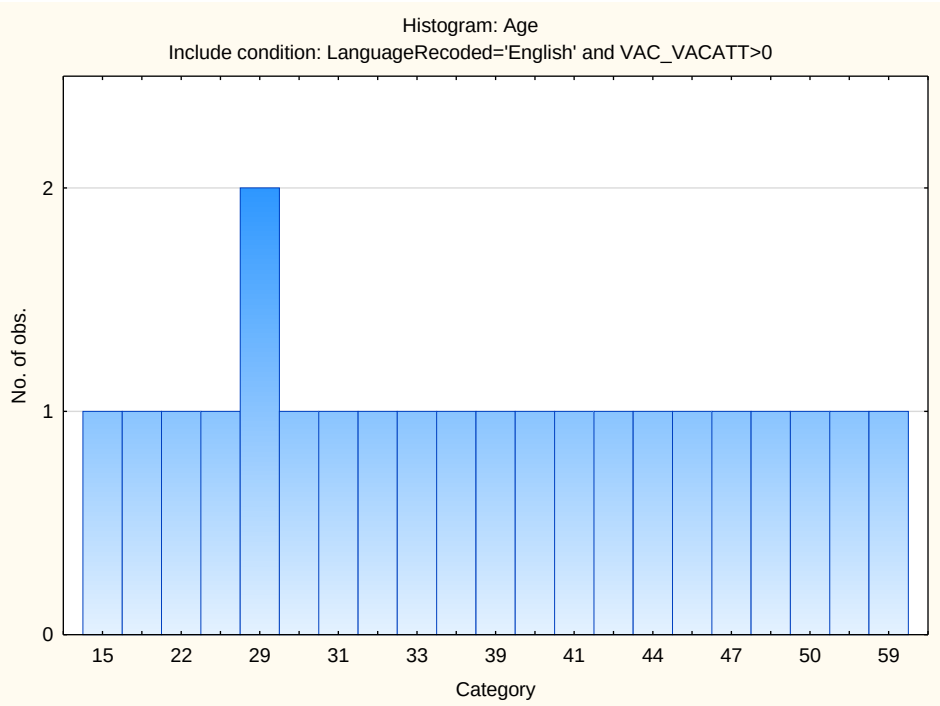
Category	Frequency table: Sex			
	Count	Cumulative Count	Percent	Cumulative Percent
M	21	21	95,45455	95,4545
F	1	22	4,54545	100,0000
Missing	0	22	0,00000	100,0000

Category	Frequency table: Education			
	Count	Cumulative Count	Percent	Cumulative Percent
Tertiary	10	10	45,45455	45,4545
< Matric	3	13	13,63636	59,0909
Grade 12	8	21	36,36364	95,4545
Post Graduate	1	22	4,54545	100,0000
Missing	0	22	0,00000	100,0000

Category	Frequency table: Language			
	Count	Cumulative Count	Percent	Cumulative Percent
English	22	22	100,0000	100,0000
Missing	0	22	0,0000	100,0000

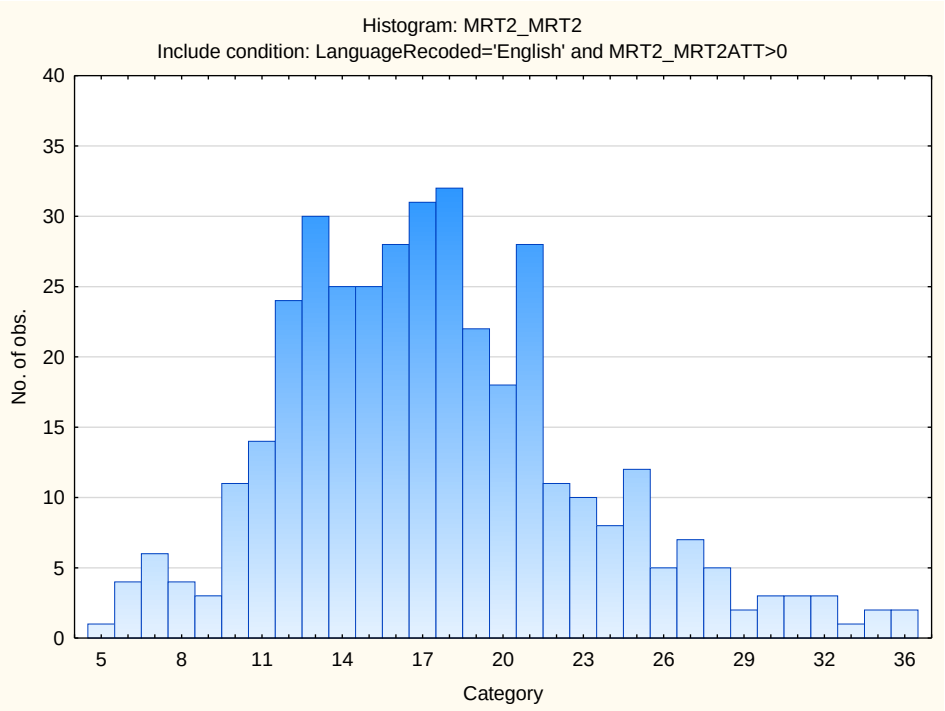
Category	Frequency table: Race			
	Count	Cumulative Count	Percent	Cumulative Percent
African	1	1	4,54545	4,5455
European	17	18	77,27273	81,8182
Coloured	3	21	13,63636	95,4545
Asian	1	22	4,54545	100,0000
Missing	0	22	0,00000	100,0000

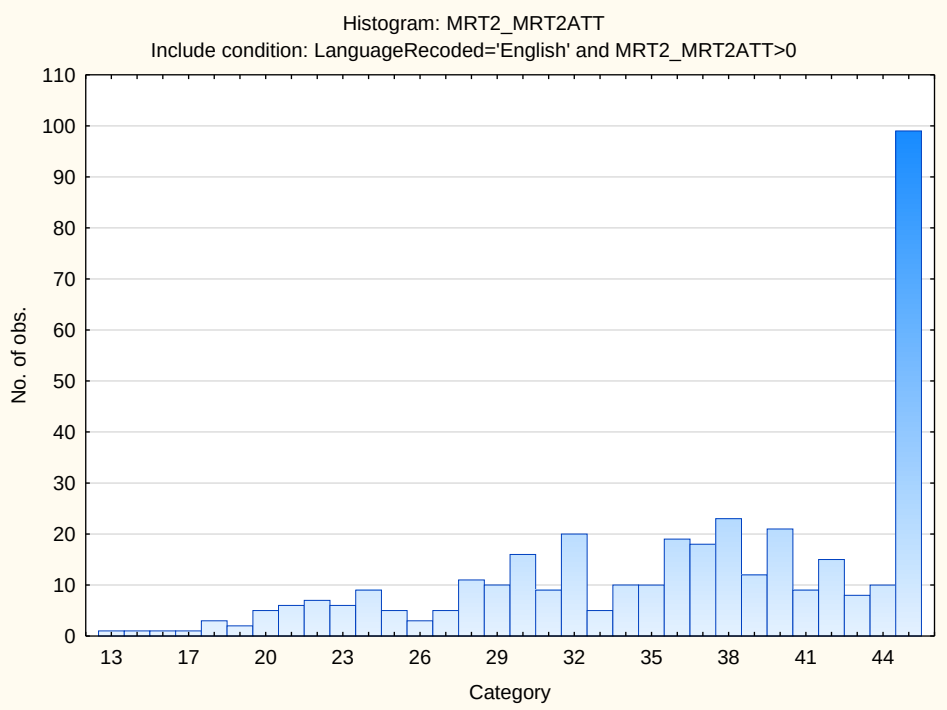
Variable	Descriptive Statistics: Age					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases Missing
Age	36,63636	11,58219	15,00000	59,00000	22	0



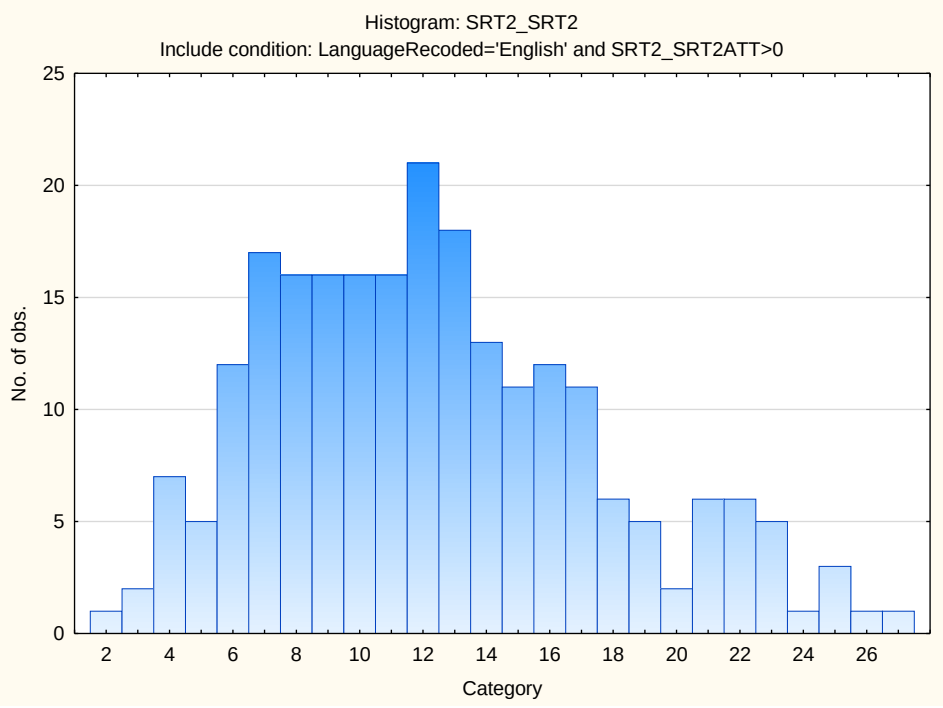
Descriptive statistics on Technical Test Battery subtests

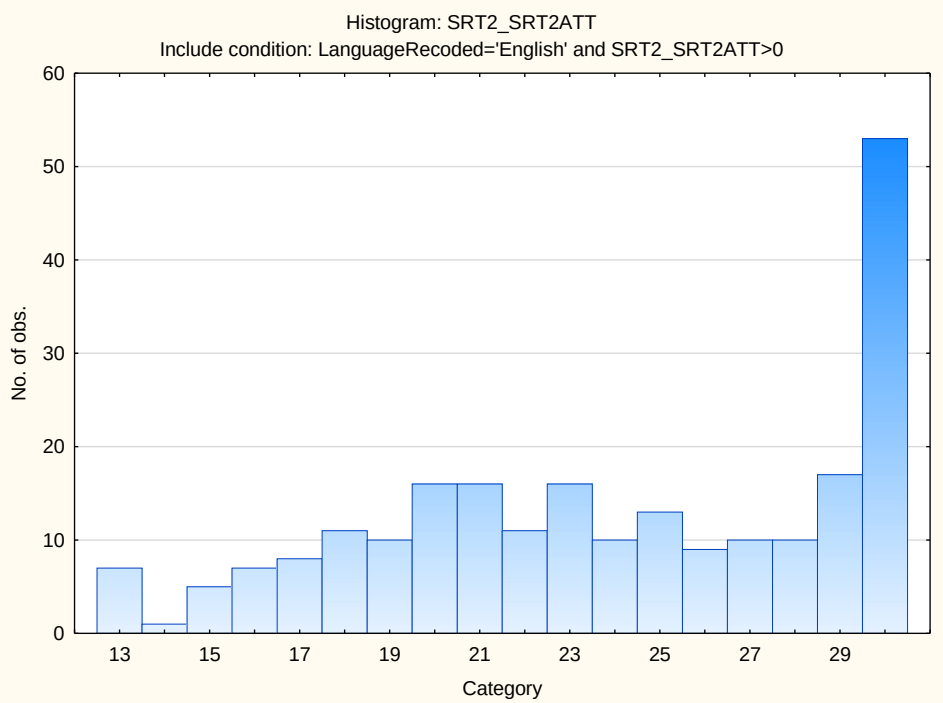
Variable	Descriptive Statistics: Mechanical Reasoning Test					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases
Mechanical Reasoning	17,50000	5,644948	5,00000	36,00000	380	0
Mechanical Reasoning Items Attempted	36,43684	7,900016	13,00000	45,00000	380	0





Variable	Descriptive Statistics: Spatial Reasoning Test					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases
Spatial Reasoning	12,34783	5,225138	2,00000	27,00000	230	0
Spatial Reasoning Items Attempted	23,97391	5,088665	13,00000	30,00000	230	0




Histogram: SRT2_SRT2ATT
Include condition: LanguageRecoded='English' and SRT2_SRT2ATT>0
60
50
40
30
20
10
0
No. of obs.
13
15
17
19
21
23
25
27
29
Category

Stanine Table

Scales	Stanine Groups								
	S9_1	**S9_2**	**S9_3**	**S9_4**	**S9_5**	**S9_6**	**S9_7**	**S9_8**	**S9_9**
Mechanical Reasoning	5-7	8-10	11-13	14-16	17-18	19-21	22-24	25-27	28-36
Spatial Reasoning	2-3	4-5	6-8	9-11	12-13	14-16	17-18	19-21	22-27

There was insufficient data to provide a norm for the VAC.

Technical Test Battery (TTB2)

Norm Group: SA Indigenous Speakers, Updated 2016

Norm Type:

Standard Deviation Norm

Sample Composition

The sample consisted of respondents who had completed any of the subtests of the Technical Test Battery (TTB2) battery in the period up to June 2015, via GeneSys for Windows. Since not all the respondents completed all the subtests, biographical information is reported separately for the three tests.

Mechanical Reasoning Test: Biographical Composition

Category	Frequency table: Sex			
	Count	Cumulative Count	Percent	Cumulative Percent
M	1301	1301	59,95392	59,9539
F	861	2162	39,67742	99,6313
U	8	2170	0,36866	100,0000
Missing	0	2170	0,00000	100,0000

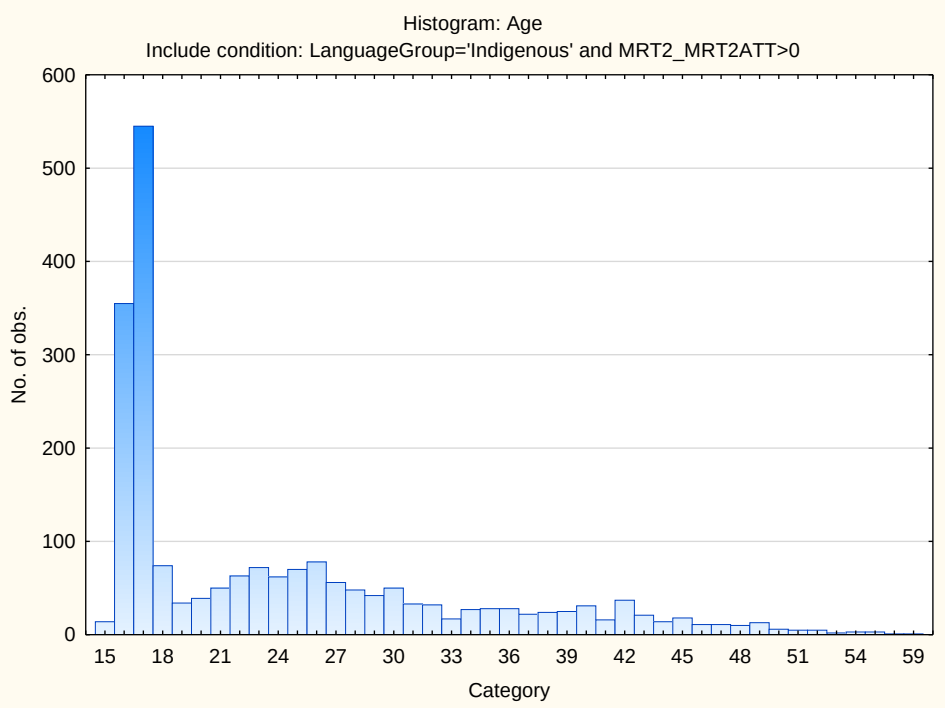
Category	Frequency table: Education			
	Count	Cumulative Count	Percent	Cumulative Percent
Tertiary	202	202	9,30876	9,3088
< Matric	1133	1335	52,21198	61,5207
Grade 12	546	1881	25,16129	86,6820
Post Graduate	1	1882	0,04608	86,7281
Missing	288	2170	13,27189	100,0000

Category	Frequency table: Language			
	Count	Cumulative Count	Percent	Cumulative Percent
isiZulu	688	688	31,70507	31,7051
isiXhosa	288	976	13,27189	44,9770
Sepedi	434	1410	20,00000	64,9770
siSwati	99	1509	4,56221	69,5392
isiNdebele	25	1534	1,15207	70,6912
Setswana	158	1692	7,28111	77,9724
Xitsonga	81	1773	3,73272	81,7051
Sesotho	350	2123	16,12903	97,8341
Tshivenda	47	2170	2,16590	100,0000
Missing	0	2170	0,00000	100,0000

Category	Frequency table: Language Group			
	Count	Cumulative Count	Percent	Cumulative Percent
Indigenous	2170	2170	100,0000	100,0000
Missing	0	2170	0,0000	100,0000

Category	Frequency table: Race			
	Count	Cumulative Count	Percent	Cumulative Percent
African	2154	2154	99,26267	99,2627
Coloured	6	2160	0,27650	99,5392
Asian	6	2166	0,27650	99,8157
Missing	4	2170	0,18433	100,0000

Variable	Descriptive Statistics: Age					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases Missing
Age	24,01908	9,298683	15,00000	59,00000	2096	74



Spatial Reasoning Test: Biographical Composition

Category	Frequency table: Sex			
	Count	Cumulative Count	Percent	Cumulative Percent
M	1002	1002	86,90373	86,9037
F	149	1151	12,92281	99,8265
U	2	1153	0,17346	100,0000
Missing	0	1153	0,00000	100,0000

Category	Frequency table: Education			
	Count	Cumulative Count	Percent	Cumulative Percent
Tertiary	219	219	18,99393	18,9939
< Matric	155	374	13,44319	32,4371
Grade 12	516	890	44,75282	77,1899
Missing	263	1153	22,81006	100,0000

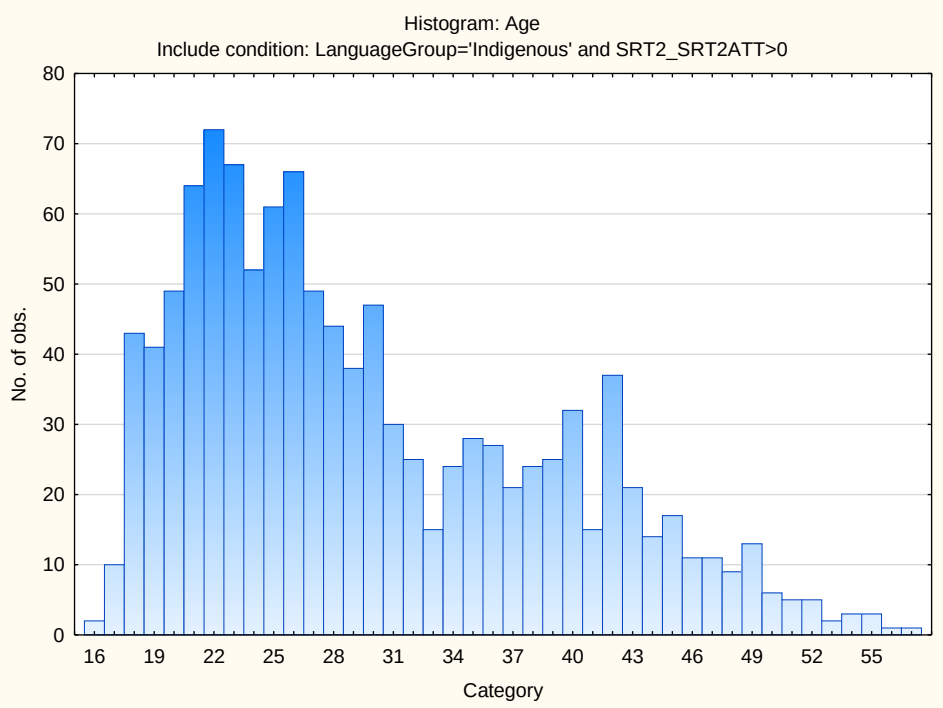
Category	Frequency table: Language			
	Count	Cumulative Count	Percent	Cumulative Percent
isiZulu	424	424	36,77363	36,7736
isiXhosa	273	697	23,67736	60,4510
Sepedi	92	789	7,97918	68,4302
siSwati	11	800	0,95403	69,3842
isiNdebele	11	811	0,95403	70,3382
Setswana	43	854	3,72940	74,0676

Category	Frequency table: Language			
	Count	Cumulative Count	Percent	Cumulative Percent
Xitsonga	33	887	2,86210	76,9297
Sesotho	252	1139	21,85603	98,7858
Tshivenda	14	1153	1,21422	100,0000
Missing	0	1153	0,00000	100,0000

Category	Frequency table: Language Group			
	Count	Cumulative Count	Percent	Cumulative Percent
Indigenous	1153	1153	100,0000	100,0000
Missing	0	1153	0,0000	100,0000

Category	Frequency table: Race			
	Count	Cumulative Count	Percent	Cumulative Percent
African	1141	1141	98,95924	98,9592
Coloured	5	1146	0,43365	99,3929
Asian	4	1150	0,34692	99,7398
Missing	3	1153	0,26019	100,0000

Variable	Descriptive Statistics: Age					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases Missing
Age	29,74071	8,954616	16,00000	59,00000	1130	23



Visual Acuity Test: Biographical Composition

Category	Frequency table: Sex			
	Count	Cumulative Count	Percent	Cumulative Percent
M	42	42	87,50000	87,5000
F	6	48	12,50000	100,0000
Missing	0	48	0,00000	100,0000

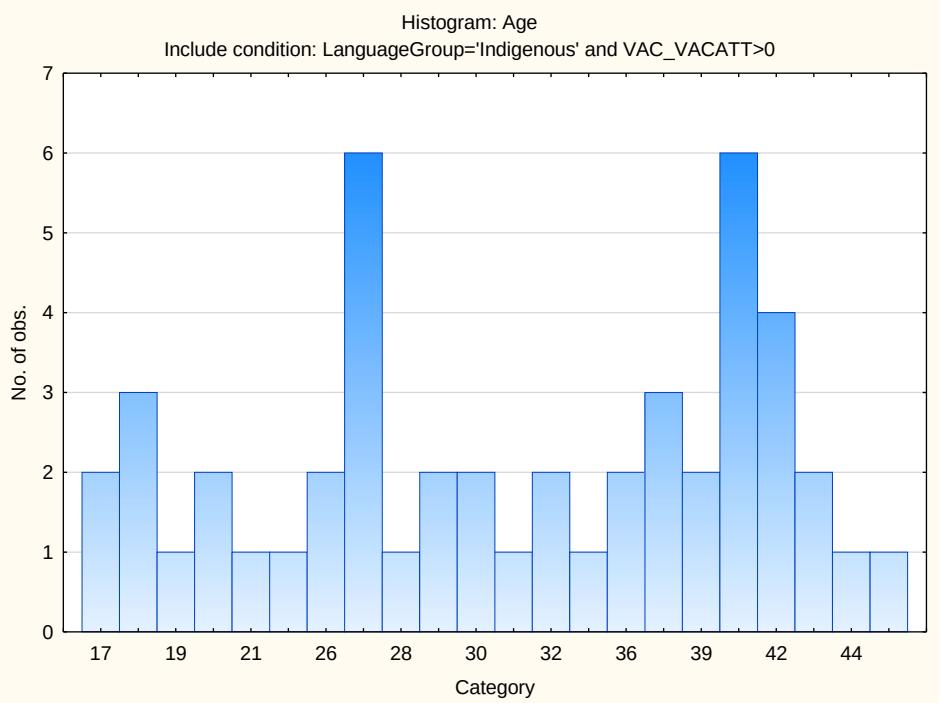
Category	Frequency table: Education			
	Count	Cumulative Count	Percent	Cumulative Percent
Tertiary	22	22	45,83333	45,8333
Grade 12	25	47	52,08333	97,9167
Missing	1	48	2,08333	100,0000

Category	Frequency table: Language			
	Count	Cumulative Count	Percent	Cumulative Percent
isiZulu	26	26	54,16667	54,1667
isiXhosa	7	33	14,58333	68,7500
Setswana	1	34	2,08333	70,8333
Xitsonga	1	35	2,08333	72,9167
Sesotho	13	48	27,08333	100,0000
Missing	0	48	0,00000	100,0000

Category	Frequency table: Language Group			
	Count	Cumulative Count	Percent	Cumulative Percent
Indigenous	48	48	100,0000	100,0000
Missing	0	48	0,0000	100,0000

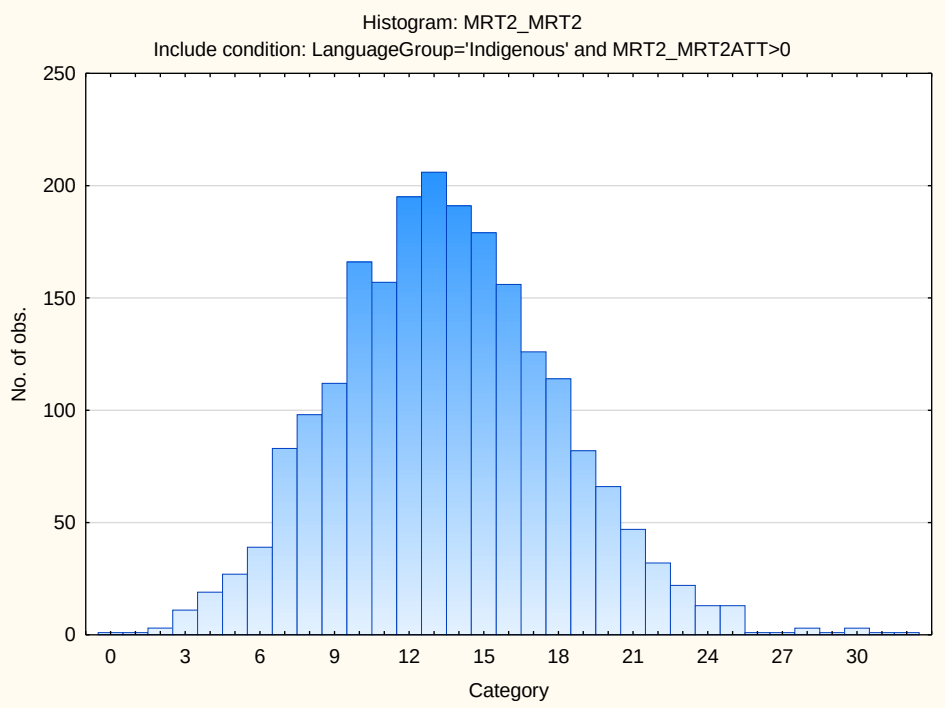
Category	Frequency table: Race			
	Count	Cumulative Count	Percent	Cumulative Percent
African	48	48	100,0000	100,0000
Missing	0	48	0,0000	100,0000

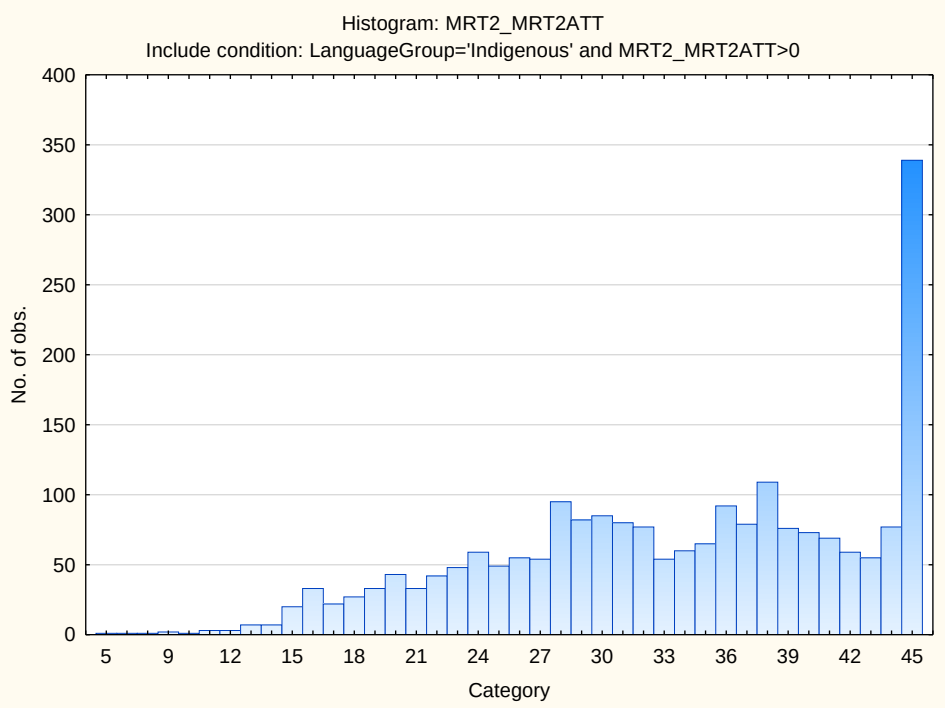
Variable	Descriptive Statistics: Age					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases Missing
Age	31,79167	8,676106	17,00000	45,00000	48	0


Histogram: Age
Include condition: LanguageGroup='Indigenous' and VAC_VACATT>0
No. of obs.
0
1
2
3
4
5
6
7
17
19
21
26
28
30
32
36
39
42
44
Category

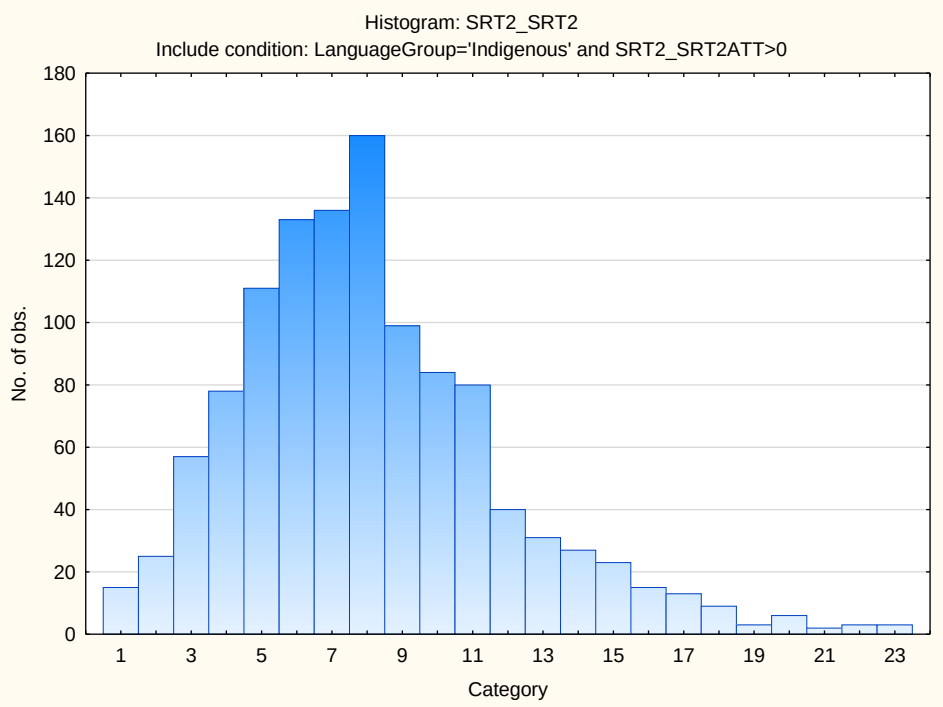
Descriptive statistics on Technical Test Battery subtests

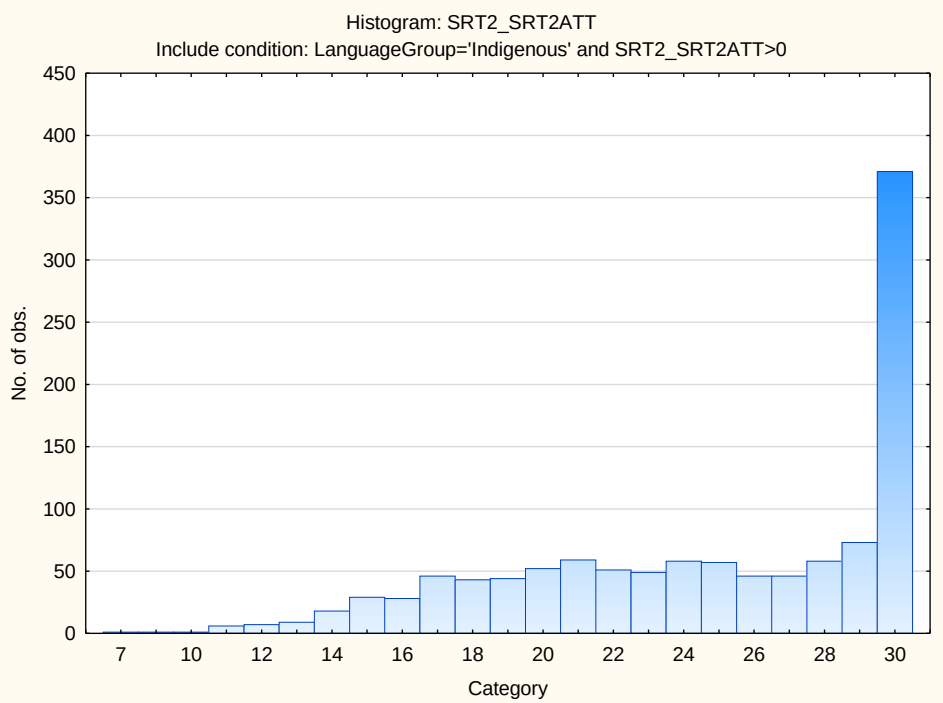
Variable	Descriptive Statistics: Mechanical Reasoning Test					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases
Mechanical Reasoning	13,52350	4,477561	0,000000	35,00000	2170	0
Mechanical Reasoning Items Attempted	33,61060	8,824030	5,000000	45,00000	2170	0





Variable	Descriptive Statistics: Spatial Reasoning Test					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases
Spatial Reasoning	8,08933	3,770292	1,000000	23,00000	1153	0
Spatial Reasoning Items Attempted	24,69471	5,312993	7,000000	30,00000	1153	0




Histogram: SRT2_SRT2ATT
Include condition: LanguageGroup='Indigenous' and SRT2_SRT2ATT>0
No. of obs.
450
400
350
300
250
200
150
100
50
0
7
10
12
14
16
18
20
22
24
26
28
30
Category

Stanine Table

Scales	Stanine Groups								
	S9_1	**S9_2**	**S9_3**	**S9_4**	**S9_5**	**S9_6**	**S9_7**	**S9_8**	**S9_9**
Mechanical Reasoning	0-5	6-7	8-10	11-12	13-14	15-16	17-19	20-21	22-35
Spatial Reasoning	1-1	2-3	4-5	6-7	8-9	10-10	11-12	13-14	15-23

There was insufficient data to provide a norm for the VAC.

Technical Test Battery (TTB2)

Norm Group: SA isiXhosa Speakers, Updated 2016

Norm Type:

Standard Deviation Norm

Sample Composition

The sample consisted of respondents who had completed any of the subtests of the Technical Test Battery (TTB2) battery in the period up to June 2015, via GeneSys for Windows. Since not all the respondents completed all the subtests, biographical information is reported separately for the three tests.

Mechanical Reasoning Test: Biographical Composition

Category	Frequency table: Sex			
	Count	Cumulative Count	Percent	Cumulative Percent
M	165	165	57,29167	57,2917
F	123	288	42,70833	100,0000
Missing	0	288	0,00000	100,0000

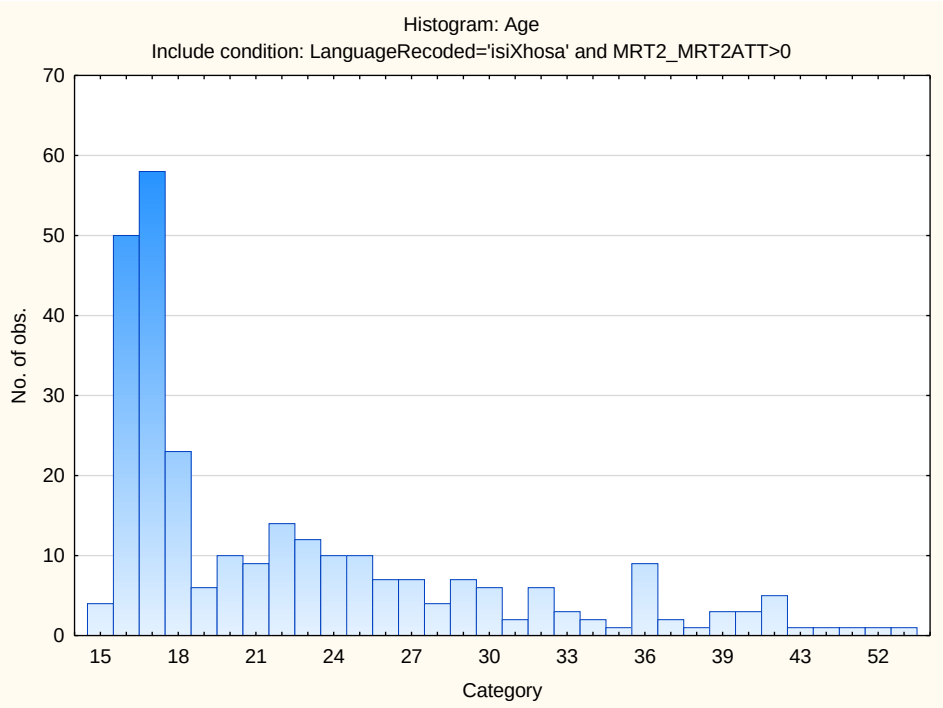
Category	Frequency table: Education			
	Count	Cumulative Count	Percent	Cumulative Percent
Tertiary	35	35	12,15278	12,1528
< Matric	125	160	43,40278	55,5556
Grade 12	110	270	38,19444	93,7500
Missing	18	288	6,25000	100,0000

Category	Frequency table: Language			
	Count	Cumulative Count	Percent	Cumulative Percent
isiXhosa	288	288	100,0000	100,0000
Missing	0	288	0,0000	100,0000

Category	Frequency table: Language Group			
	Count	Cumulative Count	Percent	Cumulative Percent
Indigenous	288	288	100,0000	100,0000
Missing	0	288	0,0000	100,0000

Category	Frequency table: Race			
	Count	Cumulative Count	Percent	Cumulative Percent
African	284	284	98,61111	98,6111
Coloured	4	288	1,38889	100,0000
Missing	0	288	0,00000	100,0000

Variable	Descriptive Statistics: Age					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases Missing
Age	22,52688	7,726798	15,00000	53,00000	279	9



Spatial Reasoning Test: Biographical Composition

Category	Frequency table: Sex			
	Count	Cumulative Count	Percent	Cumulative Percent
M	198	198	72,52747	72,5275
F	75	273	27,47253	100,0000
Missing	0	273	0,00000	100,0000

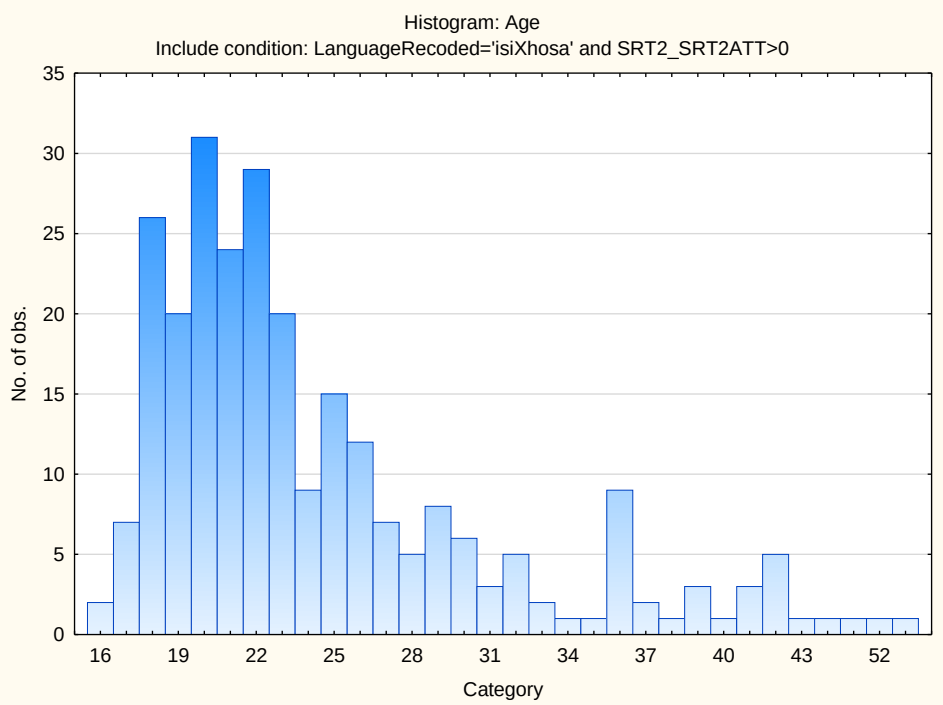
Category	Frequency table: Education			
	Count	Cumulative Count	Percent	Cumulative Percent
Tertiary	52	52	19,04762	19,0476
< Matric	16	68	5,86081	24,9084
Grade 12	185	253	67,76557	92,6740
Missing	20	273	7,32601	100,0000

Category	Frequency table: Language			
	Count	Cumulative Count	Percent	Cumulative Percent
isiXhosa	273	273	100,0000	100,0000
Missing	0	273	0,0000	100,0000

Category	Frequency table: Language Group			
	Count	Cumulative Count	Percent	Cumulative Percent
Indigenous	273	273	100,0000	100,0000
Missing	0	273	0,0000	100,0000

Category	Frequency table: Race			
	Count	Cumulative Count	Percent	Cumulative Percent
African	267	267	97,80220	97,8022
Coloured	5	272	1,83150	99,6337
Missing	1	273	0,36630	100,0000

Variable	Descriptive Statistics: Age					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases Missing
Age	24,50000	6,883124	16,00000	53,00000	262	11



Visual Acuity Test: Biographical Composition

Category	Frequency table: Sex			
	Count	Cumulative Count	Percent	Cumulative Percent
M	6	6	85,71429	85,7143
F	1	7	14,28571	100,0000
Missing	0	7	0,00000	100,0000

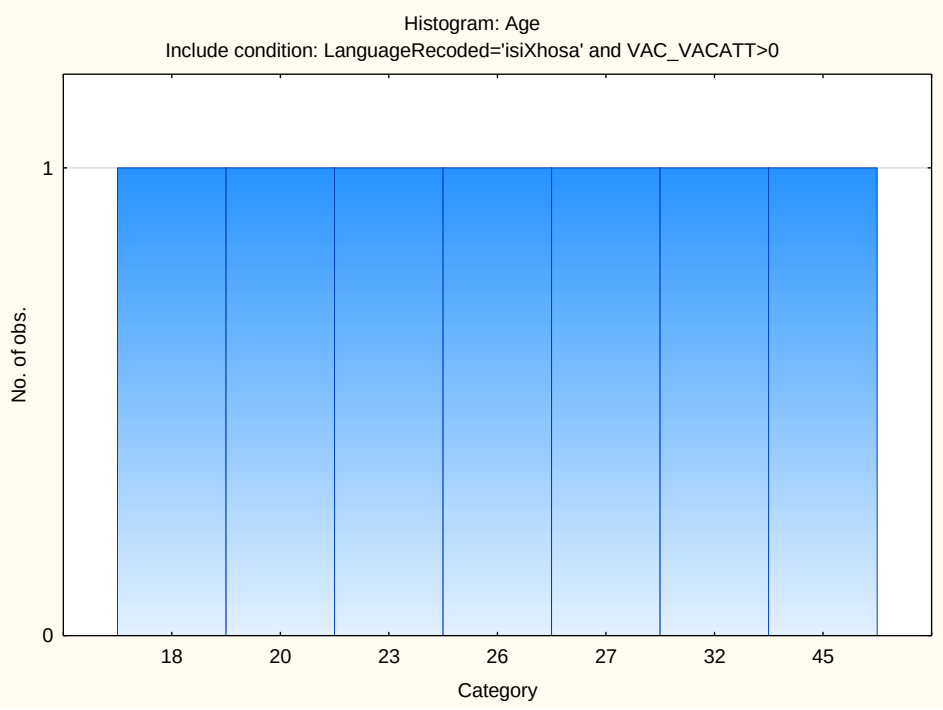
Category	Frequency table: Education			
	Count	Cumulative Count	Percent	Cumulative Percent
Tertiary	3	3	42,85714	42,8571
Grade 12	4	7	57,14286	100,0000
Missing	0	7	0,00000	100,0000

Category	Frequency table: Language			
	Count	Cumulative Count	Percent	Cumulative Percent
isiXhosa	7	7	100,0000	100,0000
Missing	0	7	0,0000	100,0000

Category	Frequency table: Language Group			
	Count	Cumulative Count	Percent	Cumulative Percent
Indigenous	7	7	100,0000	100,0000
Missing	0	7	0,0000	100,0000

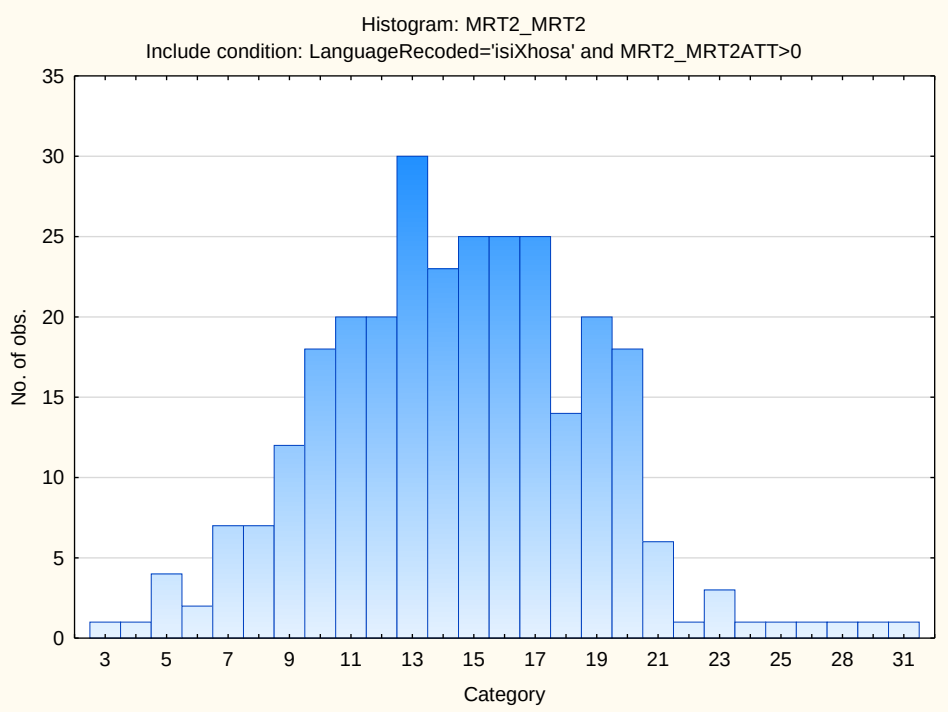
Category	Frequency table: Race			
	Count	Cumulative Count	Percent	Cumulative Percent
African	7	7	100,0000	100,0000
Missing	0	7	0,0000	100,0000

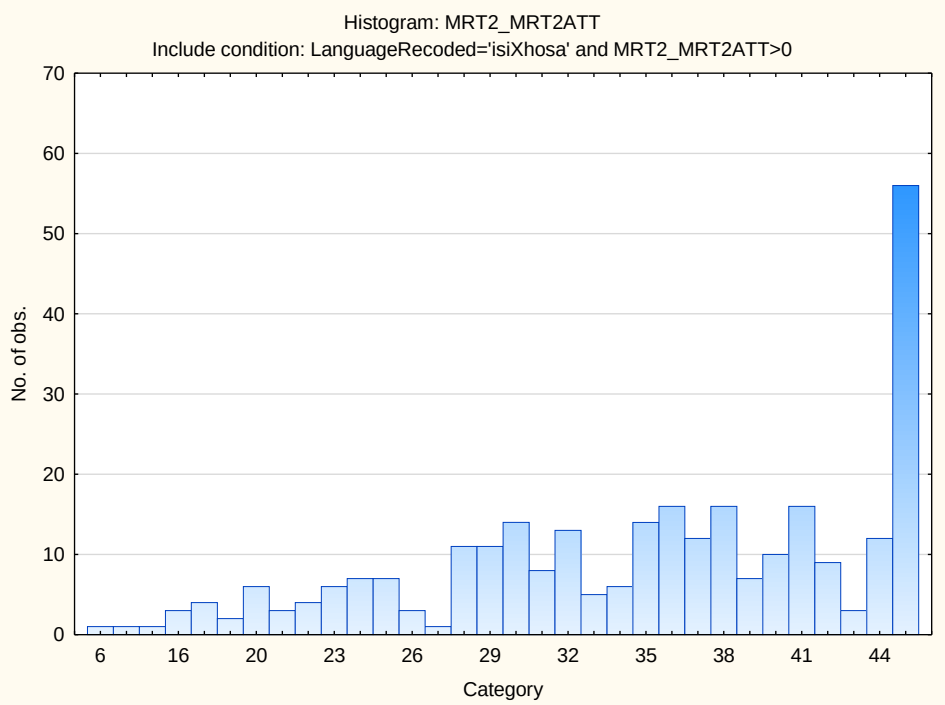
Variable	Descriptive Statistics: Age					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases Missing
Age	27,28571	9,086882	18,00000	45,00000	7	0



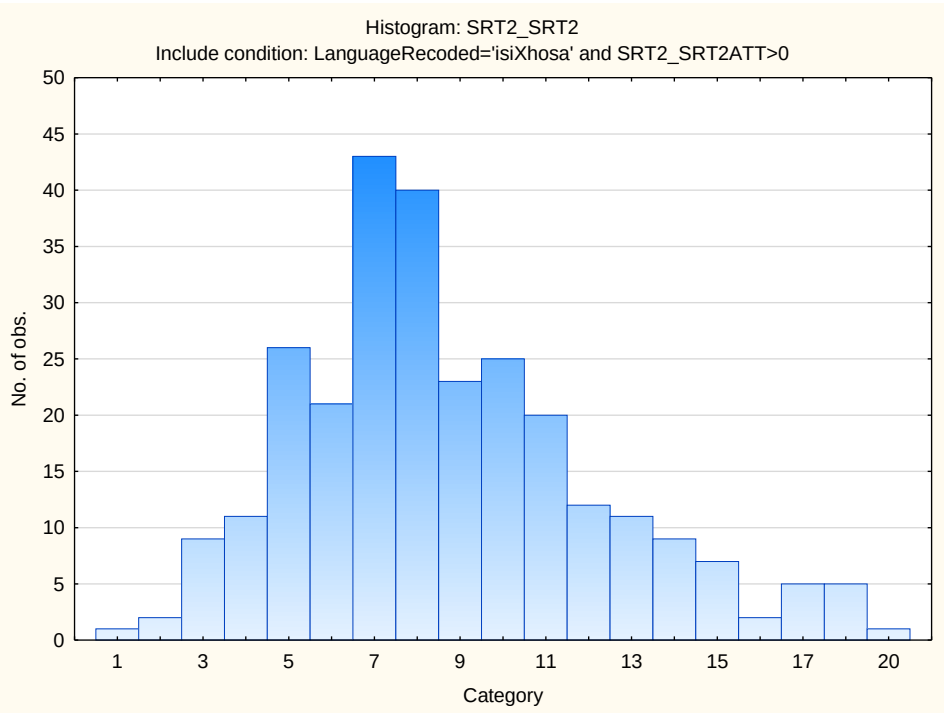
Descriptive Statistics on Technical Test Battery Subtests

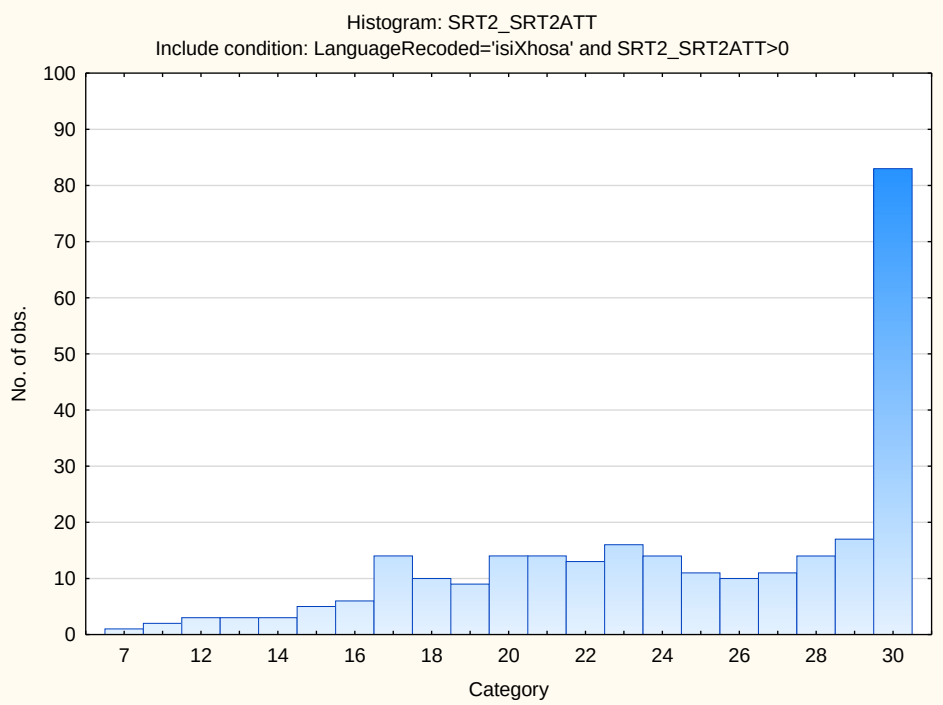
Variable	Descriptive Statistics: Mechanical Reasoning Test					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases
Mechanical Reasoning	14,50347	4,378438	3,000000	31,00000	288	0
Mechanical Reasoning Items Attempted	35,17361	8,295778	6,000000	45,00000	288	0





Variable	Descriptive Statistics: Spatial Reasoning Test					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases
Spatial Reasoning	8,69963	3,516437	1,000000	20,00000	273	0
Spatial Reasoning Items Attempted	24,45788	5,399403	7,000000	30,00000	273	0




Histogram: SRT2_SRT2ATT
Include condition: LanguageRecoded='isiXhosa' and SRT2_SRT2ATT>0
No. of obs.
Category
0
10
20
30
40
50
60
70
80
90
100
7
12
14
16
18
20
22
24
26
28
30

Stanine Table

Scales	Stanine Groups								
	S9_1	**S9_2**	**S9_3**	**S9_4**	**S9_5**	**S9_6**	**S9_7**	**S9_8**	**S9_9**
Mechanical Reasoning	3-6	7-9	10-11	12-13	14-15	16-17	18-19	20-22	23-31
Spatial Reasoning	1-2	3-4	5-6	7-7	8-9	10-11	12-13	14-14	15-20

There was insufficient data to provide a norm for the VAC.

Technical Test Battery (TTB2)

Norm Group: SA isiZulu Speakers, Updated 2016

Population, Updated 2016

Norm Type:

Standard Deviation Norm

Sample Composition

The sample consisted of respondents who had completed any of the subtests of the Technical Test Battery (TTB2) battery in the period up to June 2015, via GeneSys for Windows. Since not all the respondents completed all the subtests, biographical information is reported separately for the three tests.

Mechanical Reasoning Test: Biographical Composition

Category	Frequency table: Sex			
	Count	Cumulative Count	Percent	Cumulative Percent
M	513	513	74,56395	74,5640
F	174	687	25,29070	99,8547
U	1	688	0,14535	100,0000
Missing	0	688	0,00000	100,0000

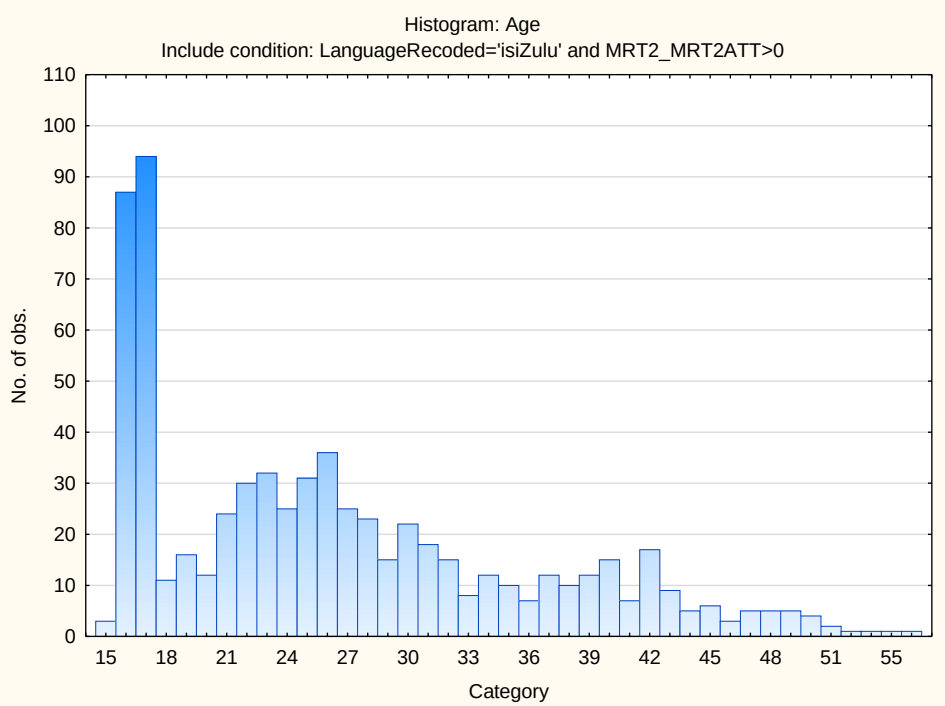
Category	Frequency table: Education			
	Count	Cumulative Count	Percent	Cumulative Percent
Tertiary	97	97	14,09884	14,0988
< Matric	260	357	37,79070	51,8895
Grade 12	241	598	35,02907	86,9186
Post Graduate	1	599	0,14535	87,0640
Missing	89	688	12,93605	100,0000

Category	Frequency table: Language			
	Count	Cumulative Count	Percent	Cumulative Percent
isiZulu	688	688	100,0000	100,0000
Missing	0	688	0,0000	100,0000

Category	Frequency table: Language Group			
	Count	Cumulative Count	Percent	Cumulative Percent
Indigenous	688	688	100,0000	100,0000
Missing	0	688	0,0000	100,0000

Category	Frequency table: Race			
	Count	Cumulative Count	Percent	Cumulative Percent
African	684	684	99,41860	99,4186
Asian	3	687	0,43605	99,8547
Missing	1	688	0,14535	100,0000

Variable	Descriptive Statistics: Age					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases Missing
Age	26,38552	9,404800	15,00000	59,00000	677	11



Spatial Reasoning Test: Biographical Composition

Category	Frequency table: Sex			
	Count	Cumulative Count	Percent	Cumulative Percent
M	394	394	92,92453	92,9245
F	30	424	7,07547	100,0000
Missing	0	424	0,00000	100,0000

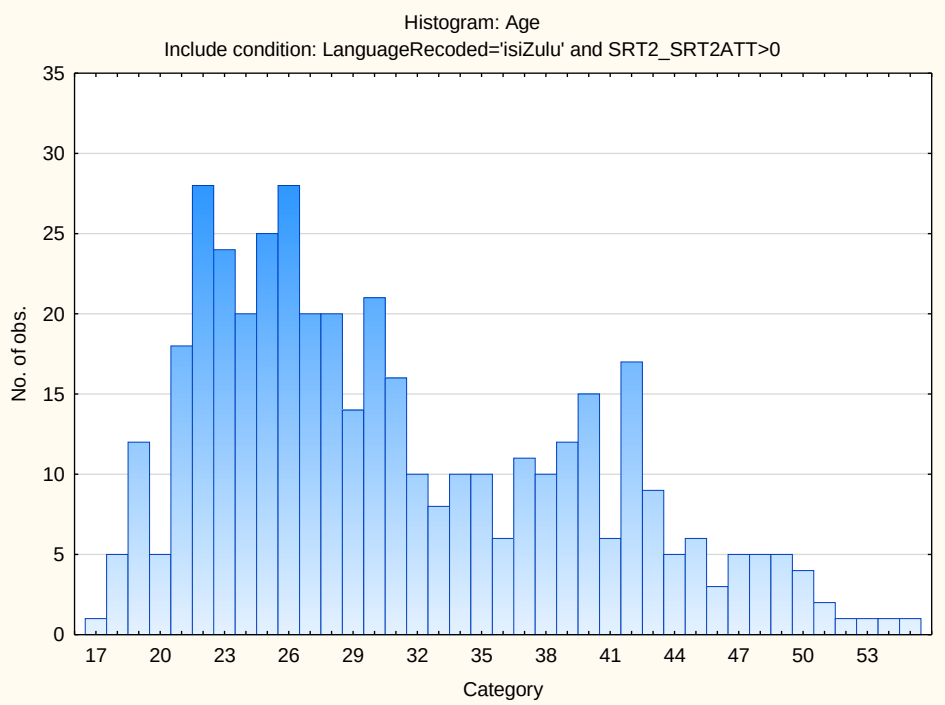
Category	Frequency table: Education			
	Count	Cumulative Count	Percent	Cumulative Percent
Tertiary	94	94	22,16981	22,1698
< Matric	57	151	13,44340	35,6132
Grade 12	197	348	46,46226	82,0755
Missing	76	424	17,92453	100,0000

Category	Frequency table: Language			
	Count	Cumulative Count	Percent	Cumulative Percent
isiZulu	424	424	100,0000	100,0000
Missing	0	424	0,0000	100,0000

Category	Frequency table: Language Group			
	Count	Cumulative Count	Percent	Cumulative Percent
Indigenous	424	424	100,0000	100,0000
Missing	0	424	0,0000	100,0000

Category	Frequency table: Race			
	Count	Cumulative Count	Percent	Cumulative Percent
African	421	421	99,29245	99,2925
Asian	3	424	0,70755	100,0000
Missing	0	424	0,00000	100,0000

Variable	Descriptive Statistics: Age					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases Missing
Age	30,96905	8,597135	17,00000	59,00000	420	4



Sample composition: Visual Acuity Test (VAC)

Category	Frequency table: Sex			
	Count	Cumulative Count	Percent	Cumulative Percent
M	23	23	88,46154	88,4615
F	3	26	11,53846	100,0000
Missing	0	26	0,00000	100,0000

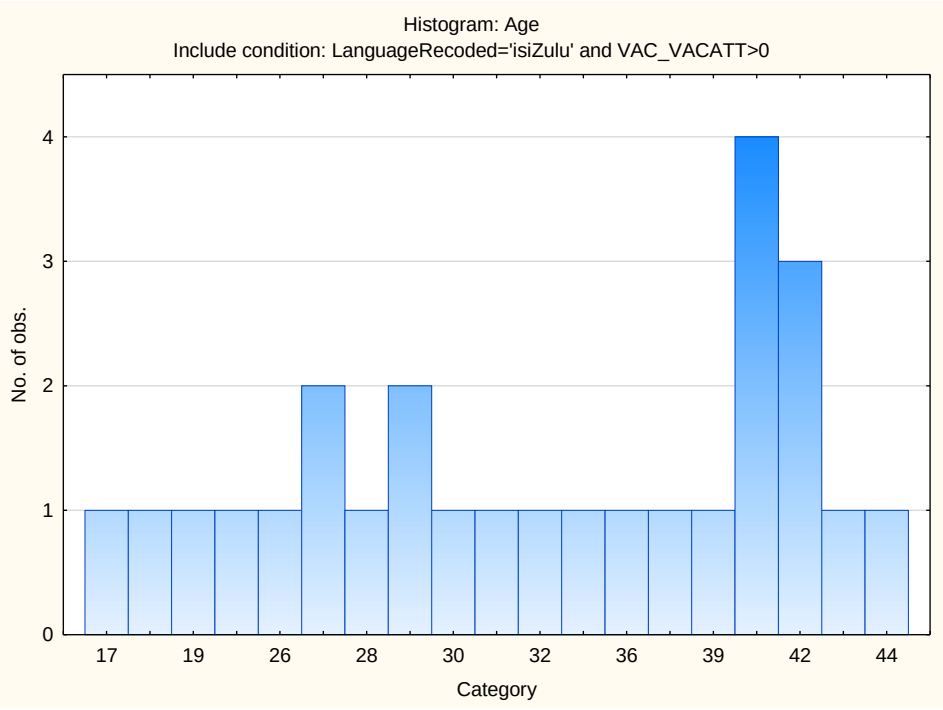
Category	Frequency table: Education			
	Count	Cumulative Count	Percent	Cumulative Percent
Tertiary	10	10	38,46154	38,4615
Grade 12	15	25	57,69231	96,1538
Missing	1	26	3,84615	100,0000

Category	Frequency table: Language			
	Count	Cumulative Count	Percent	Cumulative Percent
isiZulu	26	26	100,0000	100,0000
Missing	0	26	0,0000	100,0000

Category	Frequency table: Language Group			
	Count	Cumulative Count	Percent	Cumulative Percent
Indigenous	26	26	100,0000	100,0000
Missing	0	26	0,0000	100,0000

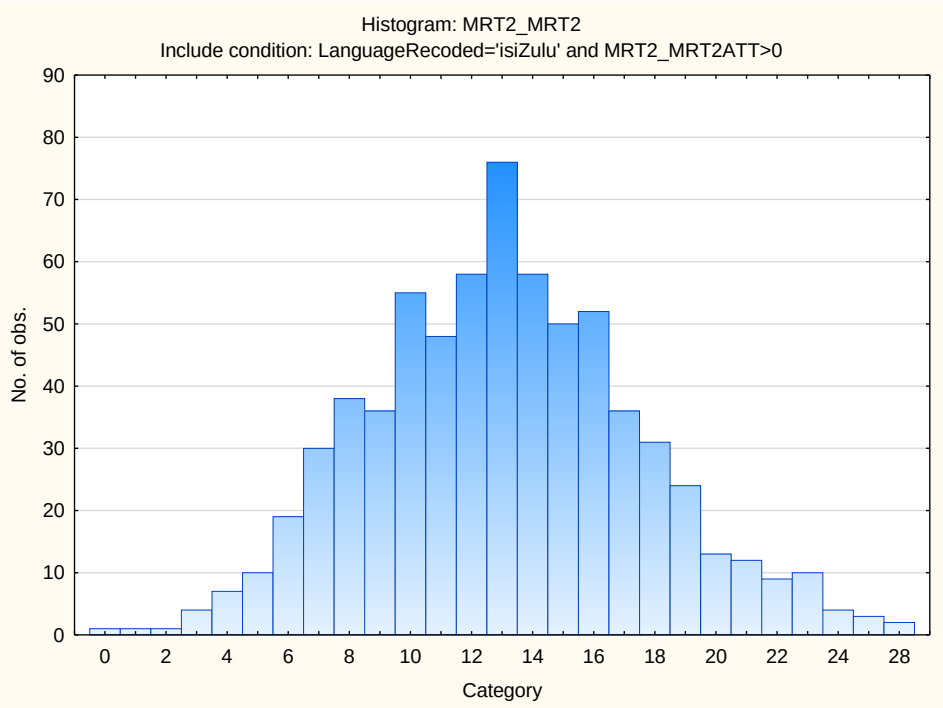
Category	Frequency table: Race			
	Count	Cumulative Count	Percent	Cumulative Percent
African	26	26	100,0000	100,0000
Missing	0	26	0,0000	100,0000

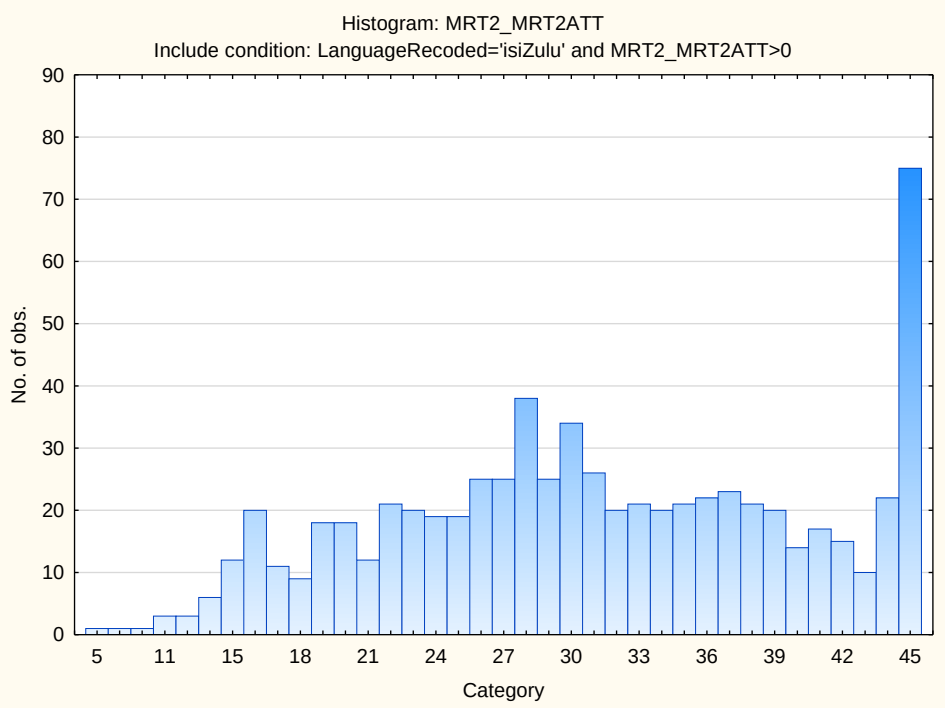
Variable	Descriptive Statistics: Age					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases Missing
Age	32,76923	8,406225	17,00000	44,00000	26	0



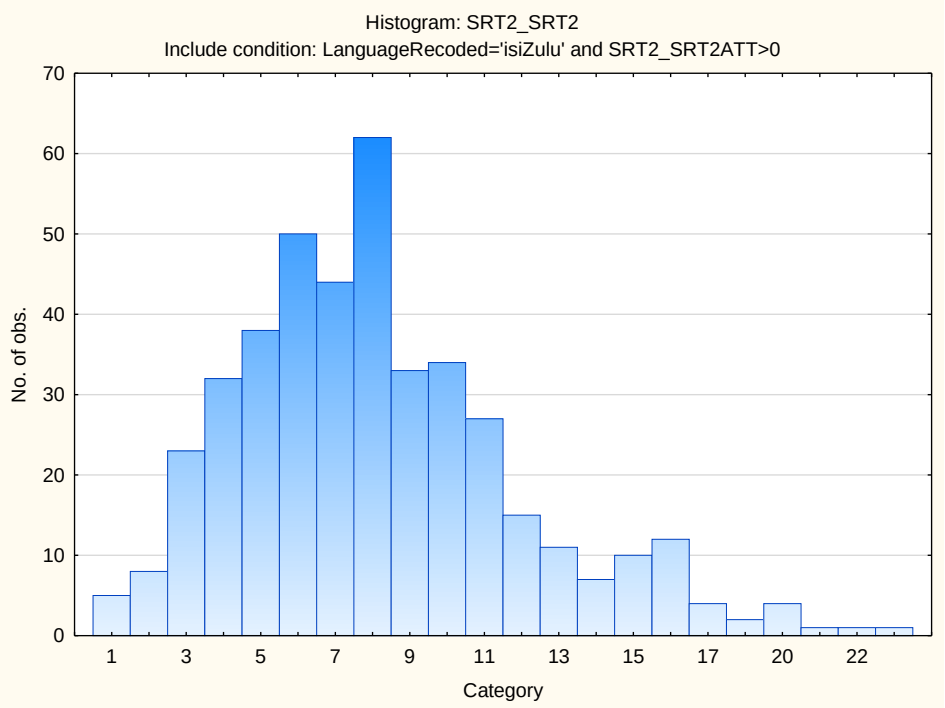
Descriptive Statistics on Technical Test Battery Subtests

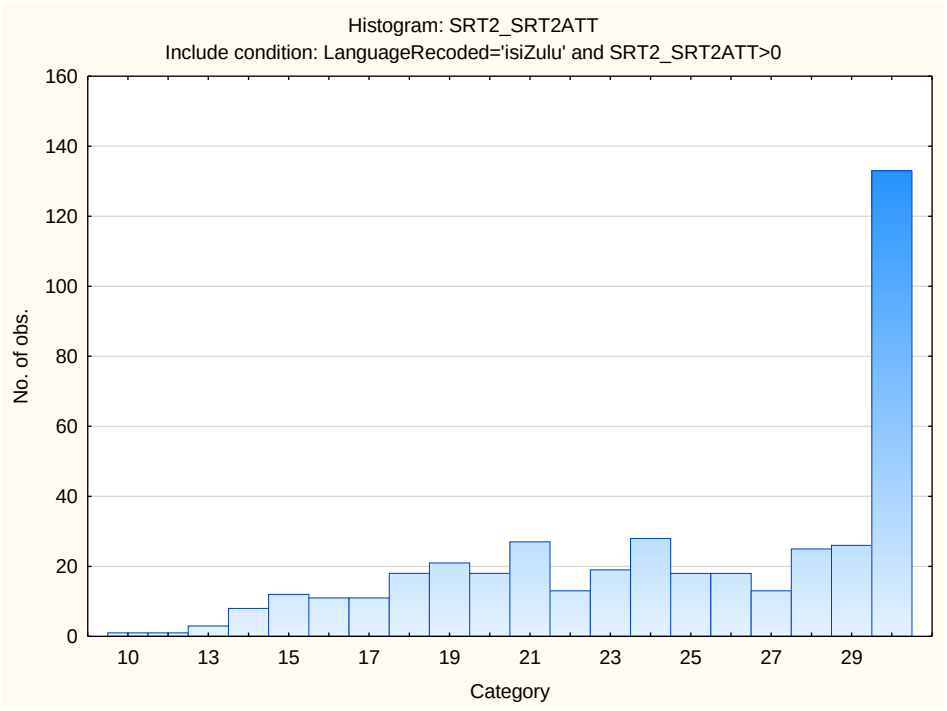
Variable	Descriptive Statistics: Mechanical Reasoning Test					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases
Mechanical Reasoning	13,07267	4,475449	0,000000	28,00000	688	0
Mechanical Reasoning Items Attempted	31,11047	9,162420	5,000000	45,00000	688	0





Variable	Descriptive Statistics: Spatial Reasoning Test					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases
Spatial Reasoning	8,15802	3,866084	1,00000	23,00000	424	0
Spatial Reasoning Items Attempted	24,70283	5,175080	10,00000	30,00000	424	0




Histogram: SRT2_SRT2ATT
Include condition: LanguageRecoded='isiZulu' and SRT2_SRT2ATT>0
No. of obs.
160
140
120
100
80
60
40
20
0
10
13
15
17
19
21
23
25
27
29
Category

Stanine Table

Scales	Stanine Groups								
	S9_1	S9_2	S9_3	S9_4	S9_5	S9_6	S9_7	S9_8	S9_9
Mechanical Reasoning	0-5	6-7	8-9	10-11	12-14	15-16	17-18	19-20	21-28
Spatial Reasoning	1-1	2-3	4-5	6-7	8-9	10-11	12-12	13-14	15-23

There was insufficient data to provide a norm for the VAC.

Technical Test Battery (TTB2)

Norm Group: SA Sepedi Speakers, Updated 2016

Norm Type:

Standard Deviation Norm

Sample Composition

The sample consisted of respondents who had completed any of the subtests of the Technical Test Battery (TTB2) battery in the period up to June 2015, via GeneSys for Windows. Since not all the respondents completed all the subtests, biographical information is reported separately for the three tests.

Mechanical Reasoning Test: Biographical Composition

Category	Frequency table: Sex			
	Count	Cumulative Count	Percent	Cumulative Percent
M	181	181	41,70507	41,7051
F	250	431	57,60369	99,3088
U	3	434	0,69124	100,0000
Missing	0	434	0,00000	100,0000

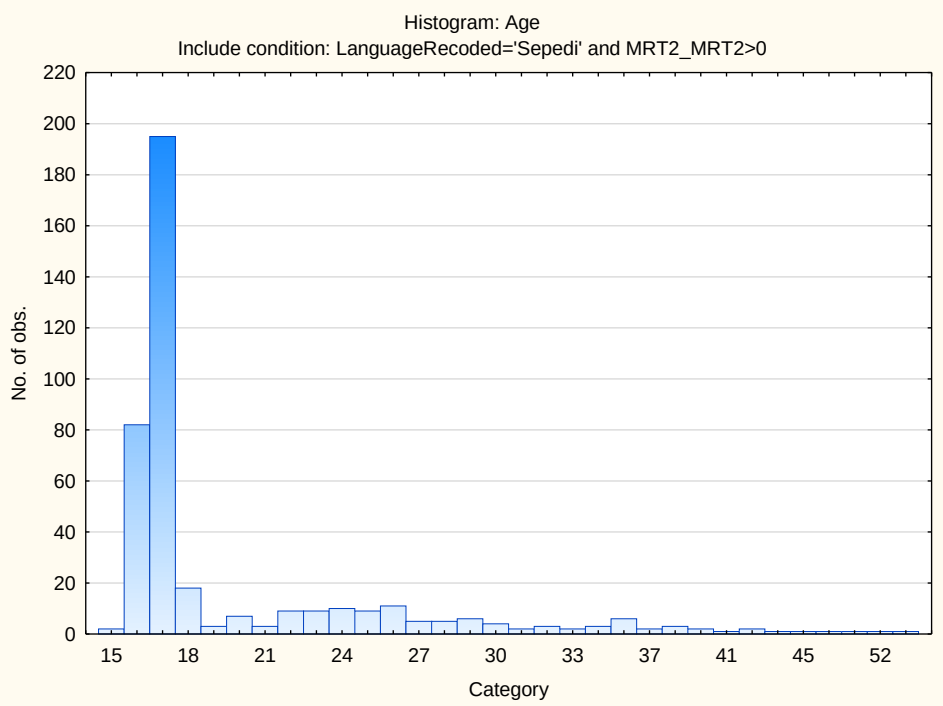
Category	Frequency table: Education			
	Count	Cumulative Count	Percent	Cumulative Percent
Tertiary	9	9	2,07373	2,0737
< Matric	308	317	70,96774	73,0415
Grade 12	57	374	13,13364	86,1751
Missing	60	434	13,82488	100,0000

Category	Frequency table: Language			
	Count	Cumulative Count	Percent	Cumulative Percent
Sepedi	434	434	100,0000	100,0000
Missing	0	434	0,0000	100,0000

Category	Frequency table: Language Group			
	Count	Cumulative Count	Percent	Cumulative Percent
Indigenous	434	434	100,0000	100,0000
Missing	0	434	0,0000	100,0000

Category	Frequency table: Race			
	Count	Cumulative Count	Percent	Cumulative Percent
African	429	429	98,84793	98,8479
Coloured	1	430	0,23041	99,0783
Asian	2	432	0,46083	99,5392
Missing	2	434	0,46083	100,0000

Variable	Descriptive Statistics: Age					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases Missing
Age	19,95610	6,451855	15,00000	54,00000	410	24



Spatial Reasoning Test: Biographical Composition

Category	Frequency table: Sex			
	Count	Cumulative Count	Percent	Cumulative Percent
M	80	80	86,95652	86,9565
F	12	92	13,04348	100,0000
Missing	0	92	0,00000	100,0000

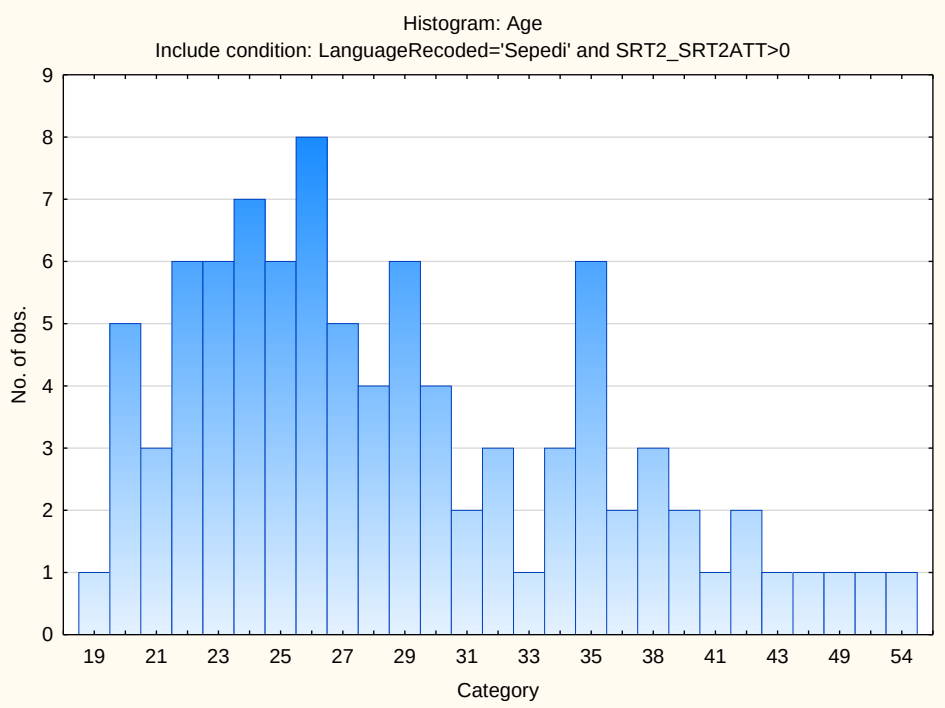
Category	Frequency table: Education			
	Count	Cumulative Count	Percent	Cumulative Percent
Tertiary	9	9	9,78261	9,7826
< Matric	15	24	16,30435	26,0870
Grade 12	15	39	16,30435	42,3913
Missing	53	92	57,60870	100,0000

Category	Frequency table: Language			
	Count	Cumulative Count	Percent	Cumulative Percent
Sepedi	92	92	100,0000	100,0000
Missing	0	92	0,0000	100,0000

Category	Frequency table: Language Group			
	Count	Cumulative Count	Percent	Cumulative Percent
Indigenous	92	92	100,0000	100,0000
Missing	0	92	0,0000	100,0000

Category	Frequency table: Race			
	Count	Cumulative Count	Percent	Cumulative Percent
African	92	92	100,0000	100,0000
Missing	0	92	0,0000	100,0000

Variable	Descriptive Statistics: Age					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases Missing
Age	29,19780	7,459848	19,00000	54,00000	91	1

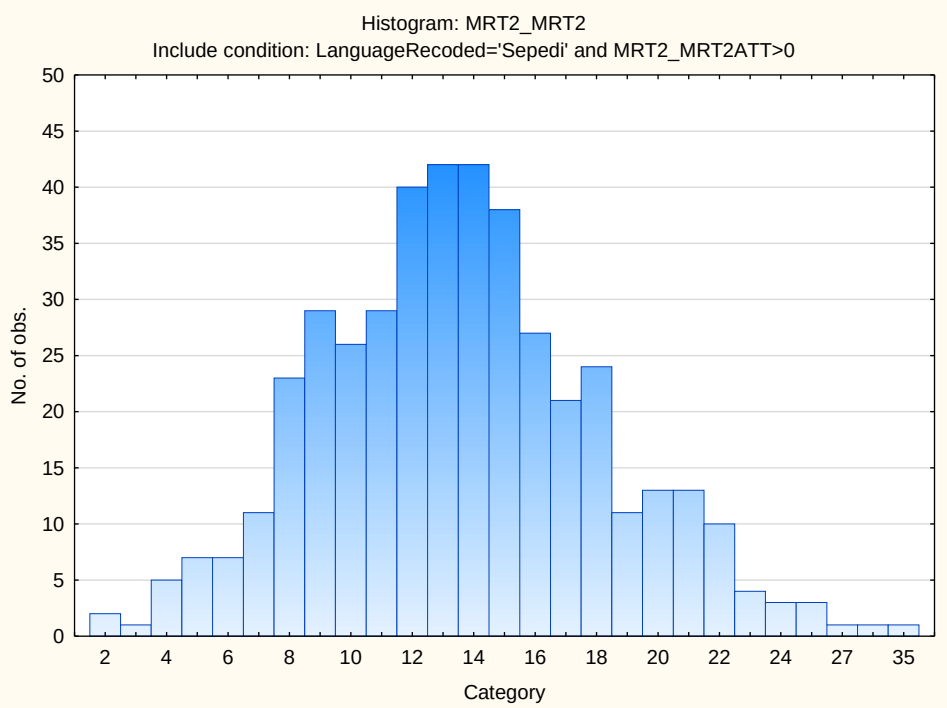


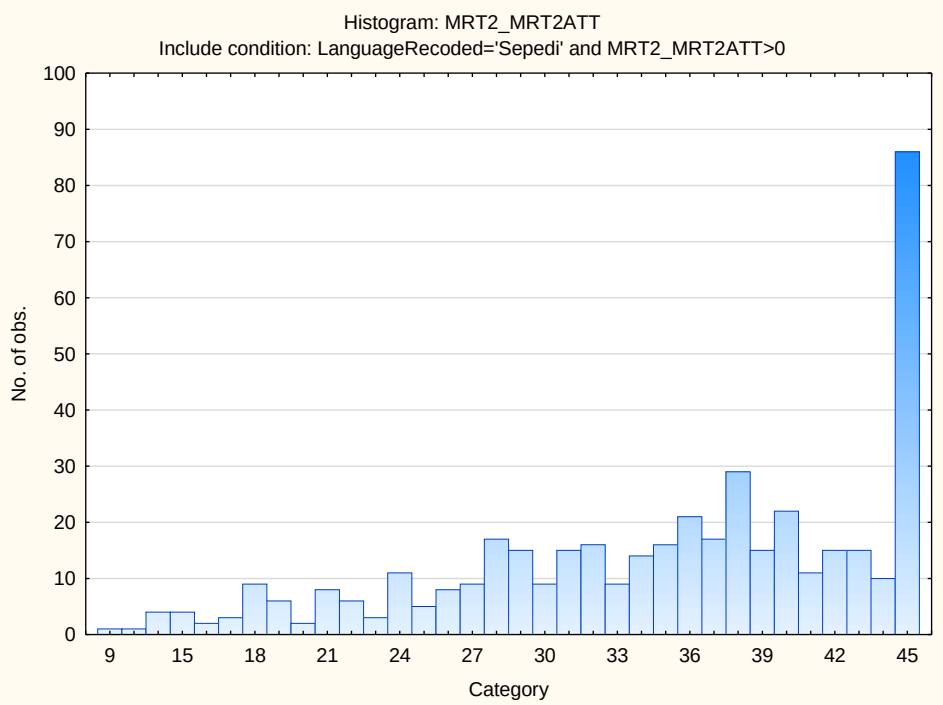
Visual Acuity Test: Biographical Composition

No first language Sepedi speakers completed the VAC

Descriptive statistics on Technical Test Battery subtests

Variable	Descriptive Statistics: Mechanical Reasoning Test					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases
Mechanical Reasoning	13,59908	4,655881	2,000000	35,00000	434	0
Mechanical Reasoning Items Attempted	35,06912	8,564647	9,000000	45,00000	434	0




Histogram: MRT2_MRT2ATT
Include condition: LanguageRecoded='Sepedi' and MRT2_MRT2ATT>0
No. of obs.
Category
0
10
20
30
40
50
60
70
80
90
100
9
15
18
21
24
27
30
33
36
39
42
45

Stanine Table

Scales	Stanine Groups								
	S9_1	**S9_2**	**S9_3**	**S9_4**	**S9_5**	**S9_6**	**S9_7**	**S9_8**	**S9_9**
Mechanical Reasoning	2-5	6-7	8-10	11-12	13-14	15-17	18-19	20-21	22-35

There was insufficient data to provide a norm for either the SRT2 or the VAC.

Technical Test Battery (TTB2)

Norm Group: SA Sesotho Speakers, Updated 2016

Norm Type:

Standard Deviation Norm

Sample Composition

The sample consisted of respondents who had completed any of the subtests of the Technical Test Battery (TTB2) battery in the period up to June 2015, via GeneSys for Windows. Since not all the respondents completed all the subtests, biographical information is reported separately for the three tests.

Mechanical Reasoning Test: Biographical Composition

Category	Frequency table: Sex			
	Count	Cumulative Count	Percent	Cumulative Percent
M	265	265	75,71429	75,7143
F	84	349	24,00000	99,7143
U	1	350	0,28571	100,0000
Missing	0	350	0,00000	100,0000

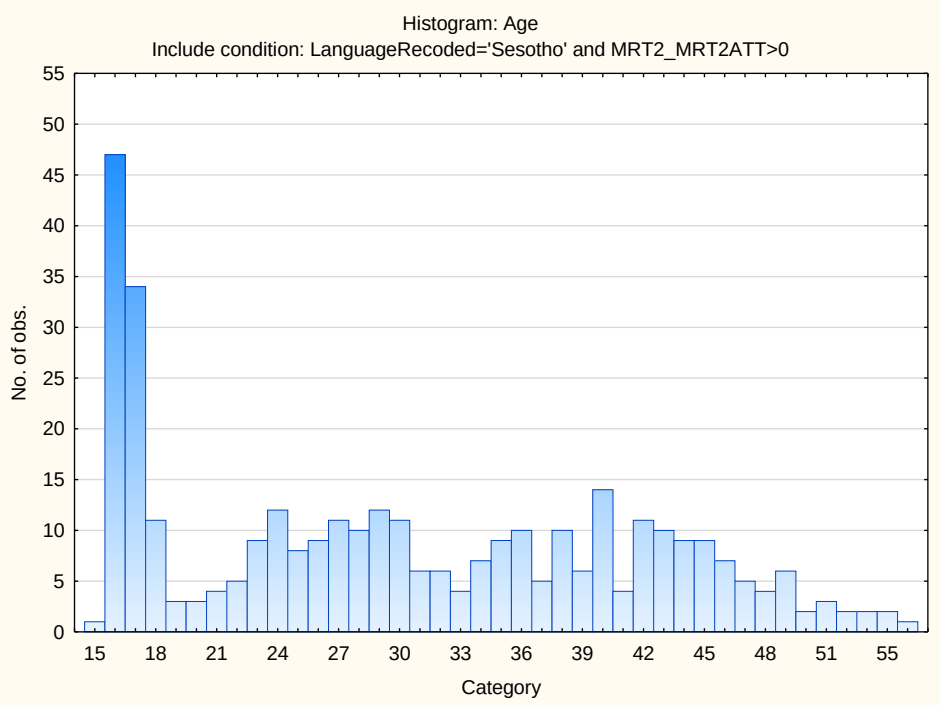
Category	Frequency table: Education			
	Count	Cumulative Count	Percent	Cumulative Percent
Tertiary	34	34	9,71429	9,7143
< Matric	156	190	44,57143	54,2857
Grade 12	93	283	26,57143	80,8571
Missing	67	350	19,14286	100,0000

Category	Frequency table: Language			
	Count	Cumulative Count	Percent	Cumulative Percent
Sesotho	350	350	100,0000	100,0000
Missing	0	350	0,0000	100,0000

Category	Frequency table: Language Group			
	Count	Cumulative Count	Percent	Cumulative Percent
Indigenous	350	350	100,0000	100,0000
Missing	0	350	0,0000	100,0000

Category	Frequency table: Race			
	Count	Cumulative Count	Percent	Cumulative Percent
African	349	349	99,71429	99,7143
Coloured	1	350	0,28571	100,0000
Missing	0	350	0,00000	100,0000

Variable	Descriptive Statistics: Age					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases Missing
Age	30,09593	11,26100	15,00000	58,00000	344	6



Spatial Reasoning Test: Biographical Composition

Category	Frequency table: Sex			
	Count	Cumulative Count	Percent	Cumulative Percent
M	237	237	94,04762	94,0476
F	14	251	5,55556	99,6032
U	1	252	0,39683	100,0000
Missing	0	252	0,00000	100,0000

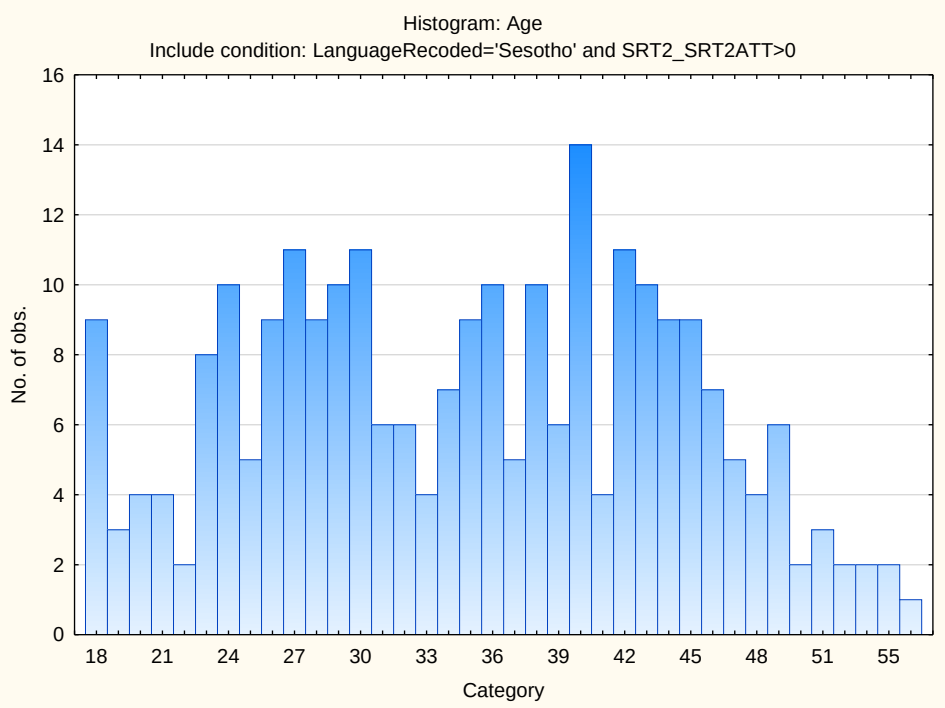
Category	Frequency table: Education			
	Count	Cumulative Count	Percent	Cumulative Percent
Tertiary	38	38	15,07937	15,0794
< Matric	64	102	25,39683	40,4762
Grade 12	84	186	33,33333	73,8095
Missing	66	252	26,19048	100,0000

Category	Frequency table: Language			
	Count	Cumulative Count	Percent	Cumulative Percent
Sesotho	252	252	100,0000	100,0000
Missing	0	252	0,0000	100,0000

Category	Frequency table: Language Group			
	Count	Cumulative Count	Percent	Cumulative Percent
Indigenous	252	252	100,0000	100,0000
Missing	0	252	0,0000	100,0000

Category	Frequency table: Race			
	Count	Cumulative Count	Percent	Cumulative Percent
African	252	252	100,0000	100,0000
Missing	0	252	0,0000	100,0000

Variable	Descriptive Statistics: Age					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases Missing
Age	34,91566	9,357856	18,00000	58,00000	249	3



Visual Acuity Test: Biographical Composition

Category	Frequency table: Sex			
	Count	Cumulative Count	Percent	Cumulative Percent
M	11	11	84,61538	84,6154
F	2	13	15,38462	100,0000
Missing	0	13	0,00000	100,0000

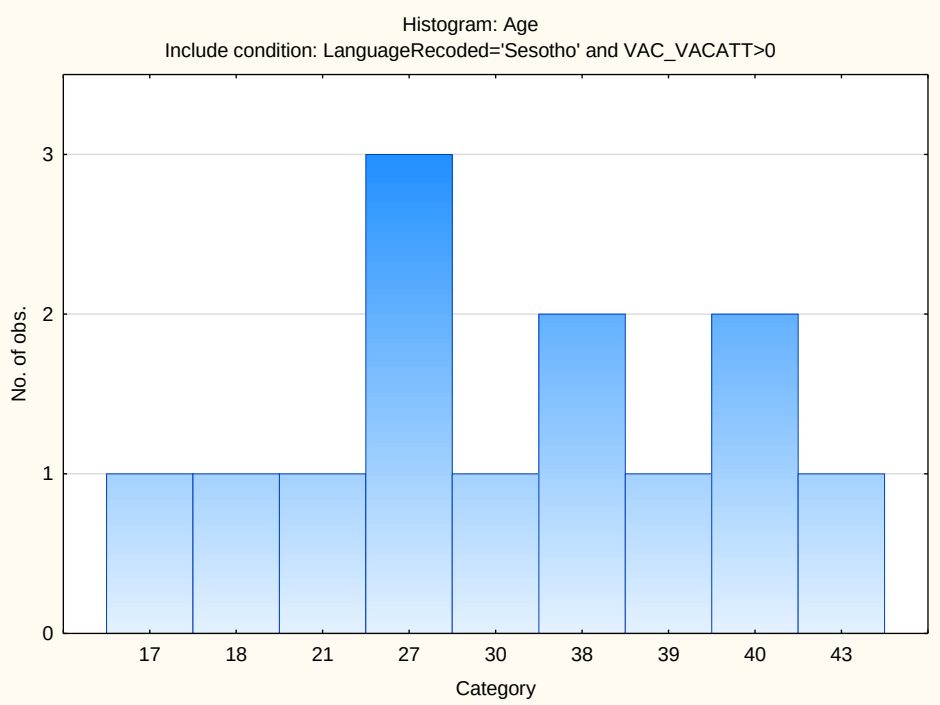
Category	Frequency table: Education			
	Count	Cumulative Count	Percent	Cumulative Percent
Tertiary	7	7	53,84615	53,8462
Grade 12	6	13	46,15385	100,0000
Missing	0	13	0,00000	100,0000

Category	Frequency table: Language			
	Count	Cumulative Count	Percent	Cumulative Percent
Sesotho	13	13	100,0000	100,0000
Missing	0	13	0,0000	100,0000

Category	Frequency table: Language Group			
	Count	Cumulative Count	Percent	Cumulative Percent
Indigenous	13	13	100,0000	100,0000
Missing	0	13	0,0000	100,0000

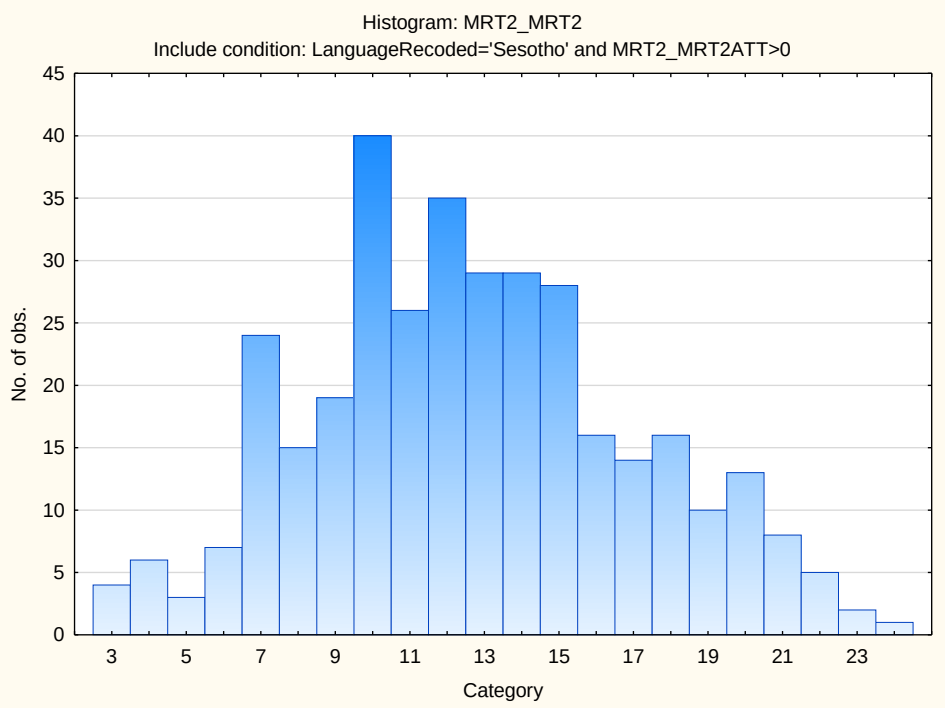
Category	Frequency table: Race			
	Count	Cumulative Count	Percent	Cumulative Percent
African	13	13	100,0000	100,0000
Missing	0	13	0,0000	100,0000

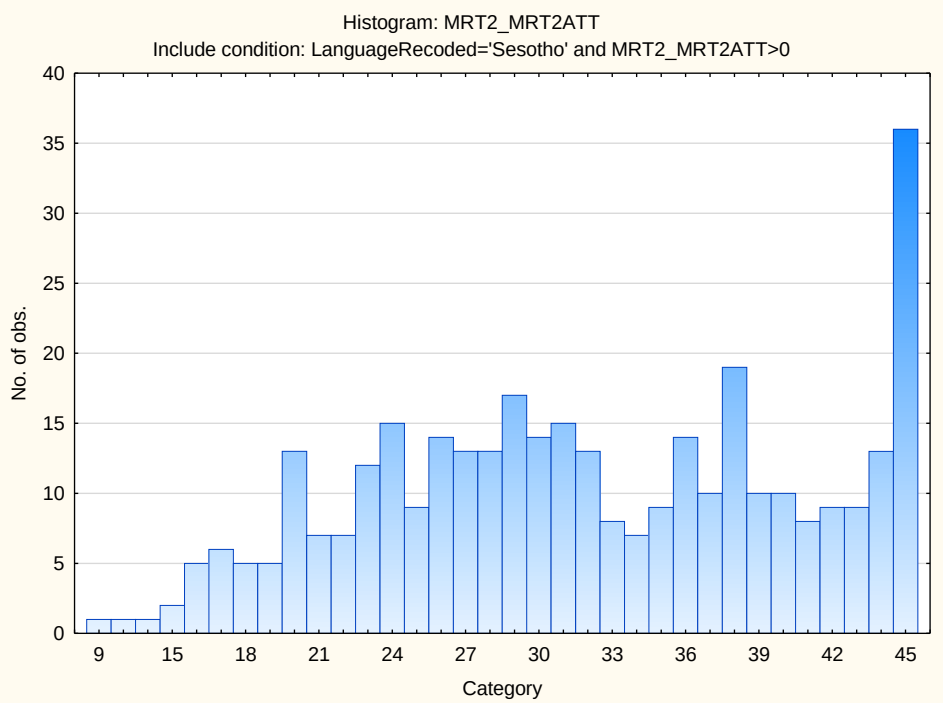
Variable	Descriptive Statistics: Age					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases Missing
Age	31,15385	9,044760	17,00000	43,00000	13	0



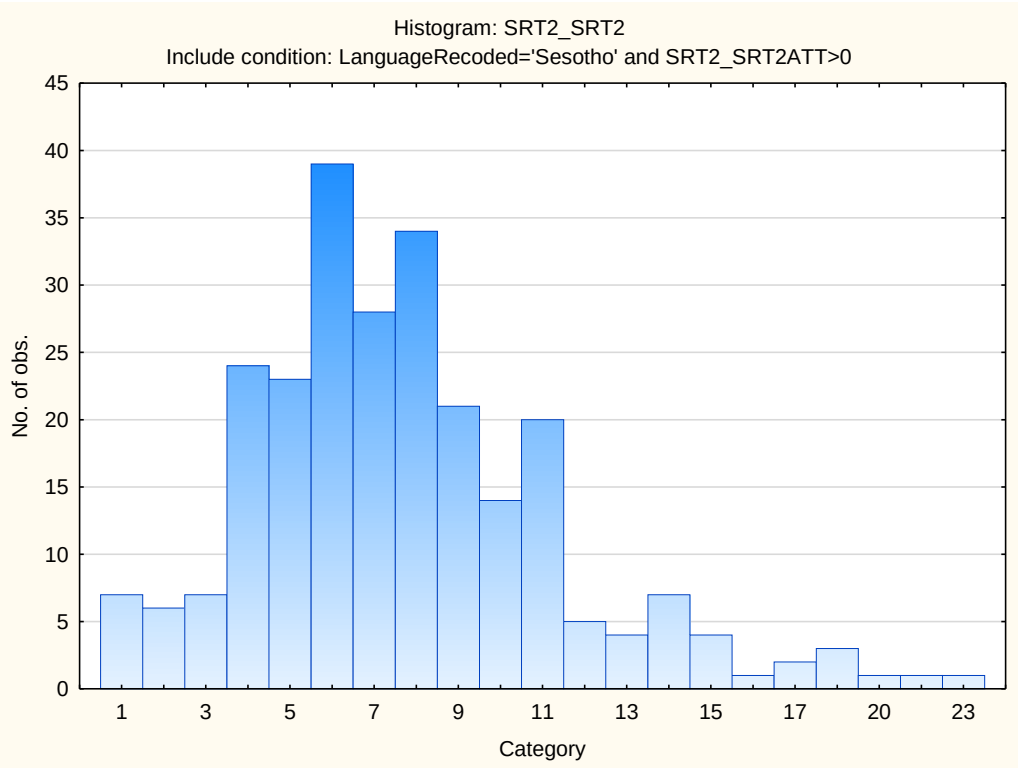
Descriptive Statistics on Technical Test Battery Subtests

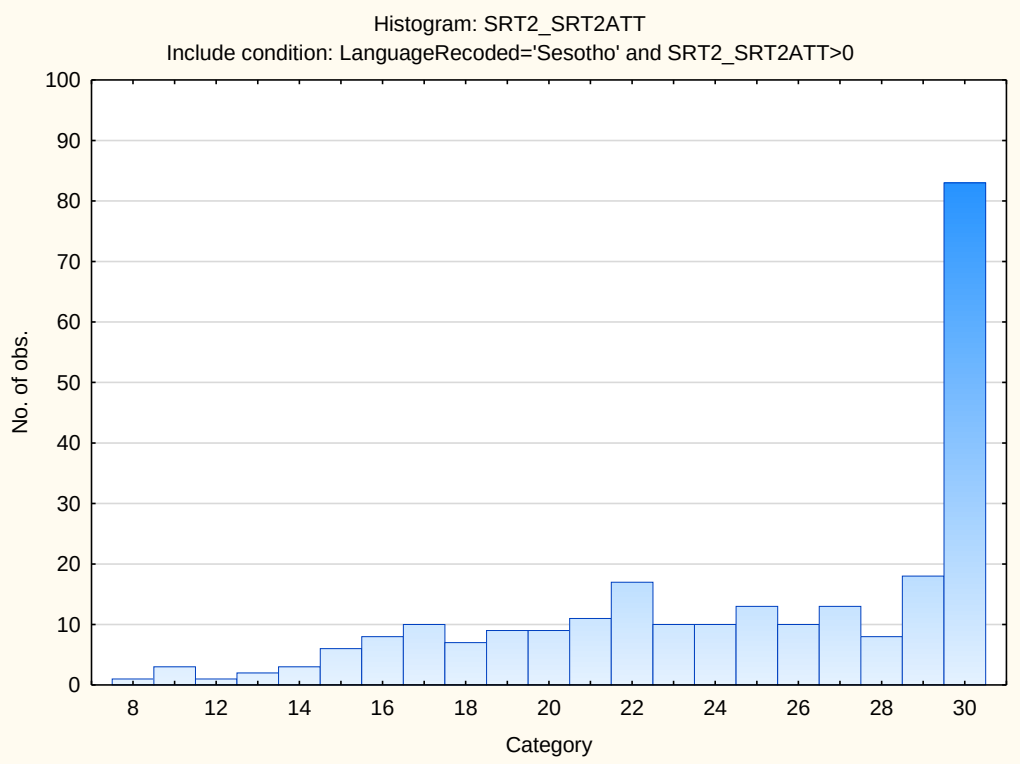
Variable	Descriptive Statistics: Mechanical Reasoning Test					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases
Mechanical Reasoning	12,68857	4,339812	3,000000	24,00000	350	0
Mechanical Reasoning Items Attempted	32,04286	8,686906	9,000000	45,00000	350	0





Variable	Descriptive Statistics: Spatial Reasoning Test					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases
Spatial Reasoning	7,71032	3,734118	1,000000	23,00000	252	0
Spatial Reasoning Items Attempted	24,73413	5,405909	8,000000	30,00000	252	0




Histogram: SRT2_SRT2ATT
Include condition: LanguageRecoded='Sesotho' and SRT2_SRT2ATT>0
No. of obs.
Category
0
10
20
30
40
50
60
70
80
90
100
8
12
14
16
18
20
22
24
26
28
30

Stanine Table

Scales	Stanine Groups								
	S9_1	**S9_2**	**S9_3**	**S9_4**	**S9_5**	**S9_6**	**S9_7**	**S9_8**	**S9_9**
Mechanical Reasoning	3-5	6-7	8-9	10-11	12-13	14-15	16-18	19-20	21-24
Spatial Reasoning	1-1	2-3	4-4	5-6	7-8	9-10	11-12	13-14	15-23

There was insufficient data to provide a norm for the VAC.

Technical Test Battery (TTB2)

Norm Group: SA Setswana Speakers, Updated 2016

Norm Type:

Standard Deviation Norm

Sample Composition

The sample consisted of respondents who had completed any of the subtests of the Technical Test Battery (TTB2) battery in the period up to June 2015, via GeneSys for Windows. Since not all the respondents completed all the subtests, biographical information is reported separately for the three tests.

Mechanical Reasoning Test: Biographical Composition

Category	Frequency table: Sex			
	Count	Cumulative Count	Percent	Cumulative Percent
M	71	71	44,93671	44,9367
F	87	158	55,06329	100,0000
Missing	0	158	0,00000	100,0000

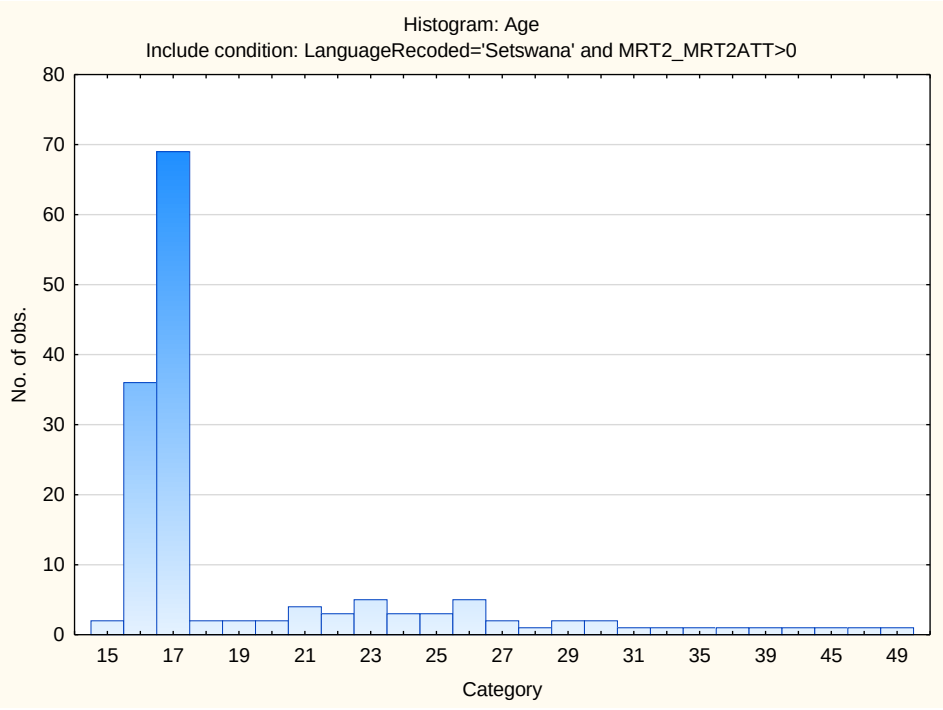
Category	Frequency table: Education			
	Count	Cumulative Count	Percent	Cumulative Percent
Tertiary	13	13	8,22785	8,2278
< Matric	109	122	68,98734	77,2152
Grade 12	19	141	12,02532	89,2405
Missing	17	158	10,75949	100,0000

Category	Frequency table: Language			
	Count	Cumulative Count	Percent	Cumulative Percent
Setswana	158	158	100,0000	100,0000
Missing	0	158	0,0000	100,0000

Category	Frequency table: Language Group			
	Count	Cumulative Count	Percent	Cumulative Percent
Indigenous	158	158	100,0000	100,0000
Missing	0	158	0,0000	100,0000

Category	Frequency table: Race			
	Count	Cumulative Count	Percent	Cumulative Percent
African	158	158	100,0000	100,0000
Missing	0	158	0,0000	100,0000

Variable	Descriptive Statistics: Age					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases Missing
Age	19,69737	6,316214	15,00000	49,00000	152	6



Spatial Reasoning Test: Biographical Composition

Category	Frequency table: Sex			
	Count	Cumulative Count	Percent	Cumulative Percent
M	35	35	81,39535	81,3953
F	8	43	18,60465	100,0000
Missing	0	43	0,00000	100,0000

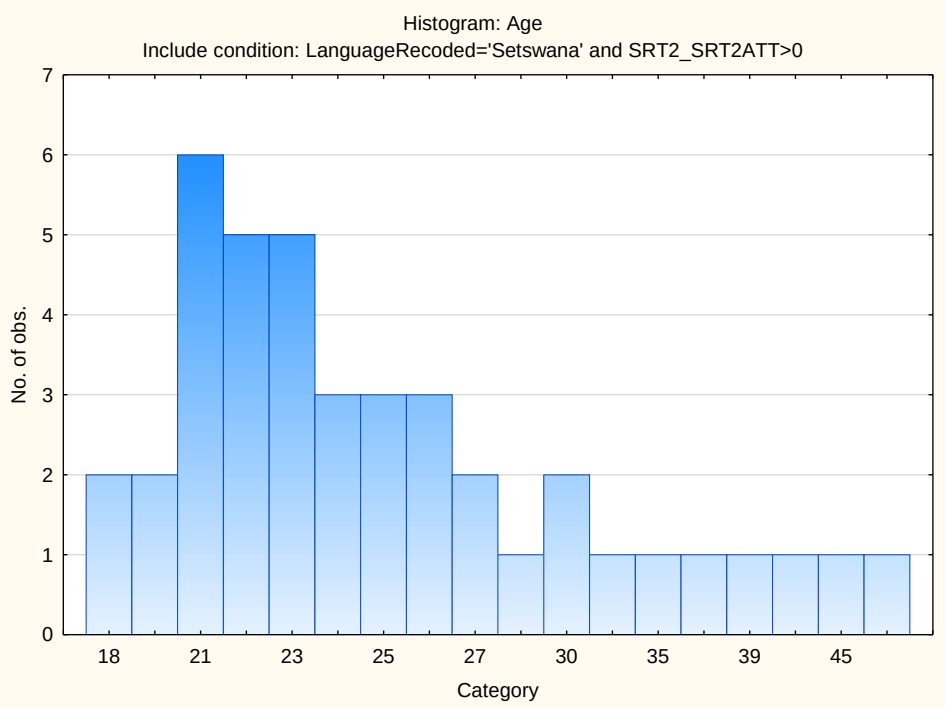
Category	Frequency table: Education			
	Count	Cumulative Count	Percent	Cumulative Percent
Tertiary	14	14	32,55814	32,5581
Grade 12	14	28	32,55814	65,1163
Missing	15	43	34,88372	100,0000

Category	Frequency table: Language			
	Count	Cumulative Count	Percent	Cumulative Percent
Setswana	43	43	100,0000	100,0000
Missing	0	43	0,0000	100,0000

Category	Frequency table: Language Group			
	Count	Cumulative Count	Percent	Cumulative Percent
Indigenous	43	43	100,0000	100,0000
Missing	0	43	0,0000	100,0000

Category	Frequency table: Race			
	Count	Cumulative Count	Percent	Cumulative Percent
African	42	42	97,67442	97,6744
Missing	1	43	2,32558	100,0000

Variable	Descriptive Statistics: Age					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases Missing
Age	26,14634	7,268291	18,00000	49,00000	41	2

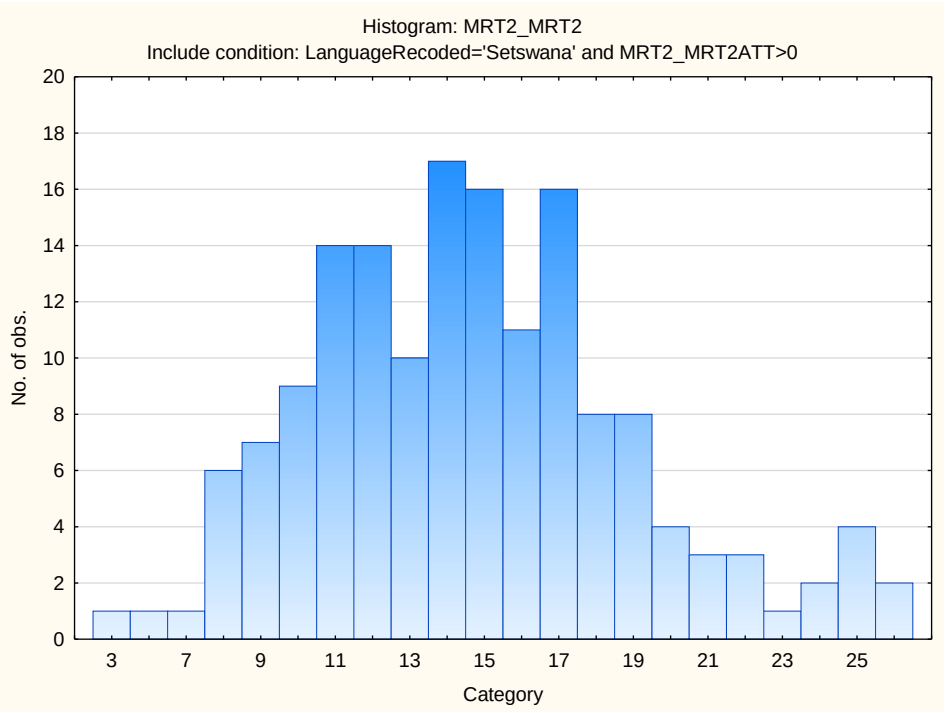


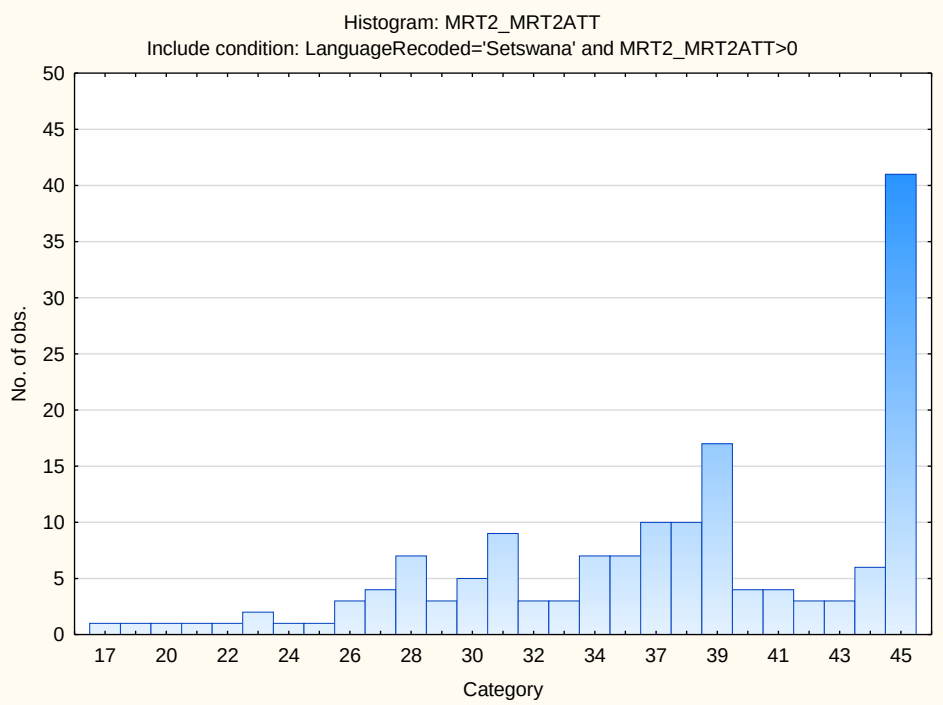
Visual Acuity Test: Biographical Composition

One first language Setswana speaker completed the VAC.

Descriptive Statistics on Technical Test Battery Subtests

Variable	Descriptive Statistics: Mechanical Reasoning Test					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases
Mechanical Reasoning	14,75316	4,488750	3,00000	30,00000	158	0
Mechanical Reasoning Items Attempted	37,20253	7,028386	17,00000	45,00000	158	0




Histogram: MRT2_MRT2ATT
Include condition: LanguageRecoded='Setswana' and MRT2_MRT2ATT>0
No. of obs.
0
5
10
15
20
25
30
35
40
45
50
17
20
22
24
26
28
30
32
34
37
39
41
43
45
Category

Stanine Table

Scales	Stanine Groups								
	S9_1	**S9_2**	**S9_3**	**S9_4**	**S9_5**	**S9_6**	**S9_7**	**S9_8**	**S9_9**
Mechanical Reasoning	3-6	7-9	10-11	12-13	14-15	16-18	19-20	21-22	23-30

There was insufficient data to provide a norm for either the SRT2 or the VAC.

TTB Reliability introduction

Reliability studies

Reliability studies are done whenever we receive a substantial body of data that contains item responses. Reliability calculation is one of the services offered by Psytech SA to its clients. In almost all cases, clients have been willing to share the results of these calculations with other users.

Availability of biographical information

Frequently full biographical information is not collected, which makes it very difficult to calculate separate reliabilities on different racial and language groups. In some cases, it has been necessary to do a post-hoc classification of respondents based on their names. In such situations it is usually not possible to distinguish between Whites and Coloureds, and they have had to be classified together in one group.

Relationship between reliability groups and norm groups

It is not possible to create a norm group for each reliability sample, because of sample size constraints. It is also not possible to report Coefficient Alpha for every norm sample, because item response data are not always available. In some cases, we have used the Kuder-Richardson Formula 21 to calculate an index of reliability in the absence of detailed item response information. For ease of reference, we have included as much information as possible about the composition of the samples, rather than refer the user to the description of a related norm group.

Standard error of measurement (SEM)

Where data are available, the standard error of measurement is reported for every group for which we have calculated reliabilities. This is usually done for samples that are also used as norm groups. In some cases, the standard error of measurement is reported for a group that has been screened for English comprehension, and for the total group as well.

Choosing an appropriate comparison group for reliability

If a larger, more diverse group is available that conforms to the demographic characteristics of the group you are interested in, use that table for comparison purposes.

The effect of reliability on validity

The reliability of a test places an upper limit on its validity. If a test is not reliable, it can not be valid.

What Does It Mean If A Test Has Low Reliability?

On an ability measure, Reliability is considered low if it is below 0.75. In cases where the reliability is below 0.65, the results should be interpreted with extreme caution by using additional information for this purpose. The interview prompts report can assist the user in obtaining additional information for the purpose of triangulation, directly from the respondent.
There are various reasons why the reliability of a test, or of a specific sample of the overall sample group, might be low:

- Respondents guessing the answers to items which they may not know. Results should therefore be interpreted with caution.
- Respondents may have rushed to complete the assessment or may have been lacking in motivation at the time of test completion. In this instance, a lower reliability could be attributed to guessing or hasty decision making.
- Respondents finding the test items too difficult.
- Shorter tests, although economic and quick to administer, tend to be less reliable.

It is best practice to always rely on multiple sources of information when making an informed decision utilising an assessment process. This is of particular importance when the reliability of an assessment is lower than usual.

Advice to users

- Collect full biographical information on the respondents.
- Verify whether the scales you are interested in for decision-making purposes, are reliable for the persons you want to test.
- Where available, bear the Standard Error of Measurement in mind when making decisions on test results.
- Do not use unreliable scales for decision making.
- Do not rely on a single test when reliability is doubtful.

List of reliability studies for the Technical Test Battery

Description of sample	Study Number
SA Workers in and applicants to a tobacco manufacturing company	R1
SA Apprentice applicants	R2
SA Applicants for learnerships to a transport company	R3
SA Workers in and applicants to a construction company	R4
SA Senior technical officers (electricians)	R5
SA Aggregate Population 2016	R6
SA Afrikaans 2016	R7
SA English 2016	R8
SA Indigenous 2016	R9
SA isiXhosa 2016	R10
SA isiZulu 2016	R11
SA Sepedi 2016	R12
SA Sesotho 2016	R13
SA Setswana 2016	R14

TTB Reliability: Workers and Applicants in a tobacco company

Sample composition

The sample consisted of workers and applicants in a company manufacturing tobacco products. Data were collected between 2002-2003.

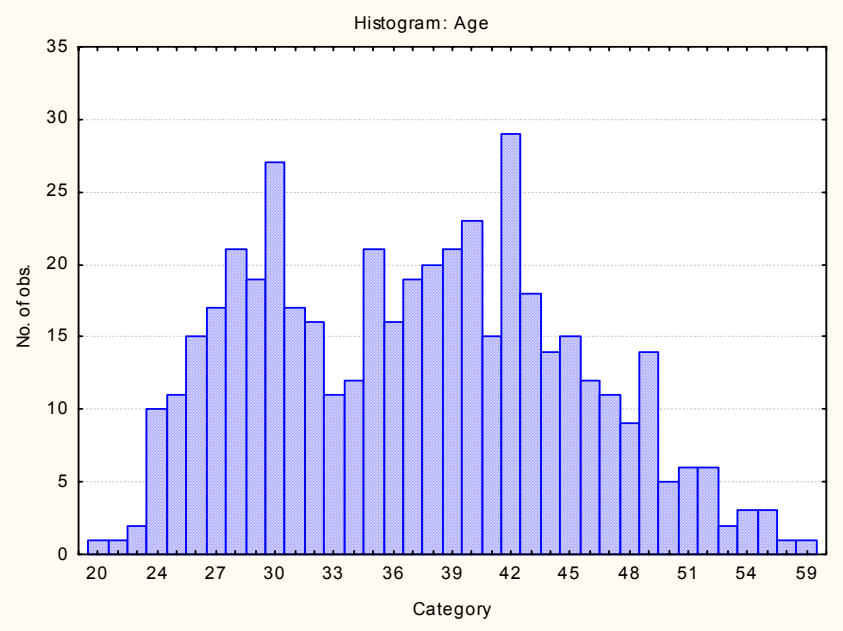
	Frequency table: Sex			
Category	Count	Cumulative Count	Percent	Cumulative Percent
Male	455	455	98.06034	98.0603
Female	9	464	1.93966	100.0000
Missing	0	464	0.00000	100.0000

	Frequency table: First Language			
Category	Count	Cumulative Count	Percent	Cumulative Percent
Afrikaans	55	55	11.85345	11.8534
Sesotho	171	226	36.85345	48.7069
isiZulu	168	394	36.20690	84.9138
English	11	405	2.37069	87.2845
Setswana	5	410	1.07759	88.3621
Other - N Sotho	1	411	0.21552	88.5776
Xitsonga	4	415	0.86207	89.4397
Sepedi	10	425	2.15517	91.5948
isiNdebele/Tshivenda	5	430	1.07759	92.6724
isiXhosa	15	445	3.23276	95.9052
siSwati	2	447	0.43103	96.3362
Missing	17	464	3.66379	100.0000

	Frequency table: Race			
Category	Count	Cumulative Count	Percent	Cumulative Percent
European	50	50	10.77586	10.7759
African	385	435	82.97414	93.7500
Asian	6	441	1.29310	95.0431
Coloured	7	448	1.50862	96.5517
Missing	16	464	3.44828	100.0000

Category	Frequency table: Education			
	Count	Cumulative Count	Percent	Cumulative Percent
Vocational Training	10	10	2.15517	2.1552
Grade 12 - N2	1	11	0.21552	2.3707
Grade 10 or 11	35	46	7.54310	9.9138
University entrance matri	2	48	0.43103	10.3448
Technikon	8	56	1.72414	12.0690
Std 7	36	92	7.75862	19.8276
Std 5	17	109	3.66379	23.4914
Grade 12	147	256	31.68103	55.1724
Std 6	46	302	9.91379	65.0862
Technikon (N2)	1	303	0.21552	65.3017
Std 8	63	366	13.57759	78.8793
Vocational Training - N2	4	370	0.86207	79.7414
Std 9	27	397	5.81897	85.5603
Technikon - N2	1	398	0.21552	85.7759
Degree	1	399	0.21552	85.9914
Technikon - N5	1	400	0.21552	86.2069
Grade 12 + N5 Fitter and	1	401	0.21552	86.4224
Vocational Training - N3	5	406	1.07759	87.5000
Grade 12 + ND in Fitting	1	407	0.21552	87.7155
Vocational Training - NTC	1	408	0.21552	87.9310
Grade 8	2	410	0.43103	88.3621
Grade 12 + Technikon Cert	1	411	0.21552	88.5776
Vocational Training - N4	5	416	1.07759	89.6552
Std 4	6	422	1.29310	90.9483
Grade 11	3	425	0.64655	91.5948
NTC 3	1	426	0.21552	91.8103
Vocational Training (Mill	1	427	0.21552	92.0259
Grade 12 + Teaching Diplo	1	428	0.21552	92.2414
University diploma	1	429	0.21552	92.4569
Grade 10	1	430	0.21552	92.6724
Grade 11 + BAdmin Diploma	1	431	0.21552	92.8879
Grade 9	2	433	0.43103	93.3190
Form 2	1	434	0.21552	93.5345
Vocational Training - Fit	1	435	0.21552	93.7500
Grade 12 & A+	1	436	0.21552	93.9655
Grade 12 + Fitter & Turne	2	438	0.43103	94.3966
Technikon - N3	1	439	0.21552	94.6121
Technikon - Marketing	1	440	0.21552	94.8276
Std 1	1	441	0.21552	95.0431
Grade 10 or 11 + Ind Refr	1	442	0.21552	95.2586
Vocational Training - N5	1	443	0.21552	95.4741
Vocational Training (N3)	1	444	0.21552	95.6897
Grade 12 + HRM Diploma	1	445	0.21552	95.9052
Vocational Training - N1	1	446	0.21552	96.1207
Grade 10 or 11 + Fitting	1	447	0.21552	96.3362
Missing	17	464	3.66379	100.0000

Variable	Descriptive Statistics					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases Missing
Age	37.12500	7.879869	20.00000	59.00000	464	0



Internal Consistency reliabilities of TTB subtests

Subtest	Cronbach coefficient Alpha
Mechanical Reasoning Test	.75
Spatial Reasoning test	.64

Standard error of measurement

	1 ScaleName	2 SEM	3 SD	4 Reliability
1	Mechanical Reasoning	2.53608036	5.072161	0.75
2	Spatial Reasoning	2.21199261	3.686654	0.64

TTB Reliability: SA Apprentice applicants

The sample consisted of individuals applying for apprentice training in a variety of trades with a local government body.

Educational levels ranged from grade 9 to N3 diplomas.

Some of the respondents were from a special educational institution for persons with learning problems.

Category	Frequency table: Race			
	Count	Cumulative Count	Percent	Cumulative Percent
Whites and coloureds	68	68	29.82456	29.8246
Blacks	156	224	68.42105	98.2456
Missing	4	228	1.75439	100.0000

Category	Frequency table: GENDER			
	Count	Cumulative Count	Percent	Cumulative Percent
Male	205	205	89.91228	89.9123
Female	18	223	7.89474	97.8070
Unknown	5	228	2.19298	100.0000
Missing	0	228	0.00000	100.0000

Internal consistency reliabilities

Test	Coefficient alpha
Spatial reasoning Test	.521486
Mechanical Reasoning Test	.605740

These reliabilities were not as high as one would expect of an ability battery. The other ability tests from other publishers that were included in this testing program also had poor reliabilities.

Standard error of measurement

	1 ScaleName	2 SEM	3 SD	4 Reliability
1	Mechanical Reasoning	3.459027	5.000421	0.521486
2	Spatial Reasoning	2.170042	3.456024	0.60574

TTB Reliability: Transport Company Applicants

Sample composition

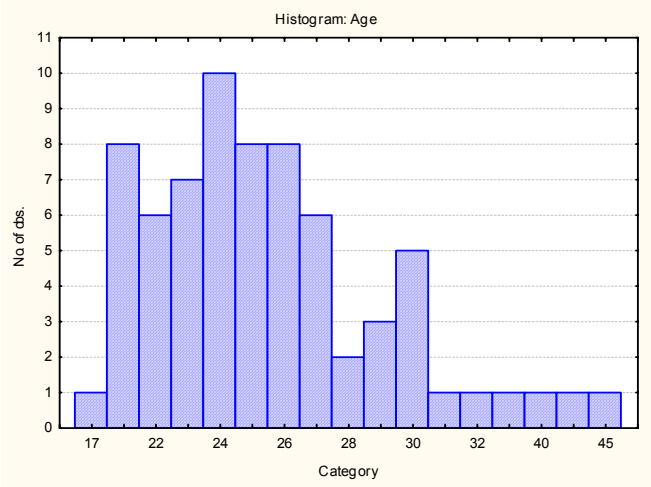
Applicants for learnerships for various trades with a road transport company based in Gauteng. Data were collected in 2003.

Category	Frequency table: Sex			
	Count	Cumulative Count	Percent	Cumulative Percent
Male	60	60	83.33333	83.3333
Female	10	70	13.88889	97.2222
Unknown	2	72	2.77778	100.0000
Missing	0	72	0.00000	100.0000

Category	Frequency table: First Language			
	Count	Cumulative Count	Percent	Cumulative Percent
English	1	1	1.38889	1.3889
Sepedi	7	8	9.72222	11.1111
Sesotho	22	30	30.55556	41.6667
isiXhosa	4	34	5.55556	47.2222
Xitsonga	8	42	11.11111	58.3333
isiZulu	2	44	2.77778	61.1111
siSwati	2	46	2.77778	63.8889
Tshivenda	10	56	13.88889	77.7778
Setswana	9	65	12.50000	90.2778
isiNdebele	4	69	5.55556	95.8333
Missing	3	72	4.16667	100.0000

Category	Frequency table: Race			
	Count	Cumulative Count	Percent	Cumulative Percent
Asian	1	1	1.38889	1.3889
African	70	71	97.22222	98.6111
Missing	1	72	1.38889	100.0000

Variable	Descriptive Statistics					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases Missing
Age	25.80000	4.781001	17.00000	45.00000	70	2



Internal Consistency Reliabilities of TTB subtests

Subtest	Cronbach coefficient Alpha
Mechanical Reasoning	.64
Spatial Reasoning	.64

TTB Reliability: SA Construction Company Workers and Applicants

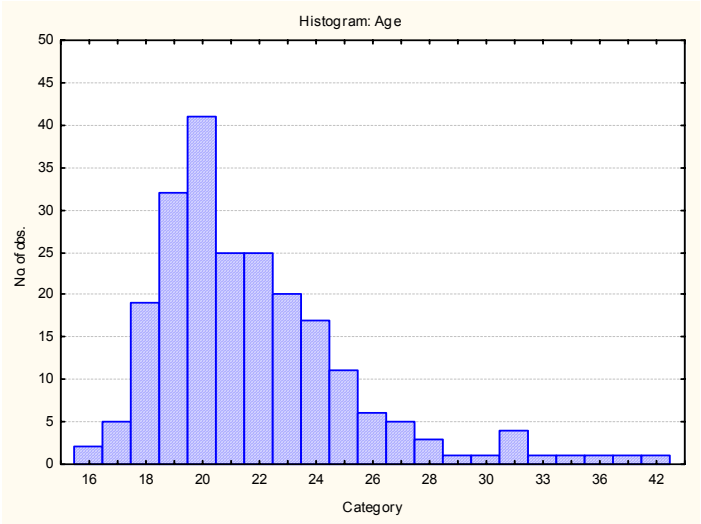
Sample Composition

Workers and applicants to a construction company based in the Western Cape.
Data were collected during 2002-2003.

Category	Frequency table: Race			
	Count	Cumulative Count	Percent	Cumulative Percent
BLACKS	124	124	55.60538	55.6054
ASIANS	2	126	0.89686	56.5022
WHITES/COLOUREDS	95	221	42.60090	99.1031
Missing	2	223	0.89686	100.0000

Category	Frequency table: Sex			
	Count	Cumulative Count	Percent	Cumulative Percent
MALE	204	204	91.47982	91.4798
FEMALE	18	222	8.07175	99.5516
UNKNOWN	1	223	0.44843	100.0000
Missing	0	223	0.00000	100.0000

Variable	Descriptive Statistics					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases Missing
Age	21.83784	3.751417	16.00000	42.00000	222	1



Internal consistency reliabilities on TTB subtests

Subtest	Cronbach Coefficient Alpha
Mechanical Reasoning	.94
Spatial Reasoning	.91

Standard Error of Measurement

	1 ScaleName	2 SEM	3 SD	4 Reliability
1	Mechanical Reasoning	1.583881	6.466169	0.94
2	Spatial Reasoning	1.596223	5.320743	0.91

TTB Reliability: Senior technical officers - electricians

Sample composition

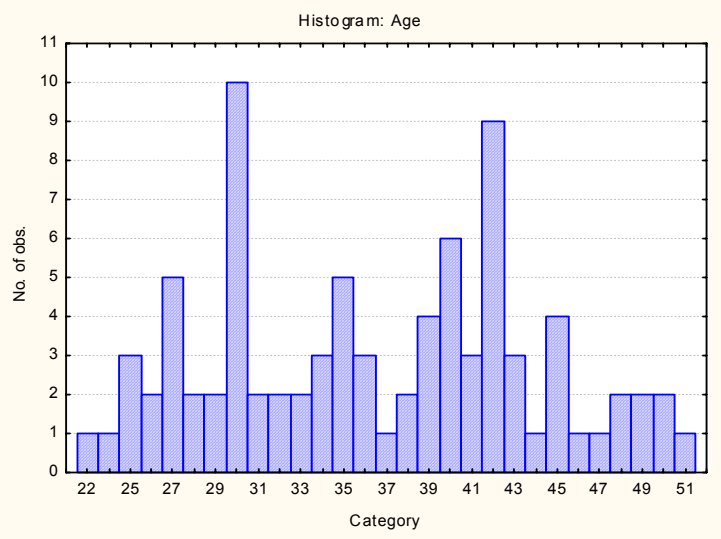
Senior technical officers tested as part of a validation study.

Category	Frequency table: Education			
	Count	Cumulative Count	Percent	Cumulative Percent
Technikon	1	1	1.13636	1.1364
Vocational Training	41	42	46.59091	47.7273
Grade 12	14	56	15.90909	63.6364
Grade 10 or 11	2	58	2.27273	65.9091
Missing	30	88	34.09091	100.0000

Category	Frequency table: First Language			
	Count	Cumulative Count	Percent	Cumulative Percent
isiZulu	8	8	9.09091	9.0909
isiXhosa	2	10	2.27273	11.3636
Afrikaans	29	39	32.95455	44.3182
English	8	47	9.09091	53.4091
Sesotho	8	55	9.09091	62.5000
Xitsonga	1	56	1.13636	63.6364
Setswana	1	57	1.13636	64.7727
isiNdebele	1	58	1.13636	65.9091
Missing	30	88	34.09091	100.0000

Category	Frequency table: Race (Eskom ttb resps_dif.sta)			
	Count	Cumulative Count	Percent	Cumulative Percent
European	51	51	57.95455	57.9545
Coloured	7	58	7.95455	65.9091
African	30	88	34.09091	100.0000
Missing	0	88	0.00000	100.0000

Variable	Descriptive Statistics					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases Missing
Age	36.47059	7.344561	22.00000	51.00000	85	3



Internal consistency reliabilities on TTB subtests

Subtest	Cronbach coefficient alpha
Mechanical Reasoning	.78
Spatial Reasoning	.85
Visual Acuity	.84

Standard Error of measurement

	1 ScaleName	2 SEM	3 SD	4 Reliability
1	Mechanical Reasoning	2.502069	6.687060	0.86
2	Spatial Reasoning	2.712282	5.319223	0.74
3	Visual Acuity	1.352718	3.280823	0.83

Technical Test Battery (TTB2)

Reliability: South Africans, Aggregate Population, Updated 2016

Sample Composition

The sample consisted of respondents who had completed any of the subtests of the Technical Test Battery (TTB2) battery in the period up to June 2015, via GeneSys for Windows. Since not all the respondents completed all the subtests, biographical information is reported separately for the three tests.

Mechanical Reasoning Test: Biographical Composition

Category	Frequency table: Sex			
	Count	Cumulative Count	Percent	Cumulative Percent
M	2785	2785	66,69061	66,6906
F	1378	4163	32,99808	99,6887
U	13	4176	0,31130	100,0000
Missing	0	4176	0,00000	100,0000

Category	Frequency table: Education			
	Count	Cumulative Count	Percent	Cumulative Percent
Tertiary	359	359	8,59674	8,5967
< Matric	1562	1921	37,40421	46,0010
Grade 12	854	2775	20,45019	66,4511
Post Graduate	6	2781	0,14368	66,5948
Missing	1395	4176	33,40517	100,0000

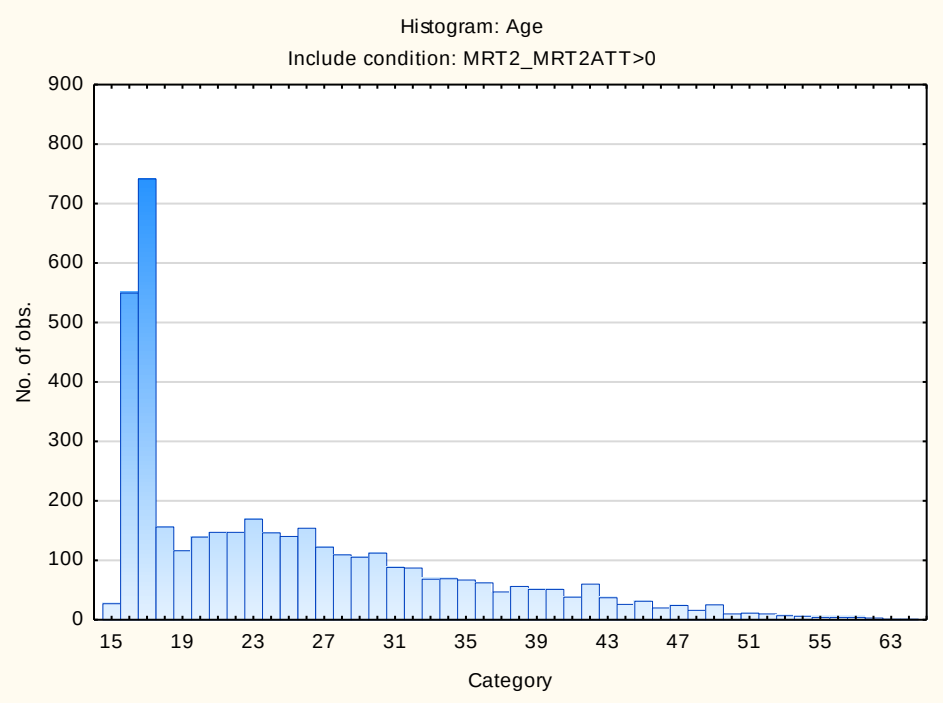
Category	Frequency table: Language			
	Count	Cumulative Count	Percent	Cumulative Percent
isiZulu	688	688	16,47510	16,4751
English	380	1068	9,09962	25,5747
isiXhosa	288	1356	6,89655	32,4713

Category	Frequency table: Language			
	Count	Cumulative Count	Percent	Cumulative Percent
Afrikaans	270	1626	6,46552	38,9368
Sepedi	434	2060	10,39272	49,3295
siSwati	99	2159	2,37069	51,7002
isiNdebele	25	2184	0,59866	52,2989
Setswana	158	2342	3,78352	56,0824
Xitsonga	81	2423	1,93966	58,0220
Sesotho	350	2773	8,38123	66,4033
Tshivenda	47	2820	1,12548	67,5287
Missing	1356	4176	32,47126	100,0000

Category	Frequency table: Language Group			
	Count	Cumulative Count	Percent	Cumulative Percent
Indigenous	2170	2170	51,96360	51,9636
English	380	2550	9,09962	61,0632
Afrikaans	270	2820	6,46552	67,5287
Missing	1356	4176	32,47126	100,0000

Category	Frequency table: Race			
	Count	Cumulative Count	Percent	Cumulative Percent
African	2513	2513	60,17720	60,1772
European	311	2824	7,44732	67,6245
Coloured	160	2984	3,83142	71,4559
Asian	131	3115	3,13697	74,5929
Missing	1061	4176	25,40709	100,0000

Variable	Descriptive Statistics: Age					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases Missing
Age	25,01354	9,203432	15,00000	69,00000	4063	113



Spatial Reasoning Test: Biographical Composition

Category	Frequency table: Sex			
	Count	Cumulative Count	Percent	Cumulative Percent
M	1898	1898	87,62696	87,6270
F	264	2162	12,18837	99,8153
U	4	2166	0,18467	100,0000
Missing	0	2166	0,00000	100,0000

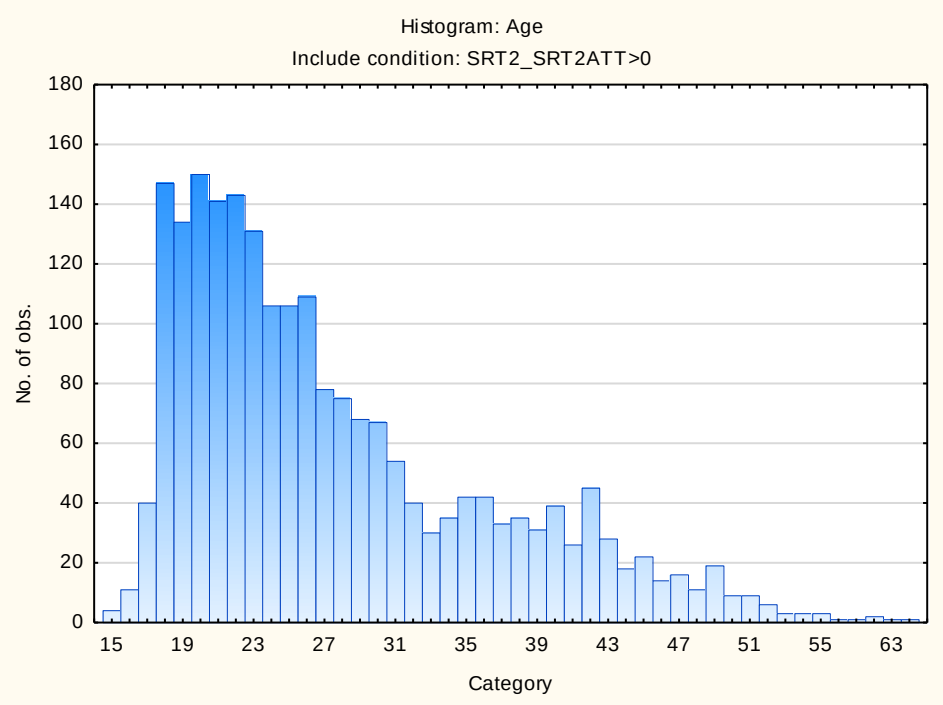
Category	Frequency table: Education			
	Count	Cumulative Count	Percent	Cumulative Percent
Tertiary	360	360	16,62050	16,6205
< Matric	216	576	9,97230	26,5928
Grade 12	821	1397	37,90397	64,4968
Post Graduate	1	1398	0,04617	64,5429
Missing	768	2166	35,45706	100,0000

Category	Frequency table: Language			
	Count	Cumulative Count	Percent	Cumulative Percent
isiZulu	424	424	19,57525	19,5753
English	230	654	10,61865	30,1939
isiXhosa	273	927	12,60388	42,7978
Afrikaans	244	1171	11,26500	54,0628
Sepedi	92	1263	4,24746	58,3102
siSwati	11	1274	0,50785	58,8181
isiNdebele	11	1285	0,50785	59,3259
Setswana	43	1328	1,98523	61,3112
Xitsonga	33	1361	1,52355	62,8347
Sesotho	252	1613	11,63435	74,4691
Tshivenda	14	1627	0,64635	75,1154
Missing	539	2166	24,88458	100,0000

Category	Frequency table: Language Group			
	Count	Cumulative Count	Percent	Cumulative Percent
Indigenous	1153	1153	53,23176	53,2318
English	230	1383	10,61865	63,8504
Afrikaans	244	1627	11,26500	75,1154
Missing	539	2166	24,88458	100,0000

Category	Frequency table: Race			
	Count	Cumulative Count	Percent	Cumulative Percent
African	1244	1244	57,43306	57,4331
European	238	1482	10,98800	68,4211
Coloured	149	1631	6,87904	75,3001
Asian	67	1698	3,09326	78,3934
Missing	468	2166	21,60665	100,0000

Variable	Descriptive Statistics: Age					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases Missing
Age	27,59418	8,749419	15,00000	69,00000	2129	37



Visual Acuity Test: Biographical Composition

Category	Frequency table: Sex			
	Count	Cumulative Count	Percent	Cumulative Percent
M	200	200	84,03361	84,0336
F	38	238	15,96639	100,0000
Missing	0	238	0,00000	100,0000

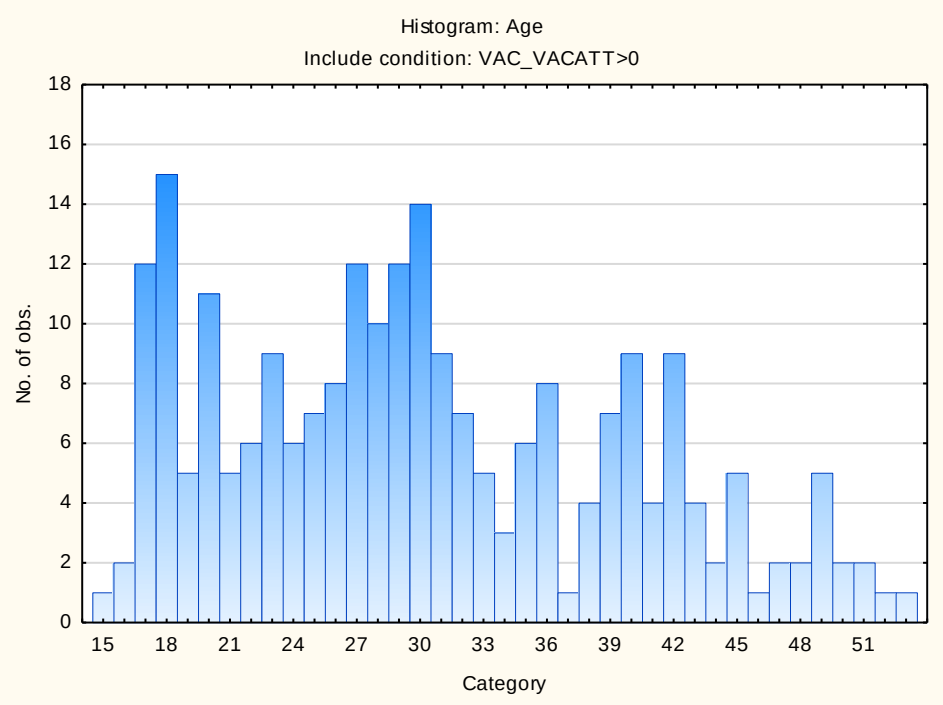
Category	Frequency table: Education			
	Count	Cumulative Count	Percent	Cumulative Percent
Tertiary	59	59	24,78992	24,7899
< Matric	6	65	2,52101	27,3109
Grade 12	42	107	17,64706	44,9580
Post Graduate	1	108	0,42017	45,3782
Missing	130	238	54,62185	100,0000

Category	Frequency table: Language			
	Count	Cumulative Count	Percent	Cumulative Percent
isiZulu	26	26	10,92437	10,9244
English	22	48	9,24370	20,1681
isiXhosa	7	55	2,94118	23,1092
Afrikaans	37	92	15,54622	38,6555
Setswana	1	93	0,42017	39,0756
Xitsonga	1	94	0,42017	39,4958
Sesotho	13	107	5,46218	44,9580
Missing	131	238	55,04202	100,0000

Category	Frequency table: Language Group			
	Count	Cumulative Count	Percent	Cumulative Percent
Indigenous	48	48	20,16807	20,1681
English	22	70	9,24370	29,4118
Afrikaans	37	107	15,54622	44,9580
Missing	131	238	55,04202	100,0000

Category	Frequency table: Race			
	Count	Cumulative Count	Percent	Cumulative Percent
African	51	51	21,42857	21,4286
European	51	102	21,42857	42,8571
Coloured	6	108	2,52101	45,3782
Asian	1	109	0,42017	45,7983
Missing	129	238	54,20168	100,0000

Variable	Descriptive Statistics: Age					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases Missing
Age	30,30342	9,504789	15,00000	59,00000	234	4


Histogram: Age
Include condition: VAC_VACATT>0
No. of obs.
Category
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2
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48
51

Cronbach Coefficient Alpha for Technical Test Battery Subtests:

Subtest	Cronbach Coefficient Alpha
Mechanical Reasoning Test	0,76
Spatial Reasoning Test	0,77
Visual Acuity Test	0,83

Results of lower than 0.75 are possibly related to respondents guessing the answers to items which they may not know, or a lack of exposure to the type of item content - which could be related to educational background. Results should therefore be interpreted with caution. Do not rely on these tests in isolation, but to consider the results as part of a holistic assessment, which incorporates additional sources of information. It should be remembered with the TTB2, that these tests have a knowledge component, they are not purely ability assessments. Therefore it is recommended that they should be used together with at least an Abstract Reasoning test. They do not substitute for general reasoning ability. School results should also be considered.

Standard Error of Measurement

Subtest	SEM	SD	Reliability
Mechanical Reasoning Test	2,81439562	5,744861	0,76
Spatial Reasoning Test	2,3152927	4,827719	0,77
Visual Acuity Test	1,4331107	3,475804	0,83

Technical Test Battery (TTB2)

Reliability: South Africans, Afrikaans Speakers, Updated 2016

Sample Composition

The sample consisted of respondents who had completed any of the subtests of the Technical Test Battery (TTB2) battery in the period up to June 2015, via GeneSys for Windows. Since not all the respondents completed all the subtests, biographical information is reported separately for the three tests.

Mechanical Reasoning Test: Biographical Composition

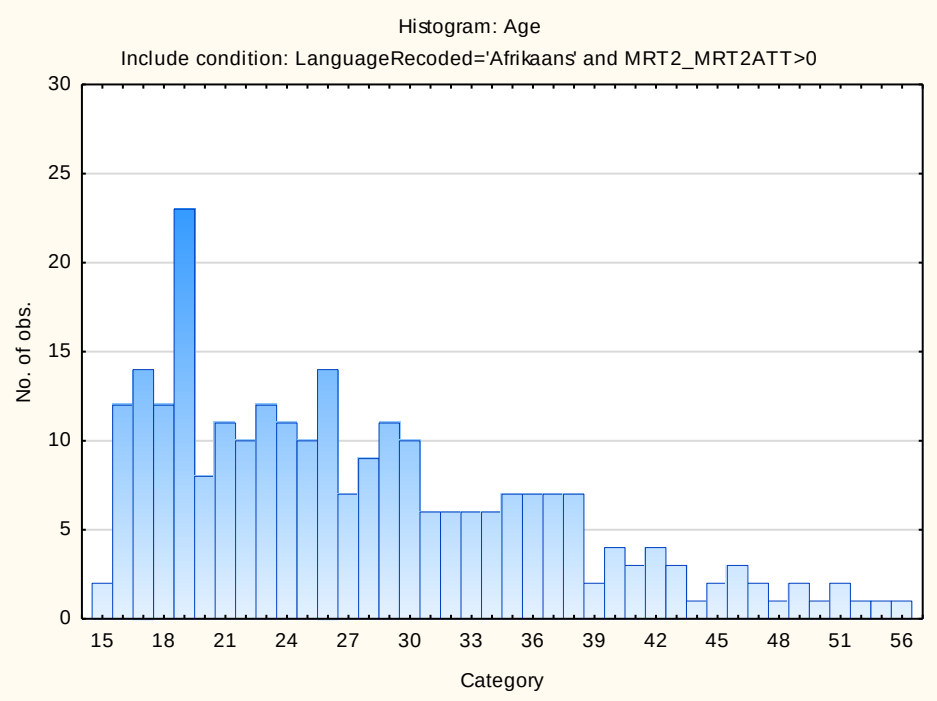
Category	Frequency table: Sex			
	Count	Cumulative Count	Percent	Cumulative Percent
M	232	232	85,92593	85,9259
F	38	270	14,07407	100,0000
Missing	0	270	0,00000	100,0000

Category	Frequency table: Education			
	Count	Cumulative Count	Percent	Cumulative Percent
Tertiary	61	61	22,59259	22,5926
< Matric	48	109	17,77778	40,3704
Grade 12	124	233	45,92593	86,2963
Post Graduate	3	236	1,11111	87,4074
Missing	34	270	12,59259	100,0000

Category	Frequency table: Language			
	Count	Cumulative Count	Percent	Cumulative Percent
Afrikaans	270	270	100,0000	100,0000
Missing	0	270	0,0000	100,0000

Category	Frequency table: Race			
	Count	Cumulative Count	Percent	Cumulative Percent
African	11	11	4,07407	4,0741
European	212	223	78,51852	82,5926
Coloured	39	262	14,44444	97,0370
Asian	1	263	0,37037	97,4074
Missing	7	270	2,59259	100,0000

Variable	Descriptive Statistics: Age					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases Missing
Age	27,67816	9,121607	15,00000	56,00000	261	9



Spatial Reasoning Test: Biographical Composition

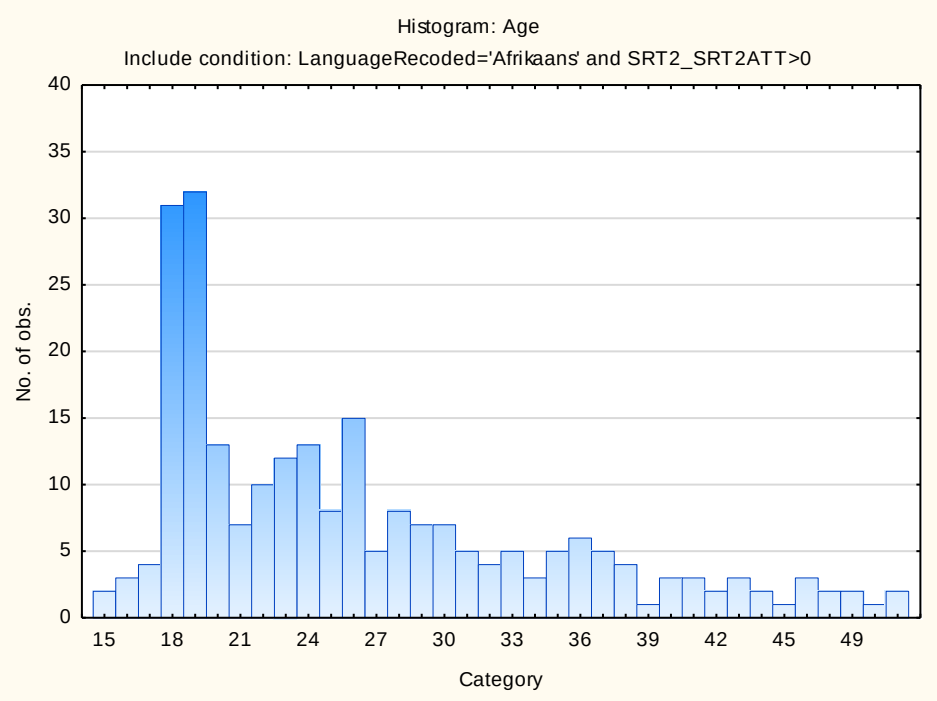
Category	Frequency table: Sex			
	Count	Cumulative Count	Percent	Cumulative Percent
M	224	224	91,80328	91,8033
F	20	244	8,19672	100,0000
Missing	0	244	0,00000	100,0000

Category	Frequency table: Education			
	Count	Cumulative Count	Percent	Cumulative Percent
Tertiary	57	57	23,36066	23,3607
< Matric	34	91	13,93443	37,2951
Grade 12	130	221	53,27869	90,5738
Missing	23	244	9,42623	100,0000

Category	Frequency table: Language			
	Count	Cumulative Count	Percent	Cumulative Percent
Afrikaans	244	244	100,0000	100,0000
Missing	0	244	0,0000	100,0000

Category	Frequency table: Race			
	Count	Cumulative Count	Percent	Cumulative Percent
African	4	4	1,63934	1,6393
European	167	171	68,44262	70,0820
Coloured	64	235	26,22951	96,3115
Missing	9	244	3,68852	100,0000

Variable	Descriptive Statistics: Age					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases Missing
Age	26,26360	8,516517	15,00000	51,00000	239	5



Visual Acuity Test: Biographical Composition

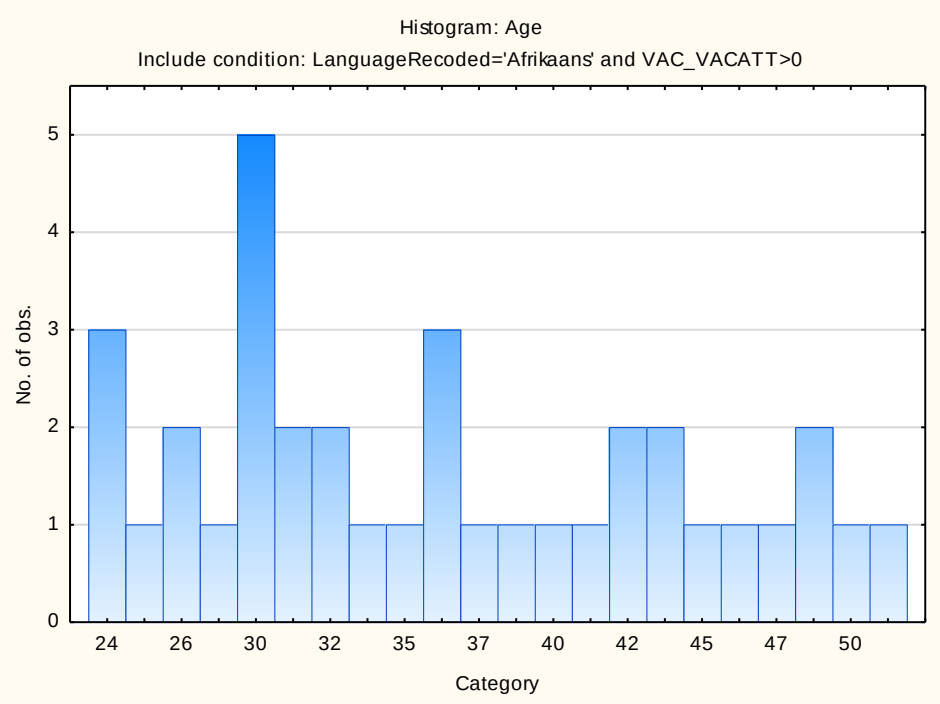
Category	Frequency table: Sex			
	Count	Cumulative Count	Percent	Cumulative Percent
M	36	36	97,29730	97,2973
F	1	37	2,70270	100,0000
Missing	0	37	0,00000	100,0000

Category	Frequency table: Education			
	Count	Cumulative Count	Percent	Cumulative Percent
Tertiary	26	26	70,27027	70,2703
< Matric	3	29	8,10811	78,3784
Grade 12	8	37	21,62162	100,0000
Missing	0	37	0,00000	100,0000

Category	Frequency table: Language			
	Count	Cumulative Count	Percent	Cumulative Percent
Afrikaans	37	37	100,0000	100,0000
Missing	0	37	0,0000	100,0000

Category	Frequency table: Race			
	Count	Cumulative Count	Percent	Cumulative Percent
European	34	34	91,89189	91,8919
Coloured	3	37	8,10811	100,0000
Missing	0	37	0,00000	100,0000

Variable	Descriptive Statistics: Age					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases Missing
Age	35,94444	8,221729	24,00000	51,00000	36	1



Cronbach Coefficient Alpha for Technical Test Battery Subtests:

Subtest	Cronbach Coefficient Alpha
Mechanical Reasoning Test	0,81
Spatial Reasoning Test	0,81

There was insufficient data to report on reliability for the VAC.

Standard Error of Measurement

Subtest	SEM	SD	Reliability
Mechanical Reasoning Test	2,72587407	6,253584	0,81
Spatial Reasoning Test	2,30209799	5,281375	0,81

Technical Test Battery (TTB2)

Reliability: South Africans, English Speakers, Updated 2016

Sample Composition

The sample consisted of respondents who had completed any of the subtests of the Technical Test Battery (TTB2) battery in the period up to June 2015, via GeneSys for Windows. Since not all the respondents completed all the subtests, biographical information is reported separately for the three tests.

Mechanical Reasoning Test: Biographical Composition

Category	Frequency table: Sex			
	Count	Cumulative Count	Percent	Cumulative Percent
M	237	237	62,36842	62,3684
F	142	379	37,36842	99,7368
U	1	380	0,26316	100,0000
Missing	0	380	0,00000	100,0000

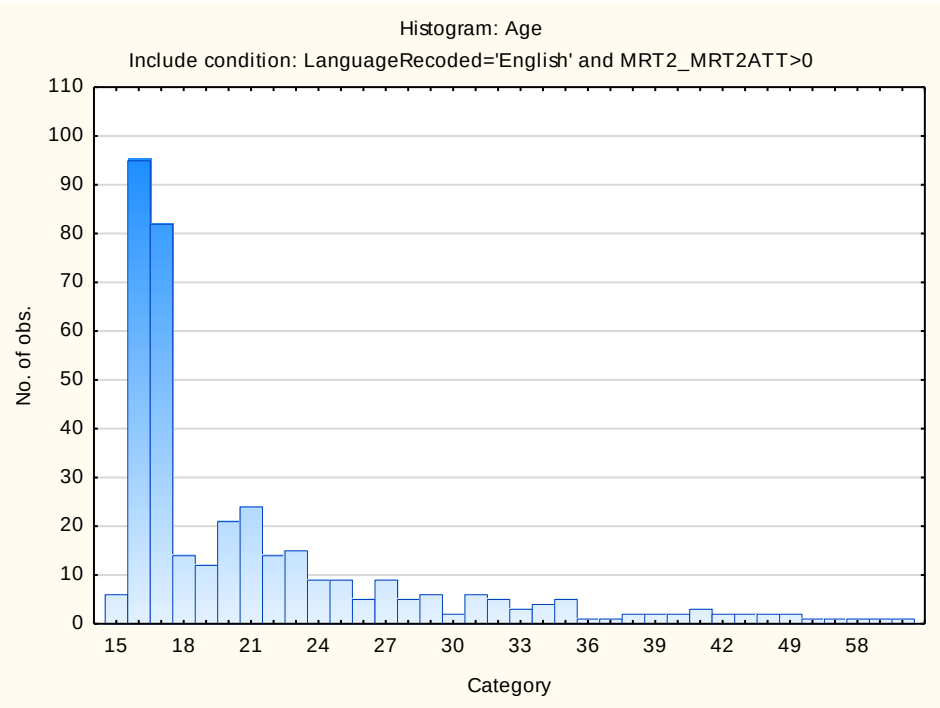
Category	Frequency table: Education			
	Count	Cumulative Count	Percent	Cumulative Percent
Tertiary	51	51	13,42105	13,4211
< Matric	195	246	51,31579	64,7368
Grade 12	118	364	31,05263	95,7895
Post Graduate	1	365	0,26316	96,0526
Missing	15	380	3,94737	100,0000

It should be noted that the largest number of respondents had not completed matric.

Category	Frequency table: Language			
	Count	Cumulative Count	Percent	Cumulative Percent
English	380	380	100,0000	100,0000
Missing	0	380	0,0000	100,0000

Category	Frequency table: Race			
	Count	Cumulative Count	Percent	Cumulative Percent
African	53	53	13,94737	13,9474
European	82	135	21,57895	35,5263
Coloured	110	245	28,94737	64,4737
Asian	119	364	31,31579	95,7895
Missing	16	380	4,21053	100,0000

Variable	Descriptive Statistics: Age					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases Missing
Age	21,53600	7,914865	15,00000	63,00000	375	5



Spatial Reasoning Test: Biographical Composition

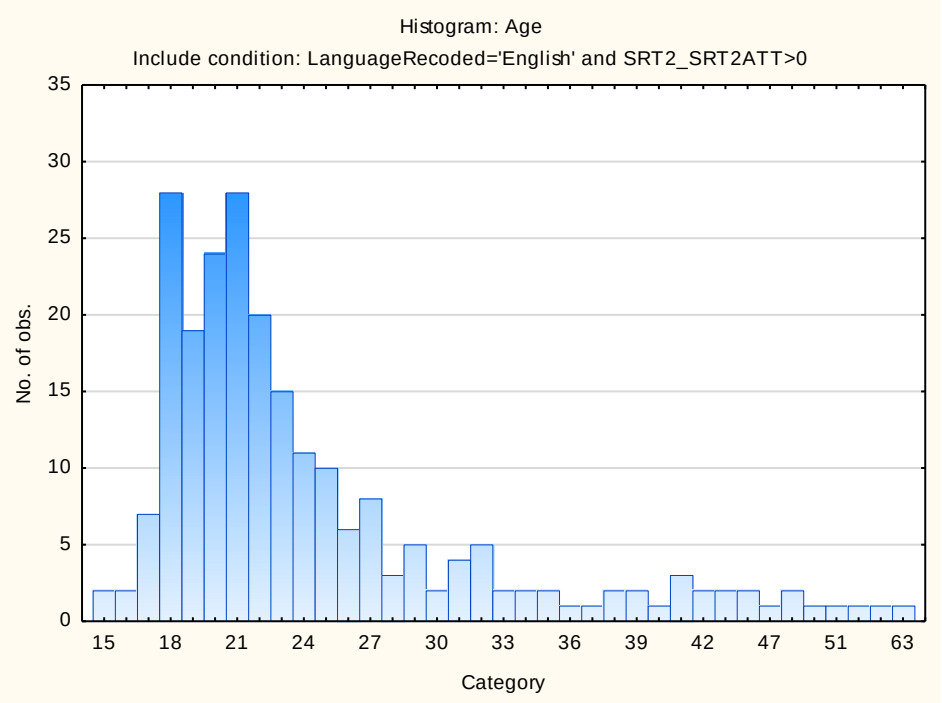
Category	Frequency table: Sex			
	Count	Cumulative Count	Percent	Cumulative Percent
M	206	206	89,56522	89,5652
F	24	230	10,43478	100,0000
Missing	0	230	0,00000	100,0000

Category	Frequency table: Education			
	Count	Cumulative Count	Percent	Cumulative Percent
Tertiary	50	50	21,73913	21,7391
< Matric	23	73	10,00000	31,7391
Grade 12	143	216	62,17391	93,9130
Post Graduate	1	217	0,43478	94,3478
Missing	13	230	5,65217	100,0000

Category	Frequency table: Language			
	Count	Cumulative Count	Percent	Cumulative Percent
English	230	230	100,0000	100,0000
Missing	0	230	0,0000	100,0000

Category	Frequency table: Race			
	Count	Cumulative Count	Percent	Cumulative Percent
African	21	21	9,13043	9,1304
European	64	85	27,82609	36,9565
Coloured	76	161	33,04348	70,0000
Asian	63	224	27,39130	97,3913
Missing	6	230	2,60870	100,0000

Variable	Descriptive Statistics: Age					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases Missing
Age	24,62009	8,322435	15,00000	63,00000	229	1



Visual Acuity Test: Biographical Composition

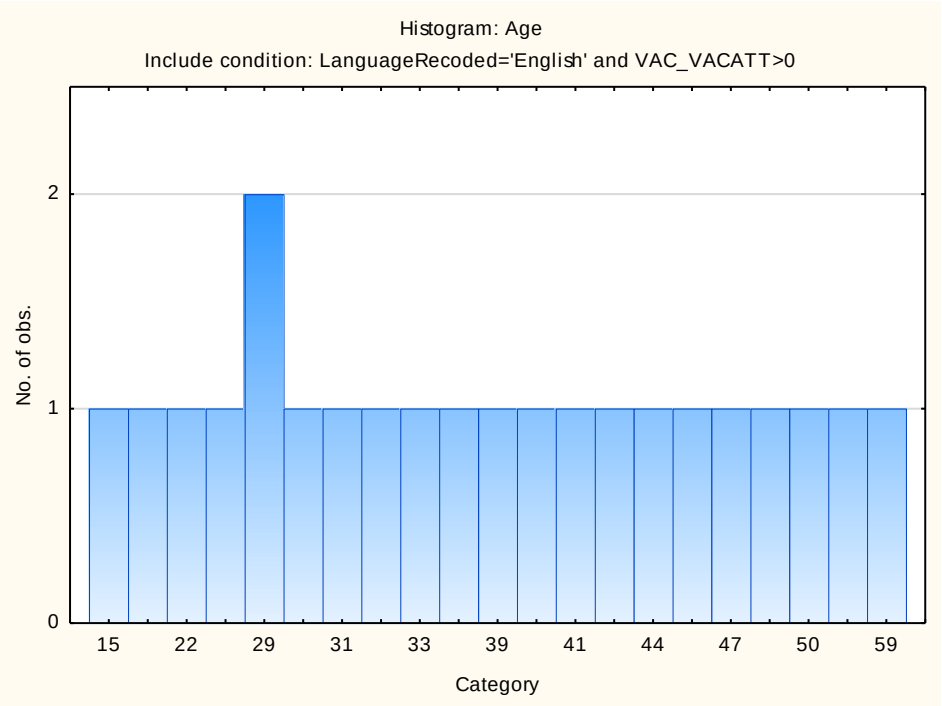
Category	Frequency table: Sex			
	Count	Cumulative Count	Percent	Cumulative Percent
M	21	21	95,45455	95,4545
F	1	22	4,54545	100,0000
Missing	0	22	0,00000	100,0000

Category	Frequency table: Education			
	Count	Cumulative Count	Percent	Cumulative Percent
Tertiary	10	10	45,45455	45,4545
< Matric	3	13	13,63636	59,0909
Grade 12	8	21	36,36364	95,4545
Post Graduate	1	22	4,54545	100,0000
Missing	0	22	0,00000	100,0000

Category	Frequency table: Language			
	Count	Cumulative Count	Percent	Cumulative Percent
English	22	22	100,0000	100,0000
Missing	0	22	0,0000	100,0000

Category	Frequency table: Race			
	Count	Cumulative Count	Percent	Cumulative Percent
African	1	1	4,54545	4,5455
European	17	18	77,27273	81,8182
Coloured	3	21	13,63636	95,4545
Asian	1	22	4,54545	100,0000
Missing	0	22	0,00000	100,0000

Variable	Descriptive Statistics: Age					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases Missing
Age	36,63636	11,58219	15,00000	59,00000	22	0



Cronbach Coefficient Alpha for Technical Test Battery Subtests:

Subtest	Cronbach Coefficient Alpha
Mechanical Reasoning Test	0,75
Spatial Reasoning Test	0,81

There was insufficient data to report on reliability for the VAC.

Standard Error of Measurement

Subtest	SEM	SD	Reliability
Mechanical Reasoning Test	2,822474	5,644948	0,75
Spatial Reasoning Test	2,27758485	5,225138	0,81

Technical Test Battery (TTB2)

Reliability: South Africans, Indigenous Speakers, Updated 2016

Sample Composition

The sample consisted of respondents who had completed any of the subtests of the Technical Test Battery (TTB2) battery in the period up to June 2015, via GeneSys for Windows. Since not all the respondents completed all the subtests, biographical information is reported separately for the three tests.

Mechanical Reasoning Test: Biographical Composition

Category	Frequency table: Sex			
	Count	Cumulative Count	Percent	Cumulative Percent
M	1301	1301	59,95392	59,9539
F	861	2162	39,67742	99,6313
U	8	2170	0,36866	100,0000
Missing	0	2170	0,00000	100,0000

Category	Frequency table: Education			
	Count	Cumulative Count	Percent	Cumulative Percent
Tertiary	202	202	9,30876	9,3088
< Matric	1133	1335	52,21198	61,5207
Grade 12	546	1881	25,16129	86,6820
Post Graduate	1	1882	0,04608	86,7281
Missing	288	2170	13,27189	100,0000

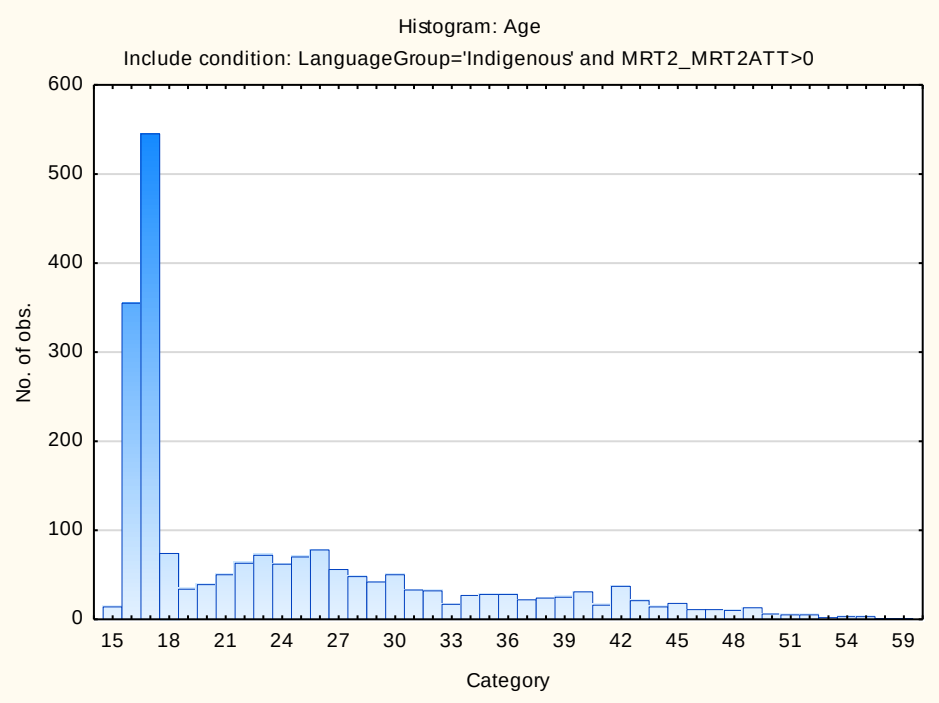
It should be noted that the majority of respondents had not completed matric.

Category	Frequency table: Language			
	Count	Cumulative Count	Percent	Cumulative Percent
isiZulu	688	688	31,70507	31,7051
isiXhosa	288	976	13,27189	44,9770
Sepedi	434	1410	20,00000	64,9770
siSwati	99	1509	4,56221	69,5392
isiNdebele	25	1534	1,15207	70,6912
Setswana	158	1692	7,28111	77,9724
Xitsonga	81	1773	3,73272	81,7051
Sesotho	350	2123	16,12903	97,8341
Tshivenda	47	2170	2,16590	100,0000
Missing	0	2170	0,00000	100,0000

Category	Frequency table: Language Group			
	Count	Cumulative Count	Percent	Cumulative Percent
Indigenous	2170	2170	100,0000	100,0000
Missing	0	2170	0,0000	100,0000

Category	Frequency table: Race			
	Count	Cumulative Count	Percent	Cumulative Percent
African	2154	2154	99,26267	99,2627
Coloured	6	2160	0,27650	99,5392
Asian	6	2166	0,27650	99,8157
Missing	4	2170	0,18433	100,0000

Variable	Descriptive Statistics: Age					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases Missing
Age	24,01908	9,298683	15,00000	59,00000	2096	74



Spatial Reasoning Test: Biographical Composition

Category	Frequency table: Sex			
	Count	Cumulative Count	Percent	Cumulative Percent
M	1002	1002	86,90373	86,9037
F	149	1151	12,92281	99,8265
U	2	1153	0,17346	100,0000
Missing	0	1153	0,00000	100,0000

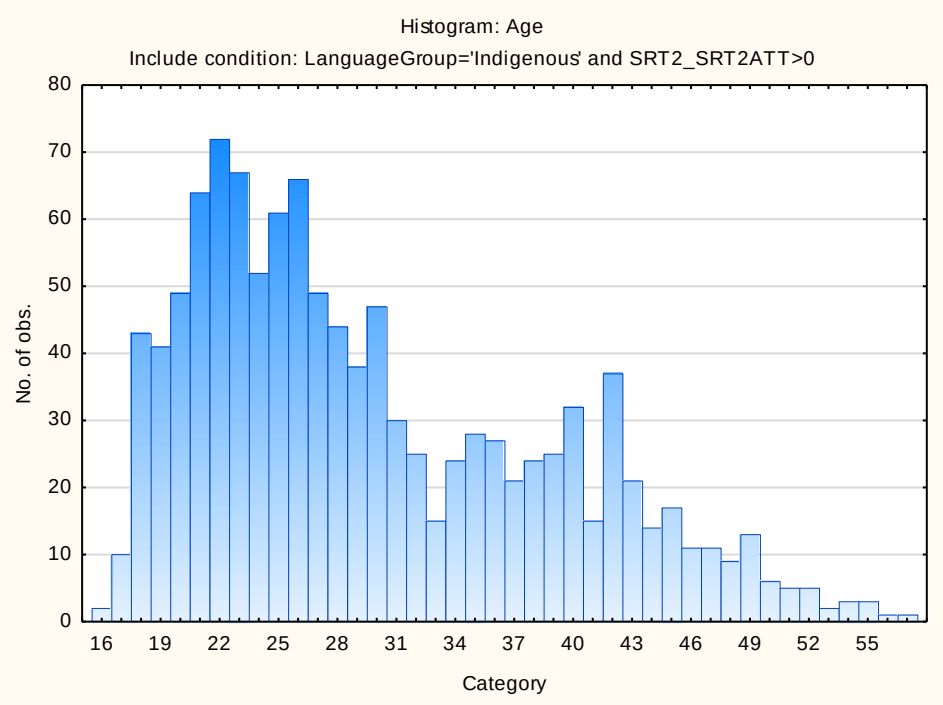
Category	Frequency table: Education			
	Count	Cumulative Count	Percent	Cumulative Percent
Tertiary	219	219	18,99393	18,9939
< Matric	155	374	13,44319	32,4371
Grade 12	516	890	44,75282	77,1899
Missing	263	1153	22,81006	100,0000

Category	Frequency table: Language			
	Count	Cumulative Count	Percent	Cumulative Percent
isiZulu	424	424	36,77363	36,7736
isiXhosa	273	697	23,67736	60,4510
Sepedi	92	789	7,97918	68,4302
siSwati	11	800	0,95403	69,3842
isiNdebele	11	811	0,95403	70,3382
Setswana	43	854	3,72940	74,0676
Xitsonga	33	887	2,86210	76,9297
Sesotho	252	1139	21,85603	98,7858
Tshivenda	14	1153	1,21422	100,0000
Missing	0	1153	0,00000	100,0000

Category	Frequency table: Language Group			
	Count	Cumulative Count	Percent	Cumulative Percent
Indigenous	1153	1153	100,0000	100,0000
Missing	0	1153	0,0000	100,0000

Category	Frequency table: Race			
	Count	Cumulative Count	Percent	Cumulative Percent
African	1141	1141	98,95924	98,9592
Coloured	5	1146	0,43365	99,3929
Asian	4	1150	0,34692	99,7398
Missing	3	1153	0,26019	100,0000

Variable	Descriptive Statistics: Age					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases Missing
Age	29,74071	8,954616	16,00000	59,00000	1130	23



Visual Acuity Test: Biographical Composition

Category	Frequency table: Sex			
	Count	Cumulative Count	Percent	Cumulative Percent
M	42	42	87,50000	87,5000
F	6	48	12,50000	100,0000
Missing	0	48	0,00000	100,0000

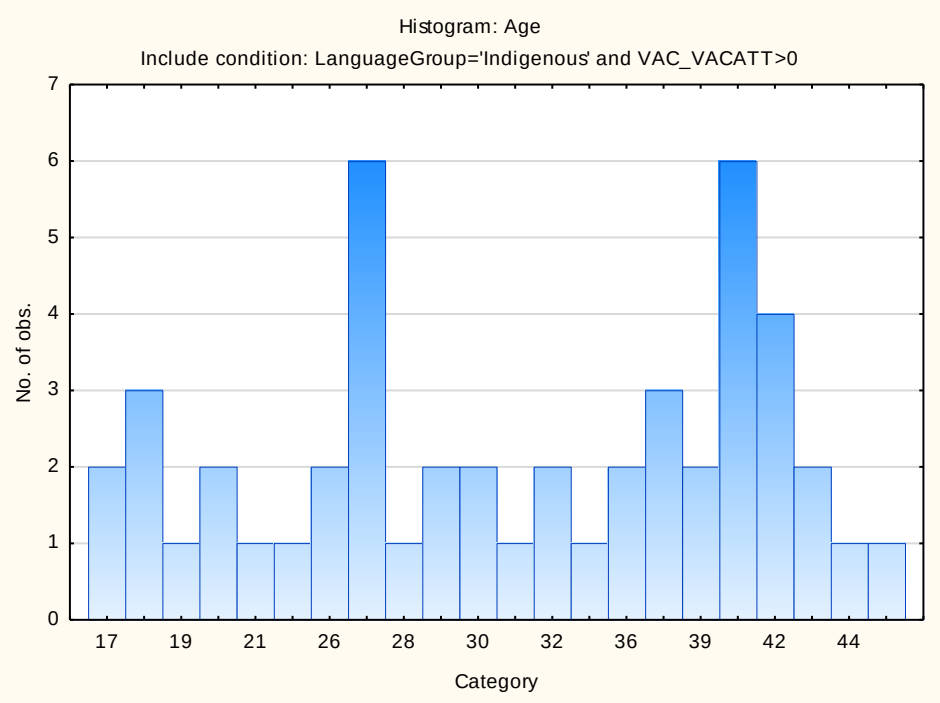
Category	Frequency table: Education			
	Count	Cumulative Count	Percent	Cumulative Percent
Tertiary	22	22	45,83333	45,8333
Grade 12	25	47	52,08333	97,9167
Missing	1	48	2,08333	100,0000

Category	Frequency table: Language			
	Count	Cumulative Count	Percent	Cumulative Percent
isiZulu	26	26	54,16667	54,1667
isiXhosa	7	33	14,58333	68,7500
Setswana	1	34	2,08333	70,8333
Xitsonga	1	35	2,08333	72,9167
Sesotho	13	48	27,08333	100,0000
Missing	0	48	0,00000	100,0000

Category	Frequency table: Language Group			
	Count	Cumulative Count	Percent	Cumulative Percent
Indigenous	48	48	100,0000	100,0000
Missing	0	48	0,0000	100,0000

Category	Frequency table: Race			
	Count	Cumulative Count	Percent	Cumulative Percent
African	48	48	100,0000	100,0000
Missing	0	48	0,0000	100,0000

Variable	Descriptive Statistics: Age					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases Missing
Age	31,79167	8,676106	17,00000	45,00000	48	0


Histogram: Age
Include condition: LanguageGroup='Indigenous' and VAC_VACATT>0
No. of obs.
0
1
2
3
4
5
6
7
17
19
21
26
28
30
32
36
39
42
44
Category

Cronbach Coefficient Alpha for Technical Test Battery Subtests:

Subtest	Cronbach Coefficient Alpha
Mechanical Reasoning Test	0,62
Spatial Reasoning Test	0,65

Results of lower than 0.75 are possibly related to respondents guessing the answers to items which they may not know, or a lack of exposure to the type of item content - which could be related to educational background. Results should therefore be interpreted with caution. Do not rely on these tests in isolation, but to consider the results as part of a holistic assessment, which incorporates additional sources of information. It should be remembered with the TTB2, that these tests have a knowledge component, they are not purely ability assessments. Therefore it is recommended that they should be used together with at least an Abstract Reasoning test. They do not substitute for general reasoning ability. School results should also be considered.

There was insufficient data to report on reliability for the VAC.

Standard Error of Measurement

Subtest	SEM	SD	Reliability
Mechanical Reasoning Test	2,76015397	4,477561	0,62
Spatial Reasoning Test	2,23053483	3,770292	0,65

Technical Test Battery (TTB2)

Reliability: South Africans, isiXhosa Speakers, Updated 2016

Sample Composition

The sample consisted of respondents who had completed any of the subtests of the Technical Test Battery (TTB2) battery in the period up to June 2015, via GeneSys for Windows. Since not all the respondents completed all the subtests, biographical information is reported separately for the three tests.

Mechanical Reasoning Test: Biographical Composition

Category	Frequency table: Sex			
	Count	Cumulative Count	Percent	Cumulative Percent
M	165	165	57,29167	57,2917
F	123	288	42,70833	100,0000
Missing	0	288	0,00000	100,0000

Category	Frequency table: Education			
	Count	Cumulative Count	Percent	Cumulative Percent
Tertiary	35	35	12,15278	12,1528
< Matric	125	160	43,40278	55,5556
Grade 12	110	270	38,19444	93,7500
Missing	18	288	6,25000	100,0000

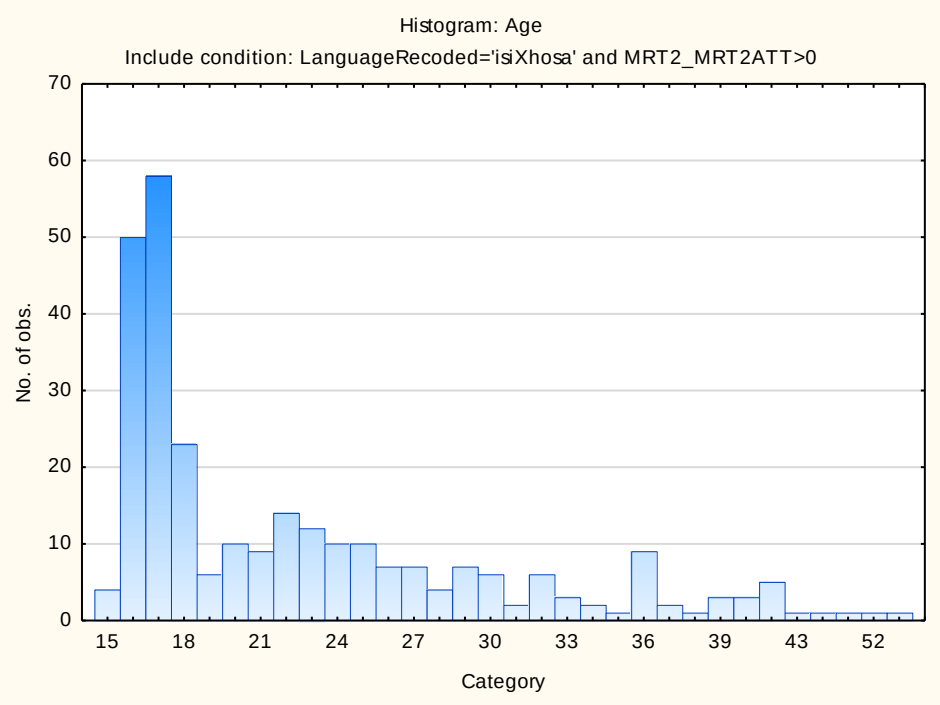
It should be noted that the largest number of respondents had not completed matric.

Category	Frequency table: Language			
	Count	Cumulative Count	Percent	Cumulative Percent
isiXhosa	288	288	100,0000	100,0000
Missing	0	288	0,0000	100,0000

Category	Frequency table: Language Group			
	Count	Cumulative Count	Percent	Cumulative Percent
Indigenous	288	288	100,0000	100,0000
Missing	0	288	0,0000	100,0000

Category	Frequency table: Race			
	Count	Cumulative Count	Percent	Cumulative Percent
African	284	284	98,61111	98,6111
Coloured	4	288	1,38889	100,0000
Missing	0	288	0,00000	100,0000

Variable	Descriptive Statistics: Age					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases Missing
Age	22,52688	7,726798	15,00000	53,00000	279	9



Spatial Reasoning Test: Biographical Composition

Category	Frequency table: Sex			
	Count	Cumulative Count	Percent	Cumulative Percent
M	198	198	72,52747	72,5275
F	75	273	27,47253	100,0000
Missing	0	273	0,00000	100,0000

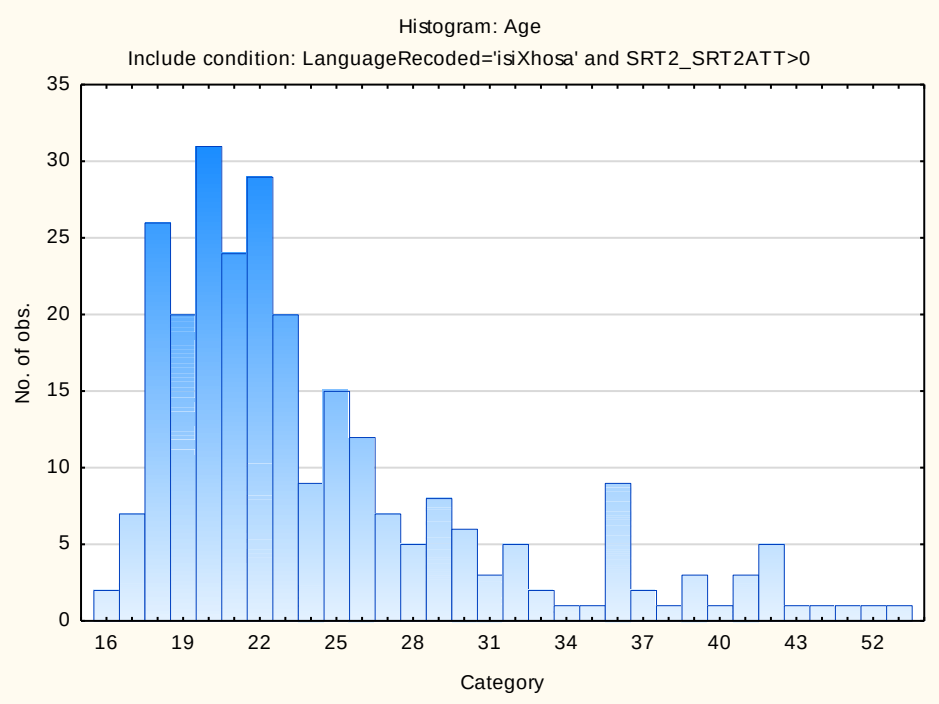
Category	Frequency table: Education			
	Count	Cumulative Count	Percent	Cumulative Percent
Tertiary	52	52	19,04762	19,0476
< Matric	16	68	5,86081	24,9084
Grade 12	185	253	67,76557	92,6740
Missing	20	273	7,32601	100,0000

Category	Frequency table: Language			
	Count	Cumulative Count	Percent	Cumulative Percent
isiXhosa	273	273	100,0000	100,0000
Missing	0	273	0,0000	100,0000

Category	Frequency table: Language Group			
	Count	Cumulative Count	Percent	Cumulative Percent
Indigenous	273	273	100,0000	100,0000
Missing	0	273	0,0000	100,0000

Category	Frequency table: Race			
	Count	Cumulative Count	Percent	Cumulative Percent
African	267	267	97,80220	97,8022
Coloured	5	272	1,83150	99,6337
Missing	1	273	0,36630	100,0000

Variable	Descriptive Statistics: Age					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases Missing
Age	24,50000	6,883124	16,00000	53,00000	262	11



Visual Acuity Test: Biographical Composition

Category	Frequency table: Sex			
	Count	Cumulative Count	Percent	Cumulative Percent
M	6	6	85,71429	85,7143
F	1	7	14,28571	100,0000
Missing	0	7	0,00000	100,0000

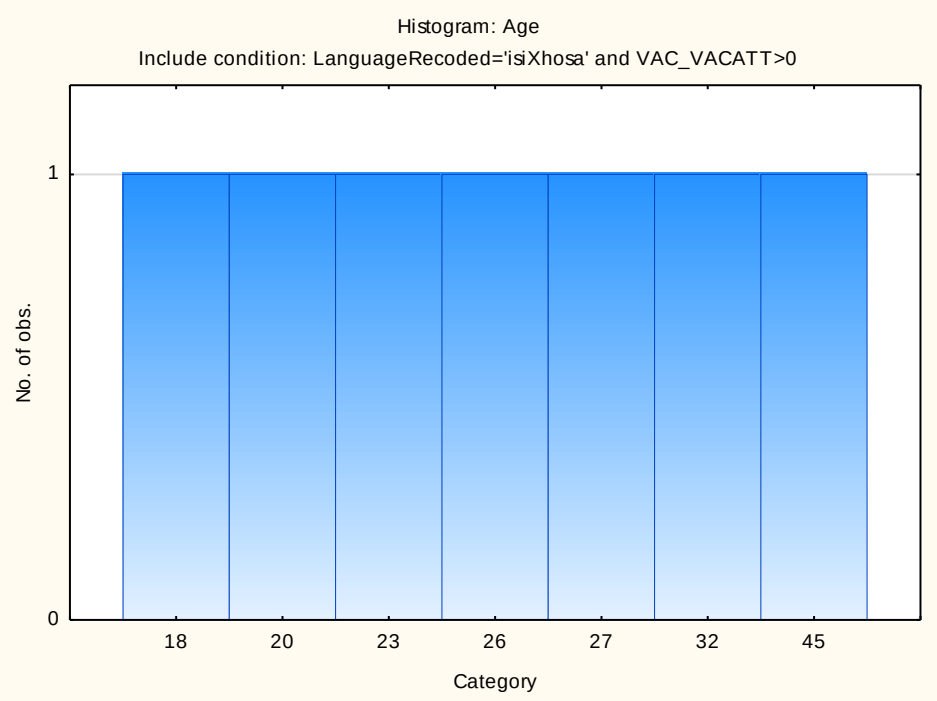
Category	Frequency table: Education			
	Count	Cumulative Count	Percent	Cumulative Percent
Tertiary	3	3	42,85714	42,8571
Grade 12	4	7	57,14286	100,0000
Missing	0	7	0,00000	100,0000

Category	Frequency table: Language			
	Count	Cumulative Count	Percent	Cumulative Percent
isiXhosa	7	7	100,0000	100,0000
Missing	0	7	0,0000	100,0000

Category	Frequency table: Language Group			
	Count	Cumulative Count	Percent	Cumulative Percent
Indigenous	7	7	100,0000	100,0000
Missing	0	7	0,0000	100,0000

Category	Frequency table: Race			
	Count	Cumulative Count	Percent	Cumulative Percent
African	7	7	100,0000	100,0000
Missing	0	7	0,0000	100,0000

Variable	Descriptive Statistics: Age					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases Missing
Age	27,28571	9,086882	18,00000	45,00000	7	0



Cronbach Coefficient Alpha for Technical Test Battery Subtests:

Subtest	Cronbach Coefficient Alpha
Mechanical Reasoning Test	0,59
Spatial Reasoning Test	0,57

Results of lower than 0.75 are possibly related to respondents guessing the answers to items which they may not know, or a lack of exposure to the type of item content - which could be related to educational background. Results should therefore be interpreted with caution. Do not rely on these tests in isolation, but to consider the results as part of a holistic assessment, which incorporates additional sources of information. It should be remembered with the TTB2, that these tests have a knowledge component, they are not purely ability assessments. Therefore it is recommended that they should be used together with at least an Abstract Reasoning test. They do not substitute for general reasoning ability. School results should also be considered.

There was insufficient data to report on reliability for the VAC.

Standard Error of Measurement

Subtest	SEM	SD	Reliability
Mechanical Reasoning Test	2,80356825	4,378438	0,59
Spatial Reasoning Test	2,30588195	3,516437	0,57

Technical Test Battery (TTB2)

Reliability: South Africans, isiZulu

Sample Composition

The sample consisted of respondents who had completed any of the subtests of the Technical Test Battery (TTB2) battery in the period up to June 2015, via GeneSys for Windows. Since not all the respondents completed all the subtests, biographical information is reported separately for the three tests.

Mechanical Reasoning Test: Biographical Composition

Category	Frequency table: Sex			
	Count	Cumulative Count	Percent	Cumulative Percent
M	513	513	74,56395	74,5640
F	174	687	25,29070	99,8547
U	1	688	0,14535	100,0000
Missing	0	688	0,00000	100,0000

Category	Frequency table: Education			
	Count	Cumulative Count	Percent	Cumulative Percent
Tertiary	97	97	14,09884	14,0988
< Matric	260	357	37,79070	51,8895
Grade 12	241	598	35,02907	86,9186
Post Graduate	1	599	0,14535	87,0640
Missing	89	688	12,93605	100,0000

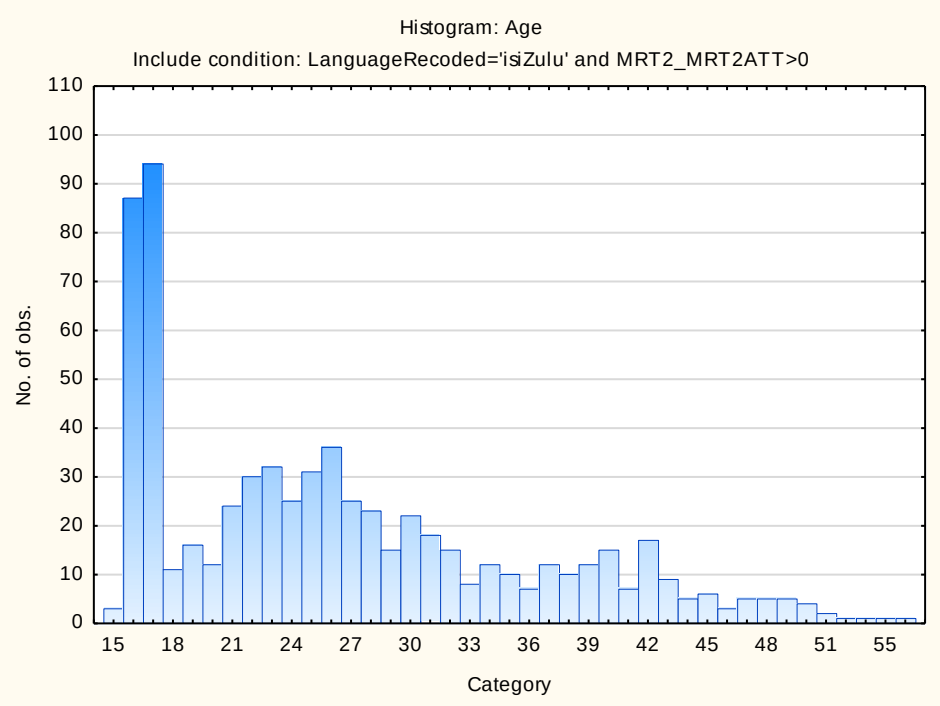
It should be noted that the largest number of respondents had not completed matric.

Category	Frequency table: Language			
	Count	Cumulative Count	Percent	Cumulative Percent
isiZulu	688	688	100,0000	100,0000
Missing	0	688	0,0000	100,0000

Category	Frequency table: Language Group			
	Count	Cumulative Count	Percent	Cumulative Percent
Indigenous	688	688	100,0000	100,0000
Missing	0	688	0,0000	100,0000

Category	Frequency table: Race			
	Count	Cumulative Count	Percent	Cumulative Percent
African	684	684	99,41860	99,4186
Asian	3	687	0,43605	99,8547
Missing	1	688	0,14535	100,0000

Variable	Descriptive Statistics: Age					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases Missing
Age	26,38552	9,404800	15,00000	59,00000	677	11



Spatial Reasoning Test: Biographical Composition

Category	Frequency table: Sex			
	Count	Cumulative Count	Percent	Cumulative Percent
M	394	394	92,92453	92,9245
F	30	424	7,07547	100,0000
Missing	0	424	0,00000	100,0000

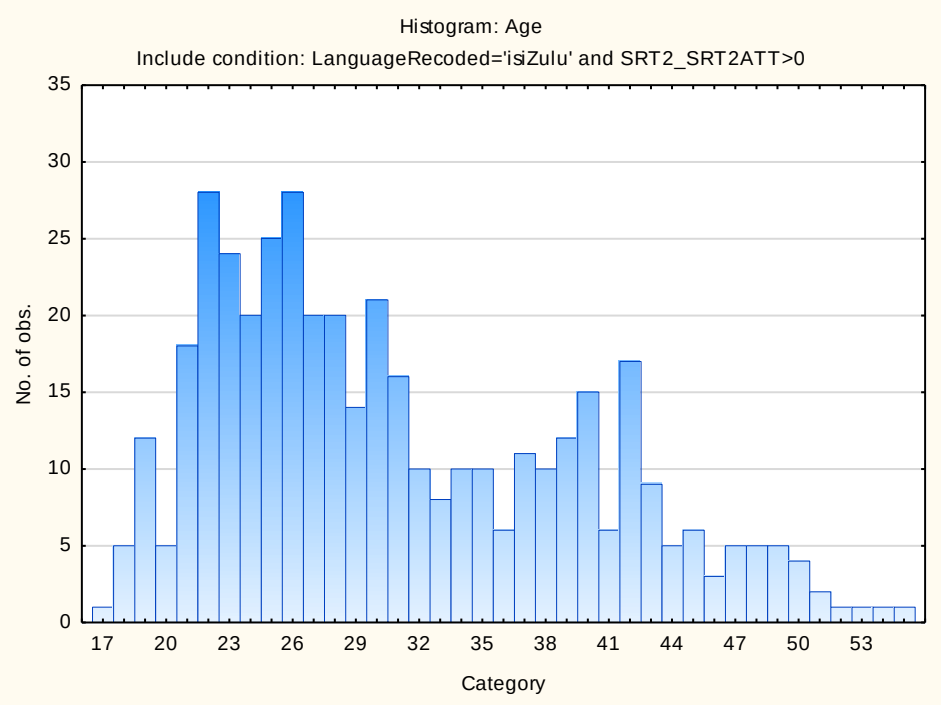
Category	Frequency table: Education			
	Count	Cumulative Count	Percent	Cumulative Percent
Tertiary	94	94	22,16981	22,1698
< Matric	57	151	13,44340	35,6132
Grade 12	197	348	46,46226	82,0755
Missing	76	424	17,92453	100,0000

Category	Frequency table: Language			
	Count	Cumulative Count	Percent	Cumulative Percent
isiZulu	424	424	100,0000	100,0000
Missing	0	424	0,0000	100,0000

Category	Frequency table: Language Group			
	Count	Cumulative Count	Percent	Cumulative Percent
Indigenous	424	424	100,0000	100,0000
Missing	0	424	0,0000	100,0000

Category	Frequency table: Race			
	Count	Cumulative Count	Percent	Cumulative Percent
African	421	421	99,29245	99,2925
Asian	3	424	0,70755	100,0000
Missing	0	424	0,00000	100,0000

Variable	Descriptive Statistics: Age					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases Missing
Age	30,96905	8,597135	17,00000	59,00000	420	4



Visual Acuity Test: Biographical Composition

Category	Frequency table: Sex			
	Count	Cumulative Count	Percent	Cumulative Percent
M	23	23	88,46154	88,4615
F	3	26	11,53846	100,0000
Missing	0	26	0,00000	100,0000

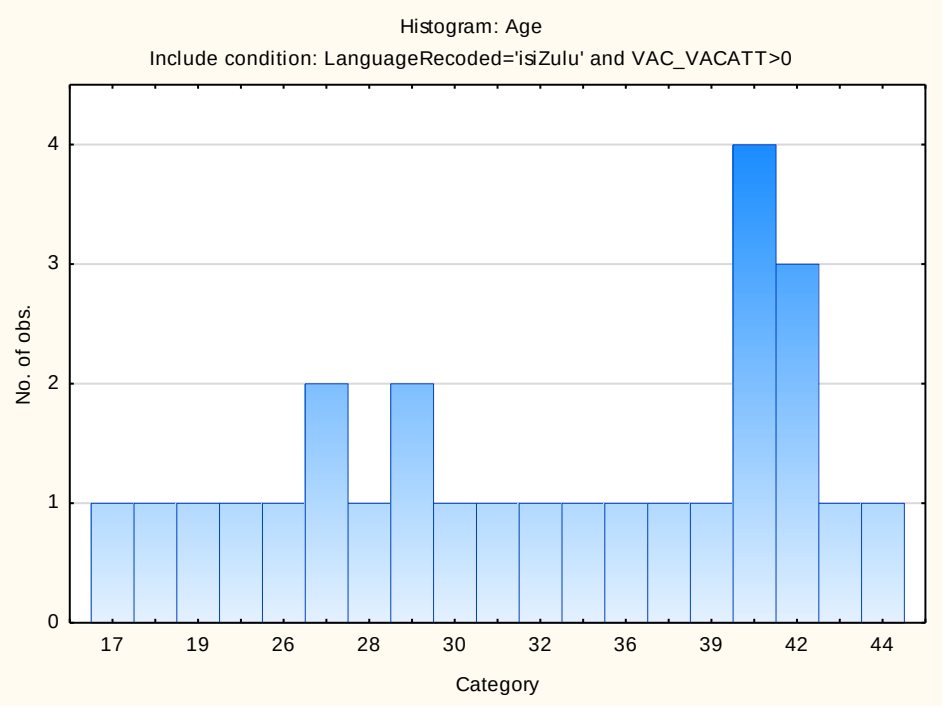
Category	Frequency table: Education			
	Count	Cumulative Count	Percent	Cumulative Percent
Tertiary	10	10	38,46154	38,4615
Grade 12	15	25	57,69231	96,1538
Missing	1	26	3,84615	100,0000

Category	Frequency table: Language			
	Count	Cumulative Count	Percent	Cumulative Percent
isiZulu	26	26	100,0000	100,0000
Missing	0	26	0,0000	100,0000

Category	Frequency table: Language Group			
	Count	Cumulative Count	Percent	Cumulative Percent
Indigenous	26	26	100,0000	100,0000
Missing	0	26	0,0000	100,0000

Category	Frequency table: Race			
	Count	Cumulative Count	Percent	Cumulative Percent
African	26	26	100,0000	100,0000
Missing	0	26	0,0000	100,0000

Variable	Descriptive Statistics: Age					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases Missing
Age	32,76923	8,406225	17,00000	44,00000	26	0



Cronbach Coefficient Alpha for Technical Test Battery Subtests:

Subtest	Cronbach Coefficient Alpha
Mechanical Reasoning Test	0,64
Spatial Reasoning Test	0,65

Results of lower than 0.75 are possibly related to respondents guessing the answers to items which they may not know, or a lack of exposure to the type of item content - which could be related to educational background. Results should therefore be interpreted with caution. Do not rely on these tests in isolation, but to consider the results as part of a holistic assessment, which incorporates additional sources of information. It should be remembered with the TTB2, that these tests have a knowledge component, they are not purely ability assessments. Therefore it is recommended that they should be used together with at least an Abstract Reasoning test. They do not substitute for general reasoning ability. School results should also be considered.

There was insufficient data to report on reliability for the VAC.

Standard Error of Measurement

Subtest	SEM	SD	Reliability
Mechanical Reasoning Test	2,6852694	4,475449	0,64
Spatial Reasoning Test	2,28720614	3,866084	0,65

Technical Test Battery (TTB2)

Reliability: South Africans, Sepedi Speakers, Updated 2016

Sample Composition

The sample consisted of respondents who had completed any of the subtests of the Technical Test Battery (TTB2) battery in the period up to June 2015, via GeneSys for Windows. Since not all the respondents completed all the subtests, biographical information is reported separately for the three tests.

Mechanical Reasoning Test: Biographical Composition

Category	Frequency table: Sex			
	Count	Cumulative Count	Percent	Cumulative Percent
M	181	181	41,70507	41,7051
F	250	431	57,60369	99,3088
U	3	434	0,69124	100,0000
Missing	0	434	0,00000	100,0000

Category	Frequency table: Education			
	Count	Cumulative Count	Percent	Cumulative Percent
Tertiary	9	9	2,07373	2,0737
< Matric	308	317	70,96774	73,0415
Grade 12	57	374	13,13364	86,1751
Missing	60	434	13,82488	100,0000

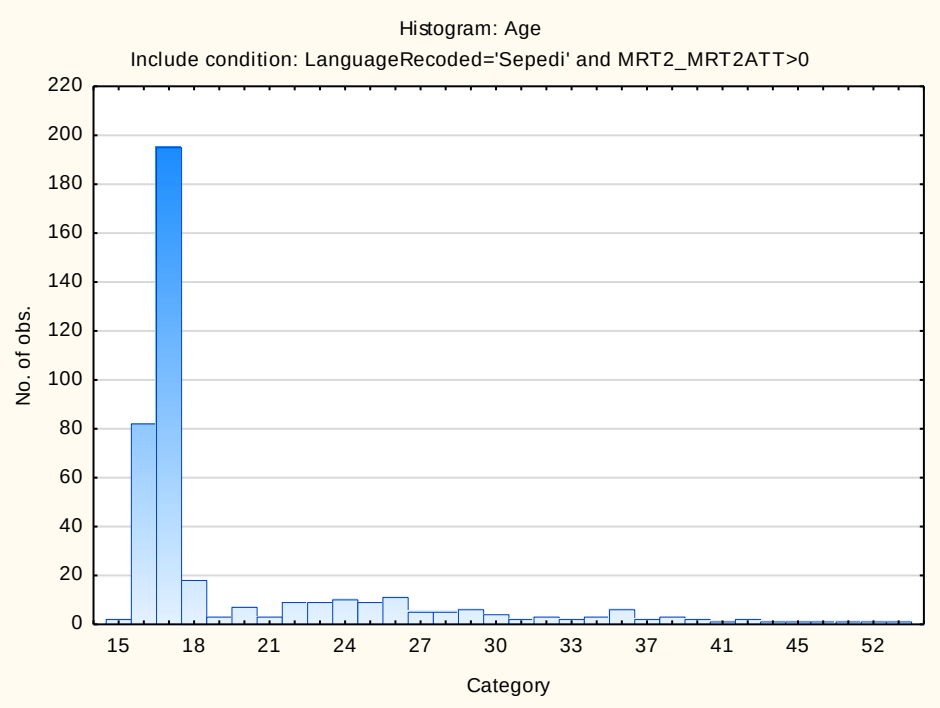
It should be noted that the majority of respondents had not completed matric.

Category	Frequency table: Language			
	Count	Cumulative Count	Percent	Cumulative Percent
Sepedi	434	434	100,0000	100,0000
Missing	0	434	0,0000	100,0000

Category	Frequency table: Language Group			
	Count	Cumulative Count	Percent	Cumulative Percent
Indigenous	434	434	100,0000	100,0000
Missing	0	434	0,0000	100,0000

Category	Frequency table: Race			
	Count	Cumulative Count	Percent	Cumulative Percent
African	429	429	98,84793	98,8479
Coloured	1	430	0,23041	99,0783
Asian	2	432	0,46083	99,5392
Missing	2	434	0,46083	100,0000

Variable	Descriptive Statistics: Age					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases Missing
Age	19,95610	6,451855	15,00000	54,00000	410	24



Spatial Reasoning Test: Biographical Composition

Category	Frequency table: Sex			
	Count	Cumulative Count	Percent	Cumulative Percent
M	80	80	86,95652	86,9565
F	12	92	13,04348	100,0000
Missing	0	92	0,00000	100,0000

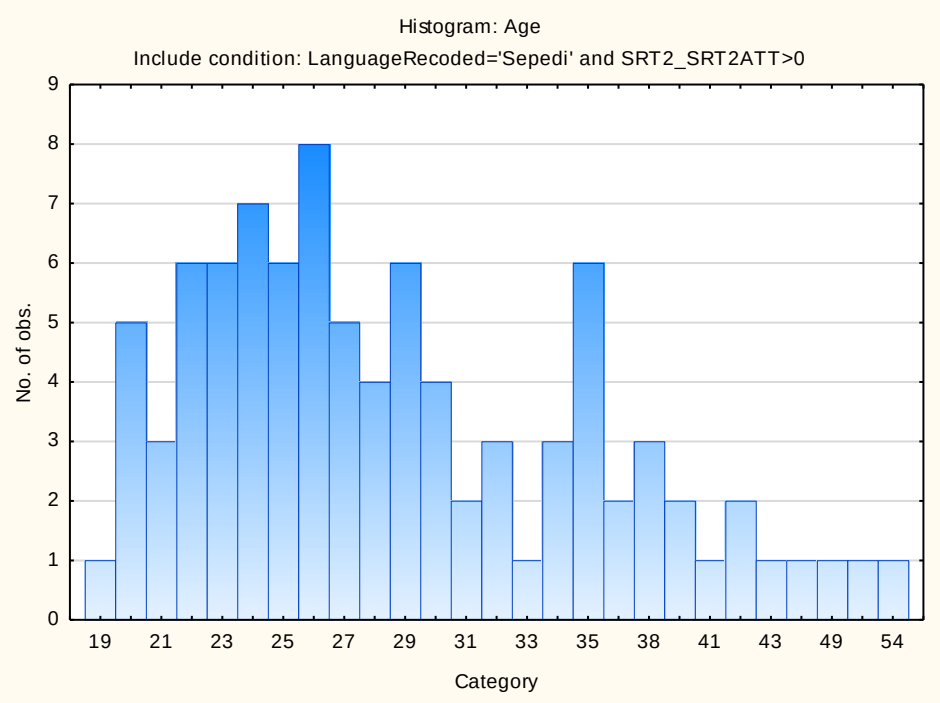
Category	Frequency table: Education			
	Count	Cumulative Count	Percent	Cumulative Percent
Tertiary	9	9	9,78261	9,7826
< Matric	15	24	16,30435	26,0870
Grade 12	15	39	16,30435	42,3913
Missing	53	92	57,60870	100,0000

Category	Frequency table: Language			
	Count	Cumulative Count	Percent	Cumulative Percent
Sepedi	92	92	100,0000	100,0000
Missing	0	92	0,0000	100,0000

Category	Frequency table: Language Group			
	Count	Cumulative Count	Percent	Cumulative Percent
Indigenous	92	92	100,0000	100,0000
Missing	0	92	0,0000	100,0000

Category	Frequency table: Race			
	Count	Cumulative Count	Percent	Cumulative Percent
African	92	92	100,0000	100,0000
Missing	0	92	0,0000	100,0000

Variable	Descriptive Statistics: Age					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases Missing
Age	29,19780	7,459848	19,00000	54,00000	91	1



Visual Acuity Test: Biographical Composition

No first language Sepedi speakers completed the VAC

Cronbach Coefficient Alpha for Technical Test Battery Subtests:

Subtest	Cronbach Coefficient Alpha
Mechanical Reasoning Test	0,65

Results of lower than 0.75 are possibly related to respondents guessing the answers to items which they may not know, or a lack of exposure to the type of item content - which could be related to educational background. Results should therefore be interpreted with caution. Do not rely on these tests in isolation, but to consider the results as part of a holistic assessment, which incorporates additional sources of information. It should be remembered with the TTB2, that these tests have a knowledge component, they are not purely ability assessments. Therefore it is recommended that they should be used together with at least an Abstract Reasoning test. They do not substitute for general reasoning ability. School results should also be considered.

There was insufficient data to report on reliability for either the SRT2 or the VAC.

Standard Error of Measurement

Subtest	SEM	SD	Reliability
Mechanical Reasoning Test	2,75445635	4,655881	0,65

Technical Test Battery (TTB2)

Reliability: South Africans, Sesotho Speakers, Updated 2016

Sample Composition

The sample consisted of respondents who had completed any of the subtests of the Technical Test Battery (TTB2) battery in the period up to June 2015, via GeneSys for Windows. Since not all the respondents completed all the subtests, biographical information is reported separately for the three tests.

Mechanical Reasoning Test: Biographical Composition

Category	Frequency table: Sex			
	Count	Cumulative Count	Percent	Cumulative Percent
M	265	265	75,71429	75,7143
F	84	349	24,00000	99,7143
U	1	350	0,28571	100,0000
Missing	0	350	0,00000	100,0000

Category	Frequency table: Education			
	Count	Cumulative Count	Percent	Cumulative Percent
Tertiary	34	34	9,71429	9,7143
< Matric	156	190	44,57143	54,2857
Grade 12	93	283	26,57143	80,8571
Missing	67	350	19,14286	100,0000

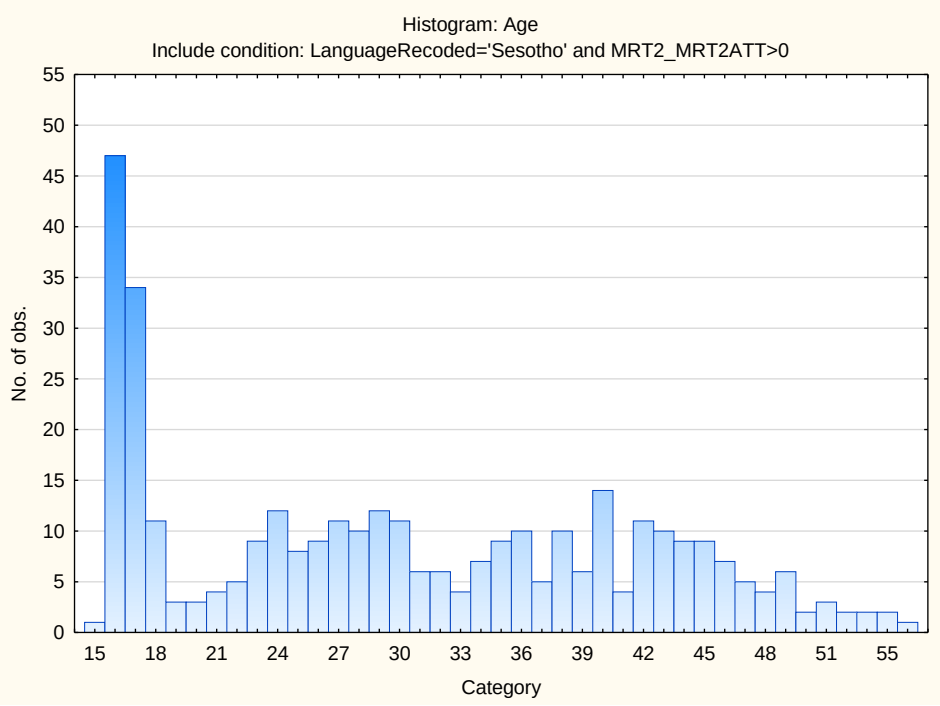
It should be noted that the majority of respondents had not completed matric.

Category	Frequency table: Language			
	Count	Cumulative Count	Percent	Cumulative Percent
Sesotho	350	350	100,0000	100,0000
Missing	0	350	0,0000	100,0000

Category	Frequency table: Language Group			
	Count	Cumulative Count	Percent	Cumulative Percent
Indigenous	350	350	100,0000	100,0000
Missing	0	350	0,0000	100,0000

Category	Frequency table: Race			
	Count	Cumulative Count	Percent	Cumulative Percent
African	349	349	99,71429	99,7143
Coloured	1	350	0,28571	100,0000
Missing	0	350	0,00000	100,0000

Variable	Descriptive Statistics: Age					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases Missing
Age	30,09593	11,26100	15,00000	58,00000	344	6



Spatial Reasoning Test: Biographical Composition

Category	Frequency table: Sex			
	Count	Cumulative Count	Percent	Cumulative Percent
M	237	237	94,04762	94,0476
F	14	251	5,55556	99,6032
U	1	252	0,39683	100,0000
Missing	0	252	0,00000	100,0000

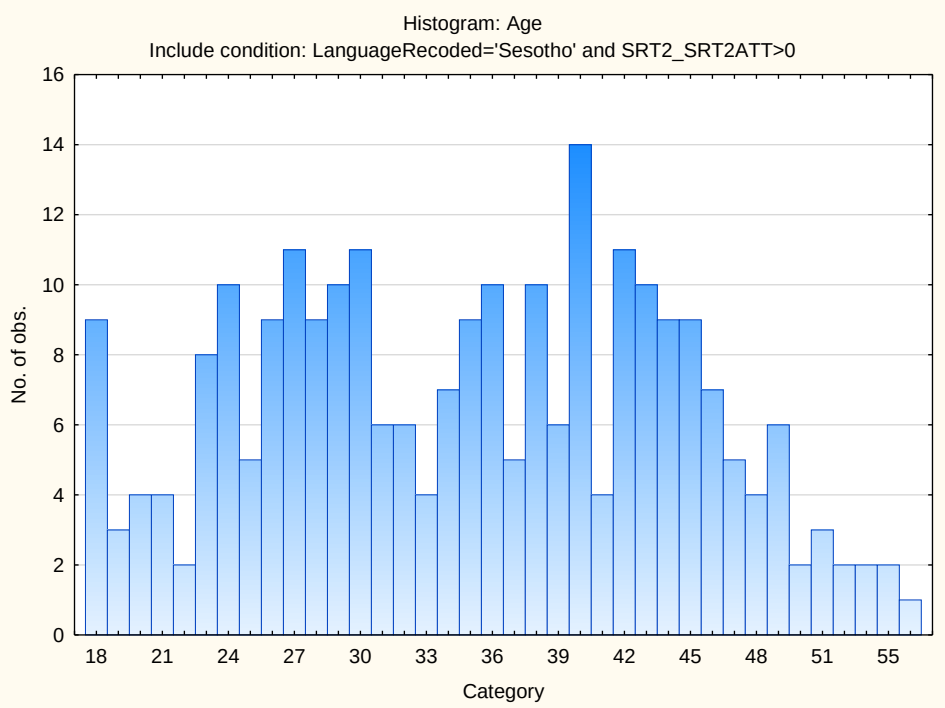
Category	Frequency table: Education			
	Count	Cumulative Count	Percent	Cumulative Percent
Tertiary	38	38	15,07937	15,0794
< Matric	64	102	25,39683	40,4762
Grade 12	84	186	33,33333	73,8095
Missing	66	252	26,19048	100,0000

Category	Frequency table: Language			
	Count	Cumulative Count	Percent	Cumulative Percent
Sesotho	252	252	100,0000	100,0000
Missing	0	252	0,0000	100,0000

Category	Frequency table: Language Group			
	Count	Cumulative Count	Percent	Cumulative Percent
Indigenous	252	252	100,0000	100,0000
Missing	0	252	0,0000	100,0000

Category	Frequency table: Race			
	Count	Cumulative Count	Percent	Cumulative Percent
African	252	252	100,0000	100,0000
Missing	0	252	0,0000	100,0000

Variable	Descriptive Statistics: Age					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases Missing
Age	34,91566	9,357856	18,00000	58,00000	249	3



Visual Acuity Test: Biographical Composition

Category	Frequency table: Sex			
	Count	Cumulative Count	Percent	Cumulative Percent
M	11	11	84,61538	84,6154
F	2	13	15,38462	100,0000
Missing	0	13	0,00000	100,0000

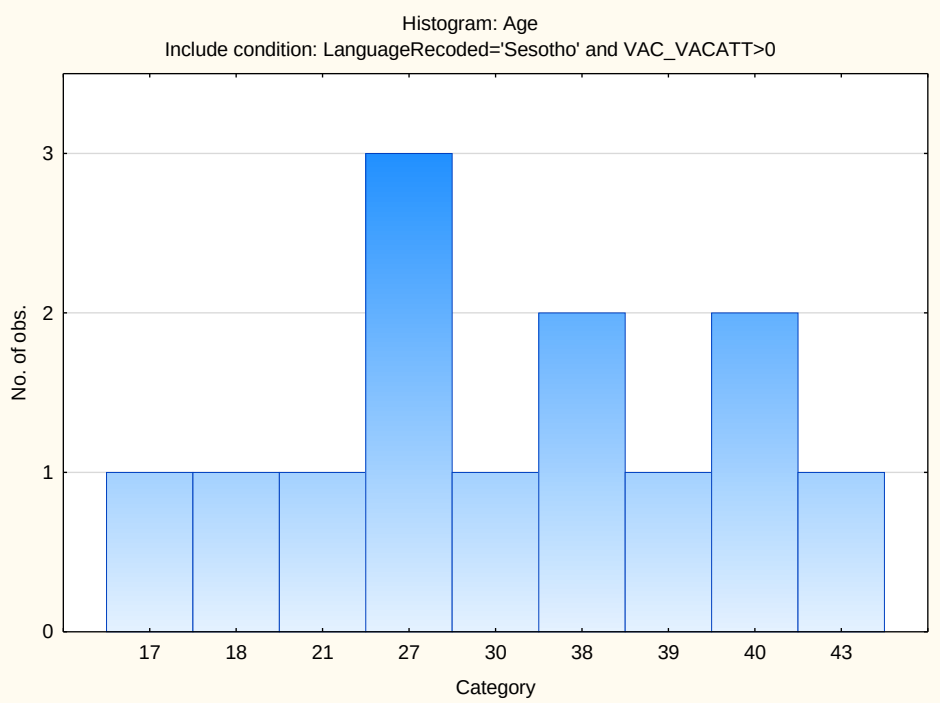
Category	Frequency table: Education			
	Count	Cumulative Count	Percent	Cumulative Percent
Tertiary	7	7	53,84615	53,8462
Grade 12	6	13	46,15385	100,0000
Missing	0	13	0,00000	100,0000

Category	Frequency table: Language			
	Count	Cumulative Count	Percent	Cumulative Percent
Sesotho	13	13	100,0000	100,0000
Missing	0	13	0,0000	100,0000

Category	Frequency table: Language Group			
	Count	Cumulative Count	Percent	Cumulative Percent
Indigenous	13	13	100,0000	100,0000
Missing	0	13	0,0000	100,0000

Category	Frequency table: Race			
	Count	Cumulative Count	Percent	Cumulative Percent
African	13	13	100,0000	100,0000
Missing	0	13	0,0000	100,0000

Variable	Descriptive Statistics: Age					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases Missing
Age	31,15385	9,044760	17,00000	43,00000	13	0



Cronbach Coefficient Alpha for Technical Test Battery Subtests:

Subtest	Cronbach Coefficient Alpha
Mechanical Reasoning Test	0,62
Spatial Reasoning Test	0,68

Results of lower than 0.75 are possibly related to respondents guessing the answers to items which they may not know, or a lack of exposure to the type of item content - which could be related to educational background. Results should therefore be interpreted with caution. Do not rely on these tests in isolation, but to consider the results as part of a holistic assessment, which incorporates additional sources of information. It should be remembered with the TTB2, that these tests have a knowledge component, they are not purely ability assessments. Therefore it is recommended that they should be used together with at least an Abstract Reasoning test. They do not substitute for general reasoning ability. School results should also be considered.

There was insufficient data to report on reliability for the VAC.

Standard Error of Measurement

Subtest	SEM	SD	Reliability
Mechanical Reasoning Test	2,67523979	4,339812	0,62
Spatial Reasoning Test	2,11233613	3,734118	0,68

Technical Test Battery (TTB2)

Reliability: South Africans, Setswana Speakers, Updated 2016

Sample Composition

The sample consisted of respondents who had completed any of the subtests of the Technical Test Battery (TTB2) battery in the period up to June 2015, via GeneSys for Windows. Since not all the respondents completed all the subtests, biographical information is reported separately for the three tests.

Mechanical Reasoning Test: Biographical Composition

Category	Frequency table: Sex			
	Count	Cumulative Count	Percent	Cumulative Percent
M	71	71	44,93671	44,9367
F	87	158	55,06329	100,0000
Missing	0	158	0,00000	100,0000

Category	Frequency table: Education			
	Count	Cumulative Count	Percent	Cumulative Percent
Tertiary	13	13	8,22785	8,2278
< Matric	109	122	68,98734	77,2152
Grade 12	19	141	12,02532	89,2405
Missing	17	158	10,75949	100,0000

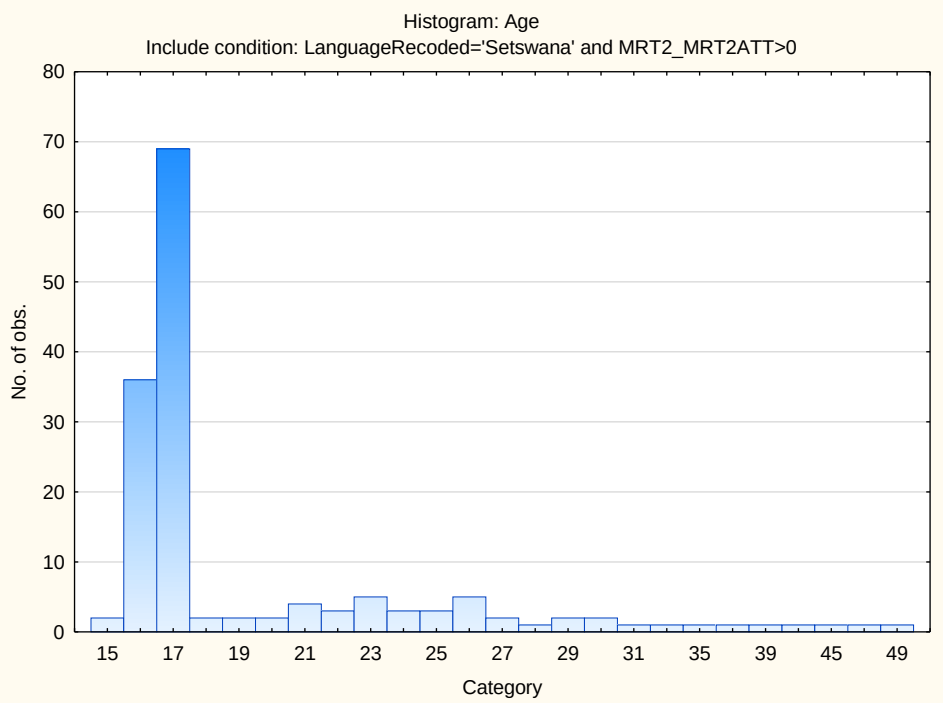
It should be noted that the majority of respondents had not completed matric.

Category	Frequency table: Language			
	Count	Cumulative Count	Percent	Cumulative Percent
Setswana	158	158	100,0000	100,0000
Missing	0	158	0,0000	100,0000

Category	Frequency table: Language Group			
	Count	Cumulative Count	Percent	Cumulative Percent
Indigenous	158	158	100,0000	100,0000
Missing	0	158	0,0000	100,0000

Category	Frequency table: Race			
	Count	Cumulative Count	Percent	Cumulative Percent
African	158	158	100,0000	100,0000
Missing	0	158	0,0000	100,0000

Variable	Descriptive Statistics: Age					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases Missing
Age	19,69737	6,316214	15,00000	49,00000	152	6



Spatial Reasoning Test: Biographical Composition

Category	Frequency table: Sex			
	Count	Cumulative Count	Percent	Cumulative Percent
M	35	35	81,39535	81,3953
F	8	43	18,60465	100,0000
Missing	0	43	0,00000	100,0000

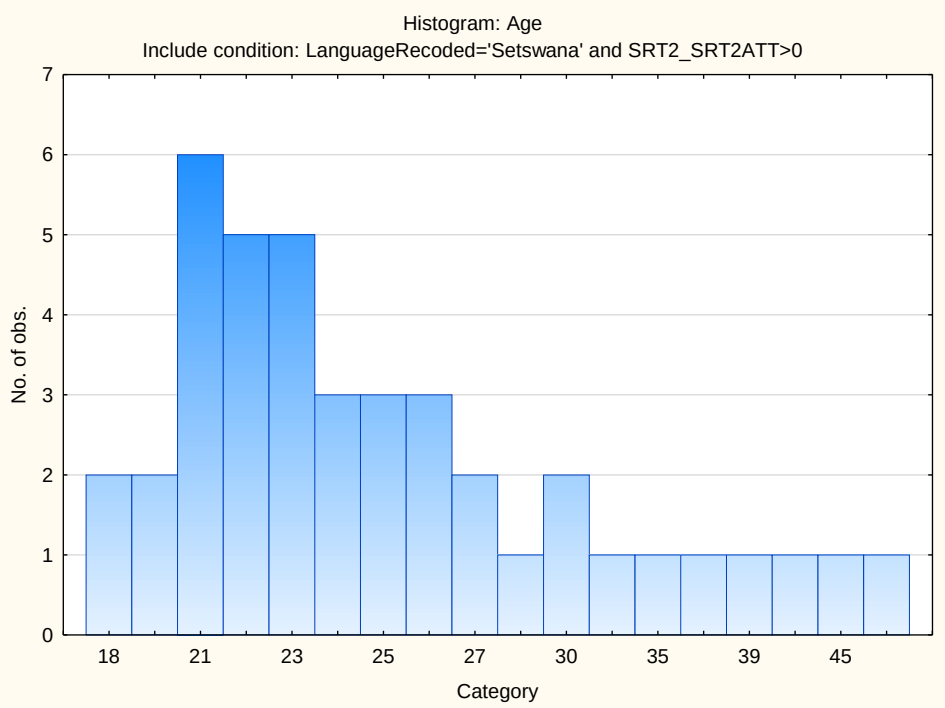
Category	Frequency table: Education			
	Count	Cumulative Count	Percent	Cumulative Percent
Tertiary	14	14	32,55814	32,5581
Grade 12	14	28	32,55814	65,1163
Missing	15	43	34,88372	100,0000

Category	Frequency table: Language			
	Count	Cumulative Count	Percent	Cumulative Percent
Setswana	43	43	100,0000	100,0000
Missing	0	43	0,0000	100,0000

Category	Frequency table: Language Group			
	Count	Cumulative Count	Percent	Cumulative Percent
Indigenous	43	43	100,0000	100,0000
Missing	0	43	0,0000	100,0000

Category	Frequency table: Race			
	Count	Cumulative Count	Percent	Cumulative Percent
African	42	42	97,67442	97,6744
Missing	1	43	2,32558	100,0000

Variable	Descriptive Statistics: Age					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases Missing
Age	26,14634	7,268291	18,00000	49,00000	41	2



Visual Acuity Test: Biographical Composition

One first language Setswana speaker completed the VAC.

Cronbach Coefficient Alpha for Technical Test Battery Subtests:

Subtest	Cronbach Coefficient Alpha
Mechanical Reasoning Test	0,61

Results of lower than 0.75 are possibly related to respondents guessing the answers to items which they may not know, or a lack of exposure to the type of item content - which could be related to educational background. Results should therefore be interpreted with caution. Do not rely on these tests in isolation, but to consider the results as part of a holistic assessment, which incorporates additional sources of information. It should be remembered with the TTB2, that these tests have a knowledge component, they are not purely ability assessments. Therefore it is recommended that they should be used together with at least an Abstract Reasoning test. They do not substitute for general reasoning ability. School results should also be considered.

There was insufficient data to report on reliability for either the SRT2 or the VAC.

Standard Error of Measurement

Subtest	SEM	SD	Reliability
Mechanical Reasoning Test	2,80322348	4,488750	0,61

Technical Test Battery (TTB2)

Validity Introduction

Recommendations

Users are strongly encouraged to do validation studies on the instruments they use within their organisations or within their industry sectors, by co-operating with other organisations in the same industry. In some cases this may mean sharing information with organisations that are potential competitors. In the interest of professionalism, users are encouraged to overcome their reservations in this regard, since co-operation is in their interest. Psytech South Africa provides extensive support for validation studies done on its instruments, and users are welcome to contact their representatives in this regard.

For construct validation studies, it is necessary to assess a particular ability with more than one instrument on the same respondents. This may seem like an unnecessary expense at first, but it is worthwhile to verify how ability measures relate to one another, particularly if one is still introducing a new measure.

Predictive validation studies can be done against competency ratings, or against 'hard' data like production or sales figures. It is preferable to use both types of criterion information, because that enables one to validate the competency ratings as well.

At the time of writing, there was still a shortage of validity information regarding the TTB2 in South Africa. More information is being sought, and this section will shortly be updated.

Index of validity studies done on the Technical Test Battery

Description	Study number
Correlations with General Reasoning Tests (1)	V1
Correlations with General Reasoning Tests (2)	V2
Intercorrelations of TTB2 subtests	V3
Correlations of TTB2 subtests with Blox, High Level FCT and Mental Alertness tests	V4

TTB Construct Validity: Correlations with GRT2

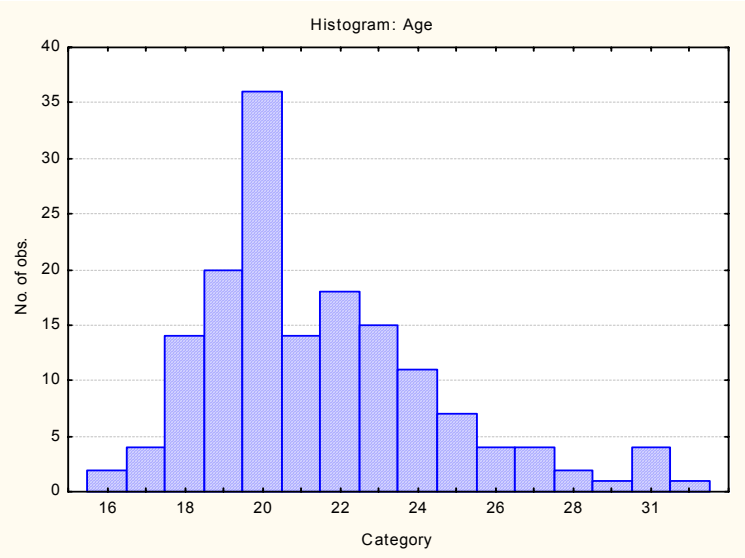
Sample composition

The sample consisted of workers and applicants at a construction company based in the Western Cape. Data were collected during 2002-2003.

Category	Frequency table: Race			
	Count	Cumulative Count	Percent	Cumulative Percent
Whites and Coloureds	67	67	42.67516	42.6752
Blacks	87	154	55.41401	98.0892
Asians	2	156	1.27389	99.3631
Missing	1	157	0.63694	100.0000

Category	Frequency table: Sex			
	Count	Cumulative Count	Percent	Cumulative Percent
Male	140	140	89.17197	89.1720
Female	17	157	10.82803	100.0000
Missing	0	157	0.00000	100.0000

Variable	Descriptive Statistics					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases Missing
Age	21.54140	3.193524	16.00000	34.00000	157	0



Correlations with General Reasoning Test Battery subtest

Variable	Correlations Marked correlations are significant at p < .05000 N=157 (Casewise deletion of missing data) Mechanical Reasoning	Spatial Reasoning
Abstract Reasoning	0.60	0.52
Numerical Reasoning	0.55	0.56
Verbal Reasoning	0.50	0.41

Comments

All the correlations were significant. The overall correlations points to the influence of a general ability factor. The Abstract Reasoning subtest had the highest correlation with Mechanical Reasoning, indicating that Mechanical Reasoning requires a degree of abstract problem solving or fluid intelligence. The Verbal Reasoning subtest had the lowest correlation with Spatial Reasoning, which can be explained by the fact that the Spatial Reasoning test has a low verbal content and therefore places fewer demands on a respondent's verbal ability.

TTB Construct Validity: Correlations with General Reasoning Test Battery

Sample Composition

The sample consisted of workers and applicants in a manufacturing company, who had completed both the General Reasoning Test Battery and the Technical Test Battery for selection or development purposes. Data were collected in 2002-2003.

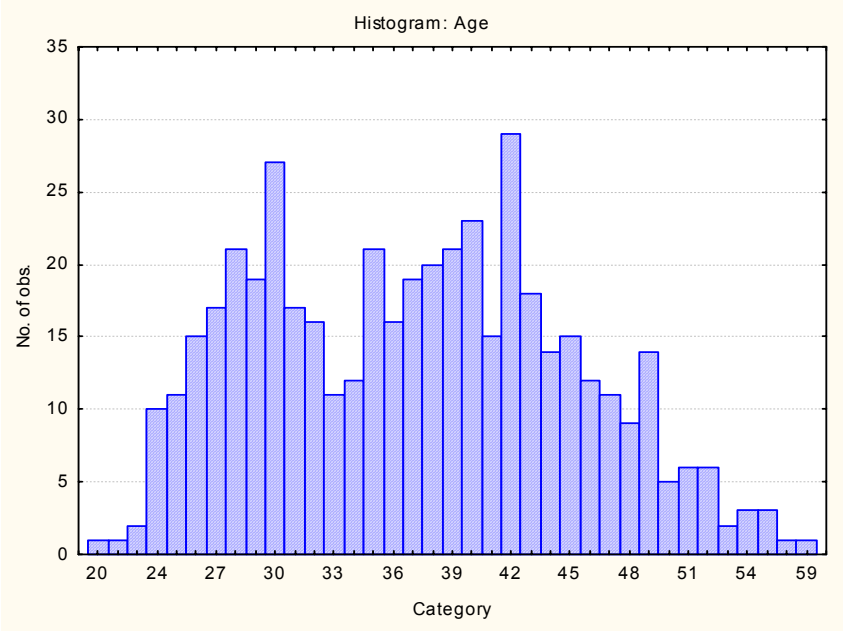
	Frequency table: Sex			
Category	Count	Cumulative Count	Percent	Cumulative Percent
Male	455	455	98.06034	98.0603
Female	9	464	1.93966	100.0000
Missing	0	464	0.00000	100.0000

	Frequency table: First Language			
Category	Count	Cumulative Count	Percent	Cumulative Percent
Afrikaans	55	55	11.85345	11.8534
Sesotho	171	226	36.85345	48.7069
isiZulu	168	394	36.20690	84.9138
English	11	405	2.37069	87.2845
Setswana	5	410	1.07759	88.3621
Other - N Sotho	1	411	0.21552	88.5776
Xitsonga	4	415	0.86207	89.4397
Sepedi	10	425	2.15517	91.5948
isiNdebele/Tshivenda	5	430	1.07759	92.6724
isiXhosa	15	445	3.23276	95.9052
siSwati	2	447	0.43103	96.3362
Missing	17	464	3.66379	100.0000

	Frequency table: Race			
Category	Count	Cumulative Count	Percent	Cumulative Percent
European	50	50	10.77586	10.7759
African	385	435	82.97414	93.7500
Asian	6	441	1.29310	95.0431
Coloured	7	448	1.50862	96.5517
Missing	16	464	3.44828	100.0000

Category	Frequency table: Education			
	Count	Cumulative Count	Percent	Cumulative Percent
Vocational Training	10	10	2.15517	2.1552
Grade 12 - N2	1	11	0.21552	2.3707
Grade 10 or 11	35	46	7.54310	9.9138
University entrance matri	2	48	0.43103	10.3448
Technikon	8	56	1.72414	12.0690
Std 7	36	92	7.75862	19.8276
Std 5	17	109	3.66379	23.4914
Grade 12	147	256	31.68103	55.1724
Std 6	46	302	9.91379	65.0862
Technikon (N2)	1	303	0.21552	65.3017
Std 8	63	366	13.57759	78.8793
Vocational Training - N2	4	370	0.86207	79.7414
Std 9	27	397	5.81897	85.5603
Technikon - N2	1	398	0.21552	85.7759
Degree	1	399	0.21552	85.9914
Technikon - N5	1	400	0.21552	86.2069
Grade 12 + N5 Fitter and	1	401	0.21552	86.4224
Vocational Training - N3	5	406	1.07759	87.5000
Grade 12 + ND in Fitting	1	407	0.21552	87.7155
Vocational Training - NTC	1	408	0.21552	87.9310
Grade 8	2	410	0.43103	88.3621
Grade 12 + Technikon Cert	1	411	0.21552	88.5776
Vocational Training - N4	5	416	1.07759	89.6552
Std 4	6	422	1.29310	90.9483
Grade 11	3	425	0.64655	91.5948
NTC 3	1	426	0.21552	91.8103
Vocational Training (Mill	1	427	0.21552	92.0259
Grade 12 + Teaching Diplo	1	428	0.21552	92.2414
University diploma	1	429	0.21552	92.4569
Grade 10	1	430	0.21552	92.6724
Grade 11 + BAdmin Diploma	1	431	0.21552	92.8879
Grade 9	2	433	0.43103	93.3190
Form 2	1	434	0.21552	93.5345
Vocational Training - Fit	1	435	0.21552	93.7500
Grade 12 & A+	1	436	0.21552	93.9655
Grade 12 + Fitter & Turne	2	438	0.43103	94.3966
Technikon - N3	1	439	0.21552	94.6121
Technikon - Marketing	1	440	0.21552	94.8276
Std 1	1	441	0.21552	95.0431
Grade 10 or 11 + Ind Refr	1	442	0.21552	95.2586
Vocational Training - N5	1	443	0.21552	95.4741
Vocational Training (N3)	1	444	0.21552	95.6897
Grade 12 + HRM Diploma	1	445	0.21552	95.9052
Vocational Training - N1	1	446	0.21552	96.1207
Grade 10 or 11 + Fitting	1	447	0.21552	96.3362
Missing	17	464	3.66379	100.0000

Variable	Descriptive Statistics					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases Missing
Age	37.12500	7.879869	20.00000	59.00000	464	0



Correlations with General Reasoning Test Battery

Variable	Correlations Marked correlations are significant at p < .05000 N=464 (Casewise deletion of missing data) Mechanical Reasoning	Spatial Reasoning
Abstract Reasoning	0.60	0.55
Numerical Reasoning	0.56	0.51
Verbal Reasoning	0.60	0.49

Comments

The similarity to the results obtained in validity study number 1 should be noted – the pattern of correlations is very similar. All the correlations are significant, pointing to the influence of a general ability factor, or 'g'. The relationship between Verbal Reasoning and Spatial Reasoning was lower than the other correlations, indicating that Spatial Reasoning relies on verbal ability to a lesser extent. Mechanical Reasoning had higher correlations with Abstract and Verbal Reasoning, which indicates that Mechanical Reasoning requires some problems solving or fluid intelligence, and also some verbal understanding.

Technical Test Battery construct validity: Intercorrelations of TTB subtests

Sample composition:

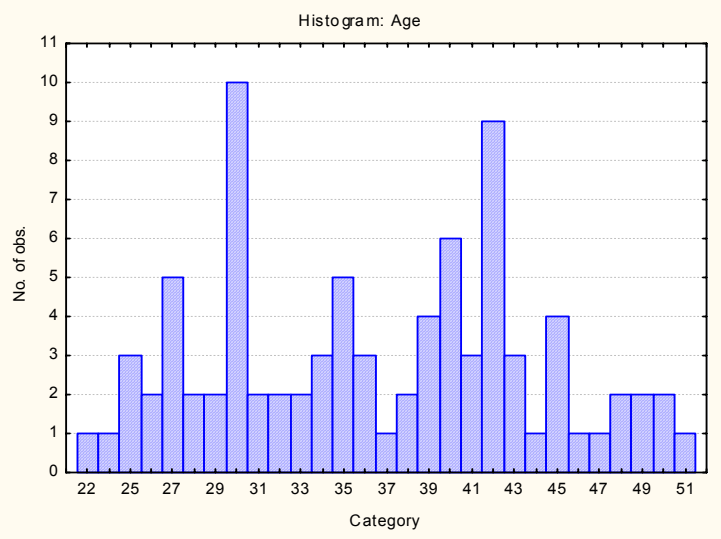
Senior technical officers tested as part of a validation study.

Category	Frequency table: Education			
	Count	Cumulative Count	Percent	Cumulative Percent
Technikon	1	1	1.13636	1.1364
Vocational Training	41	42	46.59091	47.7273
Grade 12	14	56	15.90909	63.6364
Grade 10 or 11	2	58	2.27273	65.9091
Missing	30	88	34.09091	100.0000

Category	Frequency table: First Language			
	Count	Cumulative Count	Percent	Cumulative Percent
isiZulu	8	8	9.09091	9.0909
isiXhosa	2	10	2.27273	11.3636
Afrikaans	29	39	32.95455	44.3182
English	8	47	9.09091	53.4091
Sesotho	8	55	9.09091	62.5000
Xitsonga	1	56	1.13636	63.6364
Setswana	1	57	1.13636	64.7727
isiNdebele	1	58	1.13636	65.9091
Missing	30	88	34.09091	100.0000

Category	Frequency table: Race (Eskom ttb resps_dif.sta)			
	Count	Cumulative Count	Percent	Cumulative Percent
European	51	51	57.95455	57.9545
Coloured	7	58	7.95455	65.9091
African	30	88	34.09091	100.0000
Missing	0	88	0.00000	100.0000

Variable	Descriptive Statistics					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases Missing
Age	36.47059	7.344561	22.00000	51.00000	85	3



Intercorrelations of TTB subtestss

Variable	Correlations Marked correlations are significant at p < .0 N=117 (Casewise deletion of missing data) MRT2_MRT2	SRT2_SRT2	VAC_VAC
MRT2_MRT2	1.00	0.55	0.54
SRT2_SRT2	0.55	1.00	0.48
VAC_VAC	0.54	0.48	1.00

As expected the correlations between the Technical Test Battery subtests are moderately high. This indicates that there may be some common ability factors underlying the three abilities assessed by the three subtests.

Technical Test Battery Construct Validity: Correlations with various ability tests

Sample composition

The sample consisted of individuals applying for apprentice training in a variety of trades with a local government body.

Educational levels ranged from grade 9 to N3 diplomas.

Some of the respondents were from a special educational institution for persons with learning problems.

	Frequency table: Race			
Category	Count	Cumulative Count	Percent	Cumulative Percent
Whites and coloureds	68	68	29.82456	29.8246
Blacks	156	224	68.42105	98.2456
Missing	4	228	1.75439	100.0000

	Frequency table: GENDER			
Category	Count	Cumulative Count	Percent	Cumulative Percent
Male	205	205	89.91228	89.9123
Female	18	223	7.89474	97.8070
Unknown	5	228	2.19298	100.0000
Missing	0	228	0.00000	100.0000

Ability tests used

The tests in the battery included the following:

The High Level Mental Alertness Test (general reasoning ability), published by the HSRC.
The Blox test (three dimensional perceptual ability), published by the HSRC.
The High Level Figure Classification Test (abstract reasoning ability) published by the HSRC.
The Mechanical Reasoning Test
The Spatial Reasoning Test

Correlations

Variable	Correlations Marked correlations are significant at p < .05000 N=216 (Casewise deletion of missing data) Spatial Reasoning	BLOX	High Level FCT	Mental Alertness	Mechanical Reasoning
Spatial Reasoning	1.00	0.44	0.33	0.47	0.48
BLOX	0.44	1.00	0.46	0.49	0.49
High Level FCT	0.33	0.46	1.00	0.50	0.43
Mental Alertness	0.47	0.49	0.50	1.00	0.52
Mechanical Reasoning	0.48	0.49	0.43	0.52	1.00

All the tests correlated significantly with each other, indicating the possibility of an underlying general mental ability. This indicates that both the Mechanical Reasoning and Spatial Reasoning tests have a significant reasoning component. The Mechanical Reasoning test is not just a test of knowledge of mechanical principles, and the Spatial Reasoning test is not just a test of spatial perception.

TTB Differential Item Functioning

Introduction

What is Differential Item Functioning?

Differential item functioning is found when a test item behaves differently for different population groups. Normally this means that the item shows a different relationship to the construct in question for different population groups. Normally one groups the respondents in terms of their level of score achieved on the construct, and then compares the likelihood of getting an item correct for the different population groups and the different score levels.

There are two different forms of Differential Item Functioning that are of interest to us:
Uniform bias means that one population group consistently has a better chance of answering an item correctly, irrespective of their total score.
Non-uniform bias means that the relative chance of answering the item correctly is not the same across all score levels, for different groups. This can be seen clearly on a graph, when the lines plotting the mean item score for a group are not parallel and may cross in places.

Ways of calculating Differential Item Functioning

There are many different ways of investigating Differential Item Functioning.

For the purpose of this manual, **Factorial Analysis of Variance** was used. This technique allows us to investigate the effect of combinations of continuous and categorical variables on predictor variables. It produces a particularly informative graph which is useful for visualising the effect of non-uniform bias.
The Factorial Analysis of Variance can also indicate uniform bias when a significant effect for the race group variable is found. Non-uniform bias is indicated by a significant interaction effect for the race group variable and score level.

Dividing the samples into score levels

The samples were divided into score levels in such a way that there would be sufficient persons of each group in every score category. To do this, stanine scores were calculated and the frequency tables for every race group examined for the stanine scores. To avoid creating cells with very few cases, resulting in meaningless output, the groups could not always be divided up evenly. It should also be pointed out that the low end and high end of the distributions could not be examined in great detail, because there are few persons in any group that score at the extremes of the scale. Only if one has an extremely large sample can the high end and low end of a scale be fully studied for bias. The score level variable used in the study can only be considered ordinal data (the intervals are not of uniform size). This should be borne in mind when interpreting the graphs.

Grouping respondents

Ideally, one would want to examine all race groups in detail, but in practice this is not always possible. The grouping of respondents according to race group had to be determined by the availability of data. In one study the grouping was done with Black respondents in one category and all other races in the other, and in the other study the grouping was done with White respondents in one category and all other races in the other. Thus, strictly speaking, the two studies are not comparable.

Direction and magnitude of differences

If DIF is found, the bias is not necessarily in favour of the White or Advantaged group. The size of the differences in item means scores must also be considered. In some cases the differences are very small.
For every study, a summary of the findings is given, as well as a detailed report of the findings for every item. The differences between race groups, where bias is found, is graphically depicted.

List of Differential item functioning studies reported for the Technical Test Battery:

Tests	Grouping	Sample	Study number
Mechanical Reasoning Spatial Reasoning Visual Acuity	White/Non-white	Senior technical officers	D1
Mechanical Reasoning Spatial Reasoning	White/Non-white	Workers and applicants – construction company	D2

Technical Test Battery Differential Item Functioning: Senior technical officers

Senior technical officers (electricians) tested as part of a validation study.

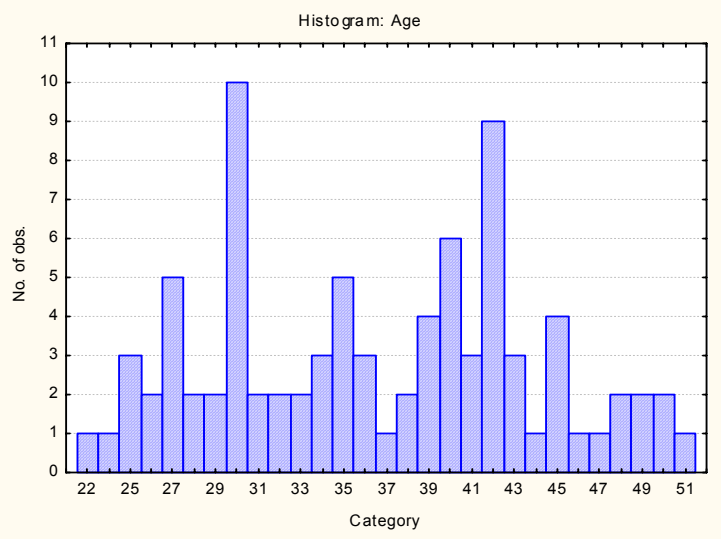
	Frequency table: Education			
Category	Count	Cumulative Count	Percent	Cumulative Percent
Technikon	1	1	1.13636	1.1364
Vocational Training	41	42	46.59091	47.7273
Grade 12	14	56	15.90909	63.6364
Grade 10 or 11	2	58	2.27273	65.9091
Missing	30	88	34.09091	100.0000

	Frequency table: First Language			
Category	Count	Cumulative Count	Percent	Cumulative Percent
isiZulu	8	8	9.09091	9.0909
isiXhosa	2	10	2.27273	11.3636
Afrikaans	29	39	32.95455	44.3182
English	8	47	9.09091	53.4091
Sesotho	8	55	9.09091	62.5000
Xitsonga	1	56	1.13636	63.6364
Setswana	1	57	1.13636	64.7727
isiNdebele	1	58	1.13636	65.9091
Missing	30	88	34.09091	100.0000

	Frequency table: Racegroup			
Category	Count	Cumulative Count	Percent	Cumulative Percent
White	51	51	57.95455	57.9545
Non-White	37	88	42.04545	100.0000
Missing	0	88	0.00000	100.0000

	Frequency table: Race			
Category	Count	Cumulative Count	Percent	Cumulative Percent
European	51	51	57.95455	57.9545
Coloured	7	58	7.95455	65.9091
African	30	88	34.09091	100.0000
Missing	0	88	0.00000	100.0000

	Descriptive Statistics					
Variable	Mean	Std.Dev	Minimum	Maximum	N	No.cases Missing
Age	36.47059	7.344561	22.00000	51.00000	85	3



Method

Method

Applicants were classified into White (non-disadvantaged) and Non-White (previously disadvantaged) for the purpose of the analysis, since the size of the sample did not allow for finer distinctions.

Applicants were classified into score levels for the test being evaluated. The cut-offs for the levels were determined by examining the frequency distributions for both race groups, trying to ensure a sufficient number of cases for both races in each category.

The statistical technique used in this study was factorial analysis of variance. For every item a factorial analysis of variance was done, using the scored item response as dependent variable, and the race group and score level (on the overall test score for the subtest being investigated) as predictor variables. If a significant effect was found for race, that was taken as an indication of uniform item bias, and the least-square difference in the means for that item was plotted graphically to illustrate which race group had a higher probability of getting the item right. If a significant interaction effect was found for race group and score level, that was taken as an indication of non-uniform item bias, and the means at all levels for both race groups were plotted to illustrate the severity of the non-uniform bias that was found.

Detailed results by item: Mechanical Reasoning Test

Item number	Uniform bias	In favour of group	Non-uniform bias
1	No		No
2	No		No
3	No		No
4	No		No
5	No		No
6	No		No
7	No		No
8	No		No
9	No		No
10	No		No
11	No		No
12	No		No
13	No		No
14	No		No
15	No		No
16	No		No
17	Yes	White	No
18	No		No
19	No		No
20	No		No
21	No		No
22	No		No
23	No		No
24	No		No
25	No		Yes
26	No		No
27	No		Yes
28	No		No
29	No		No
30	No		No
31	No		No
32	No		No
33	No		No
34	No		No
35	No		No
36	No		No
37	No		No
38	No		No
39	No		No
40	No		No
41	No		No
42	No		No
43	No		No
44	No		No
45	No		No

Uniform bias was found in one item, in favour of the White group.
Non-uniform bias was found in two items.
The graphs in the detailed results that follow give more information about the nature of this bias.

Effect	Univariate Tests of Significance for item1 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept	15.93523	1	15.93523	105.6273	0.000000
Racegroup	0.01264	1	0.01264	0.0838	0.773006
Scorelevel	3.12276	4	0.78069	5.1748	0.000957
Racegroup*Scorelevel	0.58887	4	0.14722	0.9758	0.425768
Error	11.61643	77	0.15086		

Effect	Univariate Tests of Significance for item2 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept	0.049331	1	0.049331	1.899259	0.172153
Racegroup	0.049331	1	0.049331	1.899259	0.172153
Scorelevel	0.094012	4	0.023503	0.904864	0.465456
Racegroup*Scorelevel	0.094012	4	0.023503	0.904864	0.465456
Error	2.000000	77	0.025974		

Effect	Univariate Tests of Significance for item3 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.04834	1	0.048336	0.22850	0.633993
Scorelevel	2.00626	4	0.501566	2.37106	0.059657
Racegroup*Scorelevel	0.70172	4	0.175429	0.82931	0.510593
Error	16.28833	77	0.211537		

Effect	Univariate Tests of Significance for item4 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.10774	1	0.10774	0.6792	0.412421
Scorelevel					
Racegroup*Scorelevel	0.20744	4	0.05186	0.3269	0.859106
Error	12.21497	77	0.15864		

Effect	Univariate Tests of Significance for item5 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept	30.31027	1	30.31027	213.9970	0.000000
Racegroup	0.02275	1	0.02275	0.1606	0.689673
Scorelevel	0.87518	4	0.21879	1.5447	0.197679
Racegroup*Scorelevel	1.22330	4	0.30583	2.1592	0.081498
Error	10.90619	77	0.14164		

Effect	Univariate Tests of Significance for item6 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.55015	1	0.55015	2.53155	0.115688
Scorelevel	1.93273	4	0.48318	2.22338	0.074165
Racegroup*Scorelevel	0.73046	4	0.18262	0.84031	0.503840
Error	16.73358	77	0.21732		

Effect	Univariate Tests of Significance for item7 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.18432	1	0.18432	1.11742	0.293779
Scorelevel					
Racegroup*Scorelevel	1.56482	4	0.39121	2.37166	0.059604
Error	12.70116	77	0.16495		

Effect	Univariate Tests of Significance for item8 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.11128	1	0.11128	0.50759	0.478339
Scorelevel	1.89235	4	0.47309	2.15788	0.081655
Racegroup*Scorelevel	0.73676	4	0.18419	0.84014	0.503942
Error	16.88124	77	0.21924		

Effect	Univariate Tests of Significance for item9 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept	35.85169	1	35.85169	518.9602	0.000000
Racegroup	0.00420	1	0.00420	0.0607	0.805976
Scorelevel	0.55862	4	0.13965	2.0215	0.099680
Racegroup*Scorelevel	0.36267	4	0.09067	1.3124	0.272869
Error	5.31944	77	0.06908		

Effect	Univariate Tests of Significance for item11 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.42739	1	0.427385	2.12699	0.148792
Scorelevel	1.31103	4	0.327759	1.63117	0.174942
Racegroup*Scorelevel	0.23976	4	0.059940	0.29831	0.878209
Error	15.47193	77	0.200934		

Effect	Univariate Tests of Significance for item12 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.00996	1	0.00996	0.0635	0.801666
Scorelevel					
Racegroup*Scorelevel	0.85069	4	0.21267	1.3568	0.256773
Error	12.06931	77	0.15674		

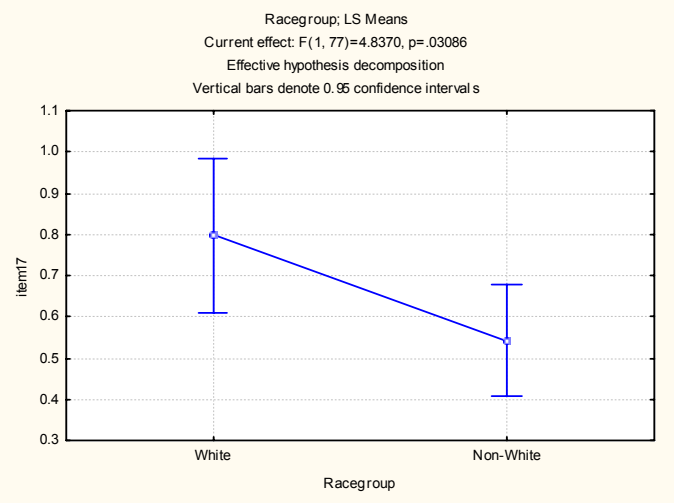
Effect	Univariate Tests of Significance for item13 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.01866	1	0.01866	0.08326	0.773698
Scorelevel	1.42701	4	0.35675	1.59188	0.184957
Racegroup*Scorelevel	1.30896	4	0.32724	1.46020	0.222531
Error	17.25624	77	0.22411		

Effect	Univariate Tests of Significance for item14 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept	0.89243	1	0.892426	5.240020	0.024814
Racegroup	0.12418	1	0.124185	0.729170	0.395801
Scorelevel	0.32446	4	0.081115	0.476278	0.753014
Racegroup*Scorelevel	0.69606	4	0.174014	1.021753	0.401504
Error	13.11385	77	0.170310		

Effect	Univariate Tests of Significance for item15 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.47982	1	0.47982	2.13904	0.147662
Scorelevel	1.36529	4	0.34132	1.52163	0.204206
Racegroup*Scorelevel	1.30121	4	0.32530	1.45020	0.225650
Error	17.27225	77	0.22431		

Effect	Univariate Tests of Significance for item16 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.07248	1	0.07248	0.29647	0.587679
Scorelevel	1.62973	4	0.40743	1.66657	0.166355
Racegroup*Scorelevel	0.42317	4	0.10579	0.43273	0.784568
Error	18.82445	77	0.24447		

Effect	Univariate Tests of Significance for item17 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup					
Scorelevel					
Racegroup*Scorelevel	0.68762	4	0.17190	1.1485	0.340258
Error	11.52540	77	0.14968		



Effect	Univariate Tests of Significance for item18 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept	13.97745	1	13.97745	77.84983	0.000000
Racegroup	0.37780	1	0.37780	2.10420	0.150957
Scorelevel	3.93379	4	0.98345	5.47748	0.000620
Racegroup*Scorelevel	1.21876	4	0.30469	1.69703	0.159283
Error	13.82486	77	0.17954		

Effect	Univariate Tests of Significance for item19 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.00264	1	0.00264	0.0225	0.881198
Scorelevel					
Racegroup*Scorelevel	0.83783	4	0.20946	1.7860	0.140214
Error	9.03032	77	0.11728		

Effect	Univariate Tests of Significance for item20 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.22701	1	0.22701	0.93547	0.336475
Scorelevel	0.23961	4	0.05990	0.24685	0.910741
Racegroup*Scorelevel	0.35254	4	0.08814	0.36319	0.834094
Error	18.68547	77	0.24267		

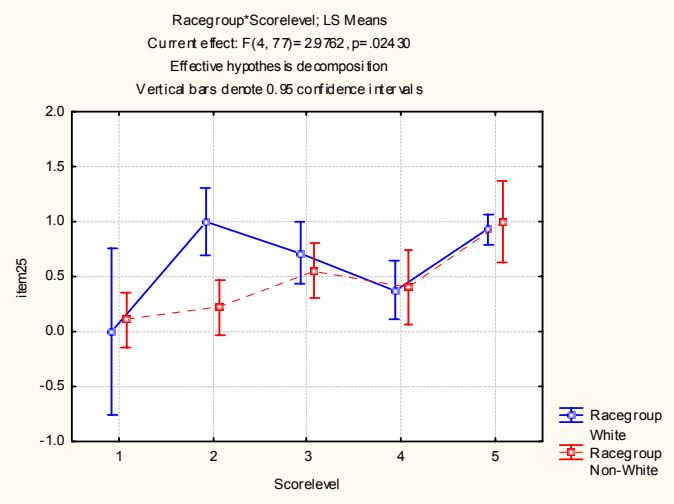
Effect	Univariate Tests of Significance for item21 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept	4.91077	1	4.910769	24.21541	0.000005
Racegroup	0.00039	1	0.000394	0.00194	0.964957
Scorelevel	2.75928	4	0.689819	3.40156	0.012901
Racegroup*Scorelevel	0.68710	4	0.171775	0.84704	0.499739
Error	15.61523	77	0.202795		

Effect	Univariate Tests of Significance for item22 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.06361	1	0.06361	0.29014	0.591687
Scorelevel	0.88807	4	0.22202	1.01271	0.406194
Racegroup*Scorelevel	1.54283	4	0.38571	1.75936	0.145686
Error	16.88080	77	0.21923		

Effect	Univariate Tests of Significance for item23 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.08782	1	0.087819	0.42420	0.516789
Scorelevel	1.72811	4	0.432027	2.08685	0.090610
Racegroup*Scorelevel	0.20550	4	0.051375	0.24816	0.909946
Error	15.94083	77	0.207024		

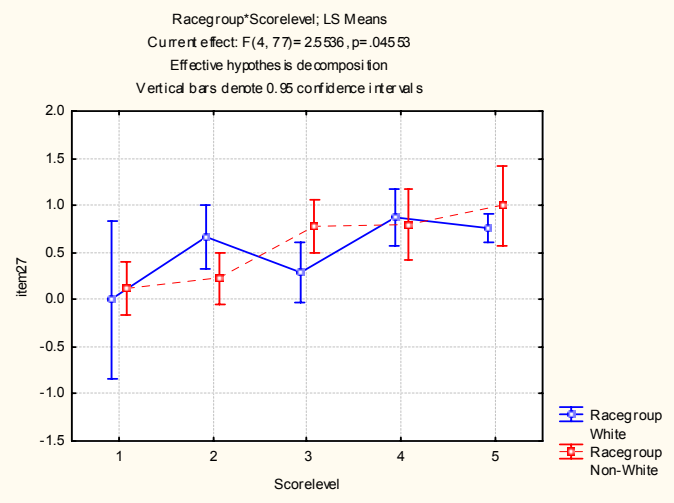
Effect	Univariate Tests of Significance for item24 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.18552	1	0.185519	0.89480	0.347139
Scorelevel					
Racegroup*Scorelevel	0.73561	4	0.183902	0.88700	0.475862
Error	15.96442	77	0.207330		

Effect	Univariate Tests of Significance for item25 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept	12.51485	1	12.51485	87.34743	0.000000
Racegroup	0.23753	1	0.23753	1.65782	0.201754
Scorelevel	3.49540	4	0.87385	6.09904	0.000257
Racegroup*Scorelevel	1.70566	4	0.42641	2.97616	0.024297
Error	11.03231	77	0.14328		



Effect	Univariate Tests of Significance for item26 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.00707	1	0.007073	0.03252	0.857371
Scorelevel	1.10758	4	0.276895	1.27297	0.287927
Racegroup*Scorelevel	0.11398	4	0.028496	0.13100	0.970620
Error	16.74896	77	0.217519		

Effect	Univariate Tests of Significance for item27 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.04693	1	0.04693	0.26285	0.609640
Scorelevel					
Racegroup*Scorelevel					
Error	13.74725	77	0.17854		



Effect	Univariate Tests of Significance for item28 Sigma-restricted parameterization Effective hypothesis decomposition				
	SS	Degr. of Freedom	MS	F	p
Intercept	0.483031	1	0.483031	4.124674	0.045714
Racegroup	0.078627	1	0.078627	0.671408	0.415090
Scorelevel	0.245691	4	0.061423	0.524497	0.718004
Racegroup*Scorelevel	0.049443	4	0.012361	0.105550	0.980252
Error	9.017296	77	0.117108		

Effect	Univariate Tests of Significance for item29 Sigma-restricted parameterization Effective hypothesis decomposition				
	SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.41410	1	0.41410	1.93499	0.168220
Scorelevel	1.61668	4	0.40417	1.88858	0.120925
Racegroup*Scorelevel	0.18340	4	0.04585	0.21425	0.929774
Error	16.47860	77	0.21401		

Effect	Univariate Tests of Significance for item30 Sigma-restricted parameterization Effective hypothesis decomposition				
	SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.01318	1	0.013181	0.08254	0.774653
Scorelevel					
Racegroup*Scorelevel	0.26876	4	0.067190	0.42075	0.793200
Error	12.29620	77	0.159691		

Effect	Univariate Tests of Significance for item31 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept	0.417842	1	0.417842	4.427129	0.038636
Racegroup	0.004139	1	0.004139	0.043853	0.834681
Scorelevel	0.652136	4	0.163034	1.727379	0.152520
Racegroup*Scorelevel	0.216095	4	0.054024	0.572393	0.683458
Error	7.267433	77	0.094382		

Effect	Univariate Tests of Significance for item32 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.29154	1	0.291535	1.59840	0.209944
Scorelevel					
Racegroup*Scorelevel	0.27011	4	0.067527	0.37023	0.829163
Error	14.04418	77	0.182392		

Effect	Univariate Tests of Significance for item33 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.44798	1	0.447977	3.24689	0.075473
Scorelevel					
Racegroup*Scorelevel	1.31013	4	0.327532	2.37392	0.059406
Error	10.62378	77	0.137971		

Effect	Univariate Tests of Significance for item34 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept	0.115785	1	0.115785	2.089343	0.152388
Racegroup	0.010804	1	0.010804	0.194956	0.660061
Scorelevel	0.357032	4	0.089258	1.610661	0.180106
Racegroup*Scorelevel	0.034447	4	0.008612	0.155399	0.960007
Error	4.267105	77	0.055417		

Effect	Univariate Tests of Significance for item35 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept	1.38482	1	1.384818	8.073184	0.005747
Racegroup	0.04011	1	0.040112	0.233842	0.630062
Scorelevel	1.90195	4	0.475488	2.771990	0.032921
Racegroup*Scorelevel	0.06548	4	0.016370	0.095432	0.983631
Error	13.20805	77	0.171533		

Effect	Univariate Tests of Significance for item36 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.01582	1	0.015825	0.120531	0.729406
Scorelevel					
Racegroup*Scorelevel	0.23919	4	0.059797	0.455452	0.768129
Error	10.10948	77	0.131292		

Effect	Univariate Tests of Significance for item37 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.12989	1	0.129891	0.82113	0.367677
Scorelevel					
Racegroup*Scorelevel	0.17648	4	0.044120	0.27891	0.890779
Error	12.18030	77	0.158186		

Effect	Univariate Tests of Significance for item38 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.00014	1	0.000142	0.00096	0.975416
Scorelevel					
Racegroup*Scorelevel	0.47575	4	0.118939	0.79812	0.530066
Error	11.47481	77	0.149023		

Effect	Univariate Tests of Significance for item39 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept	0.116158	1	0.116158	1.211112	0.274540
Racegroup	0.116158	1	0.116158	1.211112	0.274540
Scorelevel	0.299485	4	0.074871	0.780641	0.541187
Racegroup*Scorelevel	0.299485	4	0.074871	0.780641	0.541187
Error	7.385057	77	0.095910		

Effect	Univariate Tests of Significance for item40 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept	0.64291	1	0.642912	4.690004	0.033434
Racegroup	0.00292	1	0.002922	0.021318	0.884297
Scorelevel	1.30549	4	0.326373	2.380868	0.058799
Racegroup*Scorelevel	0.31207	4	0.078018	0.569138	0.685794
Error	10.55527	77	0.137081		

Effect	Univariate Tests of Significance for item41 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept	0.052792	1	0.052792	0.620448	0.433299
Racegroup	0.052792	1	0.052792	0.620448	0.433299
Scorelevel	0.320216	4	0.080054	0.940846	0.445002
Racegroup*Scorelevel	0.320216	4	0.080054	0.940846	0.445002
Error	6.551724	77	0.085087		

Effect	Univariate Tests of Significance for item42 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept	0.383894	1	0.383894	3.166178	0.079124
Racegroup	0.222332	1	0.222332	1.833688	0.179653
Scorelevel	0.101780	4	0.025445	0.209858	0.932225
Racegroup*Scorelevel	0.150023	4	0.037506	0.309330	0.870919
Error	9.336138	77	0.121249		

Effect	Univariate Tests of Significance for item43 Sigma-restricted parameterization Effective hypothesis decomposition				
	SS	Degr. of Freedom	MS	F	p
Intercept	0.161676	1	0.161676	3.374047	0.070090
Racegroup	0.069818	1	0.069818	1.457037	0.231097
Scorelevel	0.980663	4	0.245166	5.116401	0.001041
Racegroup*Scorelevel	0.423486	4	0.105872	2.209450	0.075700
Error	3.689655	77	0.047918		

Effect	Univariate Tests of Significance for item44 Sigma-restricted parameterization Effective hypothesis decomposition				
	SS	Degr. of Freedom	MS	F	p
Intercept	0.041193	1	0.041193	0.740803	0.392076
Racegroup	0.041193	1	0.041193	0.740803	0.392076
Scorelevel	0.088570	4	0.022143	0.398210	0.809350
Racegroup*Scorelevel	0.088570	4	0.022143	0.398210	0.809350
Error	4.281609	77	0.055605		

Effect	Univariate Tests of Significance for item45 Sigma-restricted parameterization Effective hypothesis decomposition				
	SS	Degr. of Freedom	MS	F	p
Intercept	0.000528	1	0.000528	0.042102	0.837967
Racegroup	0.000528	1	0.000528	0.042102	0.837967
Scorelevel	0.003202	4	0.000801	0.063843	0.992348
Racegroup*Scorelevel	0.003202	4	0.000801	0.063843	0.992348
Error	0.965517	77	0.012539		

Detailed results by item: Spatial Reasoning Test

Item number	Uniform bias	In favour of group	Non-uniform bias
1	No		No
2	No		No
3	No		No
4	No		No
5	No		No
6	No		No
7	No		No
8	No		No
9	No		No
10	No		No
11	No		No
12	No		No
13	Yes	White	No
14	No		No
15	No		Yes
16	Yes	Non-White	Yes
17	No		No
18	No		No
19	No		No
20	No		No
21	No		No
22	No		No
23	No		No
24	No		No
25	No		No
26	No		No
27	No		Yes
28	No		No
29	No		No
30	No		No

Uniform bias was found in two items. One item was biased in favour of the White group, and one item in favour of the non-White group.
Non-uniform bias was found in three items.
More information about this bias can be found in the graphs included in the detailed results that follow.

Effect	Univariate Tests of Significance for item1 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept	27.50719	1	27.50719	143.2938	0.000000
Racegroup	0.68189	1	0.68189	3.5522	0.063241
Scorelevel	5.63148	4	1.40787	7.3341	0.000047
Racegroup*Scorelevel	0.05951	4	0.01488	0.0775	0.988934
Error	14.78119	77	0.19196		

Effect	Univariate Tests of Significance for item2 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.00063	1	0.00063	0.0033	0.954513
Scorelevel	1.50019	4	0.37505	1.9592	0.109150
Racegroup*Scorelevel	0.86813	4	0.21703	1.1338	0.346947
Error	14.74002	77	0.19143		

Effect	Univariate Tests of Significance for item3 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.12951	1	0.12951	0.7662	0.384129
Scorelevel					
Racegroup*Scorelevel	0.08606	4	0.02152	0.1273	0.972124
Error	13.01604	77	0.16904		

Effect	Univariate Tests of Significance for item4 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.02935	1	0.02935	0.1958	0.659332
Scorelevel					
Racegroup*Scorelevel	0.59095	4	0.14774	0.9858	0.420434
Error	11.54015	77	0.14987		

Effect	Univariate Tests of Significance for item5 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept	6.17144	1	6.171436	26.54269	0.000002
Racegroup	0.32831	1	0.328306	1.41201	0.238375
Scorelevel	0.99592	4	0.248979	1.07083	0.376796
Racegroup*Scorelevel	1.30451	4	0.326128	1.40264	0.241048
Error	17.90325	77	0.232510		

Effect	Univariate Tests of Significance for item6 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.03495	1	0.03495	0.1782	0.674064
Scorelevel					
Racegroup*Scorelevel	0.47805	4	0.11951	0.6095	0.657009
Error	15.09799	77	0.19608		

Effect	Univariate Tests of Significance for item7 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.16270	1	0.16270	0.80002	0.373874
Scorelevel					
Racegroup*Scorelevel	0.52718	4	0.13180	0.64805	0.629954
Error	15.65958	77	0.20337		

Effect	Univariate Tests of Significance for item8 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.00656	1	0.00656	0.0335	0.855311
Scorelevel					
Racegroup*Scorelevel	0.86222	4	0.21555	1.0996	0.362920
Error	15.09496	77	0.19604		

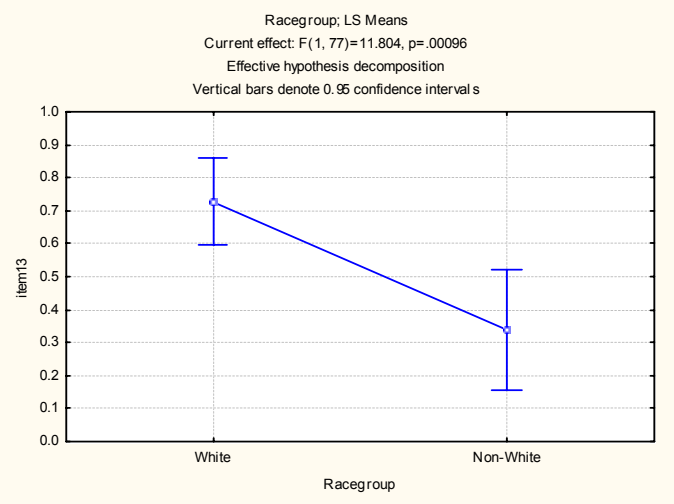
Effect	Univariate Tests of Significance for item9 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept	11.04240	1	11.04240	62.54160	0.000000
Racegroup	0.02886	1	0.02886	0.16348	0.687091
Scorelevel	5.45348	4	1.36337	7.72181	0.000028
Racegroup*Scorelevel	0.15254	4	0.03814	0.21599	0.928792
Error	13.59519	77	0.17656		

Effect	Univariate Tests of Significance for item10 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.23773	1	0.237733	1.14499	0.287942
Scorelevel					
Racegroup*Scorelevel	1.57520	4	0.393800	1.89666	0.119518
Error	15.98734	77	0.207628		

Effect	Univariate Tests of Significance for item11 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.00101	1	0.00101	0.0061	0.937762
Scorelevel					
Racegroup*Scorelevel	0.76779	4	0.19195	1.1672	0.331893
Error	12.66261	77	0.16445		

Effect	Univariate Tests of Significance for item12 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.36462	1	0.364624	1.60855	0.208517
Scorelevel	1.08603	4	0.271507	1.19776	0.318639
Racegroup*Scorelevel	1.04932	4	0.262329	1.15727	0.336309
Error	17.45428	77	0.226679		

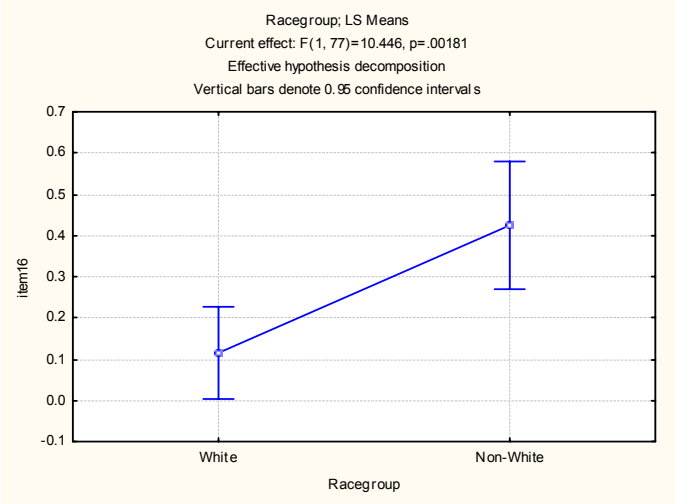
Effect	Univariate Tests of Significance for item13 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept	17.32248	1	17.32248	88.17650	0.000000
Racegroup	2.31887	1	2.31887	11.80375	0.000956
Scorelevel	1.57292	4	0.39323	2.00165	0.102610
Racegroup*Scorelevel	0.41954	4	0.10489	0.53390	0.711197
Error	15.12683	77	0.19645		

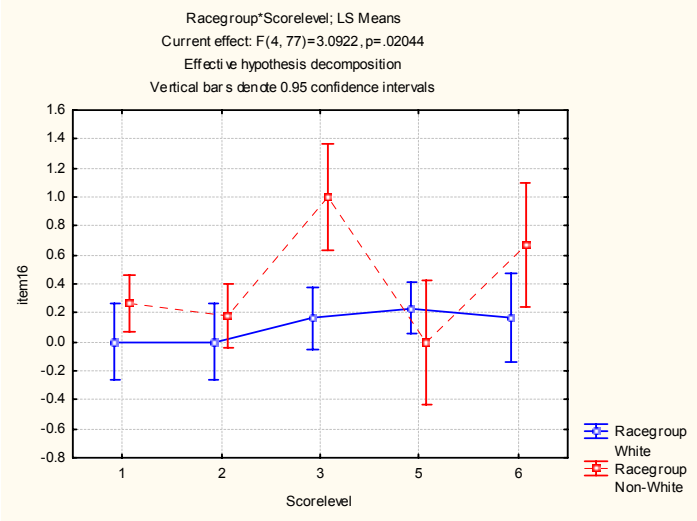


Effect	Univariate Tests of Significance for item14 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.34600	1	0.34600	1.90230	0.171813
Scorelevel					
Racegroup*Scorelevel	0.25288	4	0.06322	0.34758	0.844950
Error	14.00517	77	0.18189		

Effect	Univariate Tests of Significance for item15 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.31271	1	0.31271	1.95336	0.166239
Scorelevel					
Racegroup*Scorelevel					
Error	12.32683	77	0.16009		

Effect	Univariate Tests of Significance for item16 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept	4.41052	1	4.410520	31.45939	0.000000
Racegroup	1.46457	1	1.464568	10.44649	0.001810
Scorelevel	2.45907	4	0.614769	4.38503	0.003016
Racegroup*Scorelevel	1.73407	4	0.433517	3.09219	0.020443
Error	10.79519	77	0.140197		





Effect	Univariate Tests of Significance for item17 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.01879	1	0.01879	0.10023	0.752412
Scorelevel					
Racegroup*Scorelevel	0.09581	4	0.02395	0.12776	0.971932
Error	14.43623	77	0.18748		

Effect	Univariate Tests of Significance for item18 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept	4.09728	1	4.097275	28.20064	0.000001
Racegroup	0.00493	1	0.004933	0.03395	0.854299
Scorelevel	4.33594	4	1.083986	7.46083	0.000039
Racegroup*Scorelevel	0.78222	4	0.195554	1.34596	0.260631
Error	11.18734	77	0.145290		

Effect	Univariate Tests of Significance for item19 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.00171	1	0.00171	0.00743	0.931540
Scorelevel	1.61773	4	0.40443	1.75937	0.145685
Racegroup*Scorelevel	0.31292	4	0.07823	0.34032	0.849950
Error	17.70031	77	0.22987		

Effect	Univariate Tests of Significance for item20 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.01359	1	0.01359	0.0889	0.766366
Scorelevel					
Racegroup*Scorelevel	1.41106	4	0.35277	2.3080	0.065479
Error	11.76921	77	0.15285		

Effect	Univariate Tests of Significance for item21 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.31705	1	0.31705	1.68600	0.198005
Scorelevel					
Racegroup*Scorelevel	0.51604	4	0.12901	0.68603	0.603793
Error	14.47999	77	0.18805		

Effect	Univariate Tests of Significance for item22 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept	2.43119	1	2.431186	13.39792	0.000460
Racegroup	0.02416	1	0.024157	0.13312	0.716215
Scorelevel	1.06393	4	0.265981	1.46579	0.220803
Racegroup*Scorelevel	0.21357	4	0.053393	0.29424	0.880872
Error	13.97242	77	0.181460		

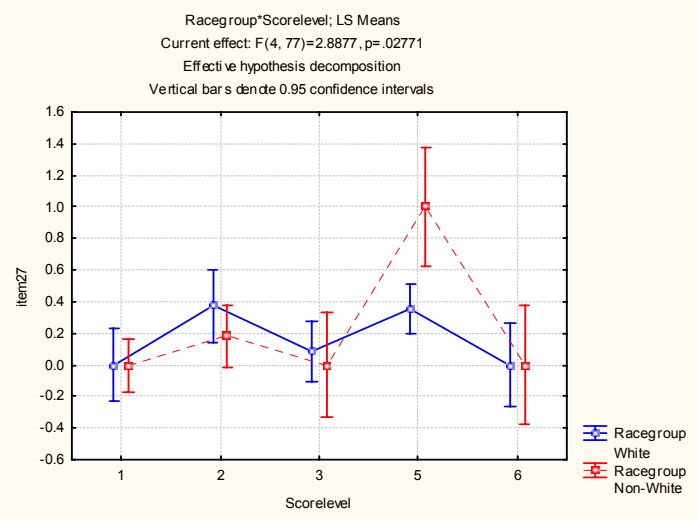
Effect	Univariate Tests of Significance for item23 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.32377	1	0.323766	1.91394	0.170524
Scorelevel					
Racegroup*Scorelevel	0.33978	4	0.084946	0.50216	0.734210
Error	13.02545	77	0.169162		

Effect	Univariate Tests of Significance for item24 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.17482	1	0.174819	1.16063	0.284698
Scorelevel					
Racegroup*Scorelevel	0.18086	4	0.045216	0.30019	0.876968
Error	11.59804	77	0.150624		

Effect	Univariate Tests of Significance for item25 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.00000	1	0.000000	0.00000	1.000000
Scorelevel					
Racegroup*Scorelevel	0.42030	4	0.105076	0.66037	0.621414
Error	12.25205	77	0.159118		

Effect	Univariate Tests of Significance for item26 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept	2.41523	1	2.415227	14.72846	0.000253
Racegroup	0.15566	1	0.155662	0.94925	0.332960
Scorelevel	0.65415	4	0.163538	0.99728	0.414296
Racegroup*Scorelevel	0.27539	4	0.068848	0.41984	0.793853
Error	12.62674	77	0.163984		

Effect	Univariate Tests of Significance for item27 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.084077	1	0.084077	0.77901	0.380190
Scorelevel					
Racegroup*Scorelevel					
Error	8.310383	77	0.107927		



Effect	Univariate Tests of Significance for item28 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.23502	1	0.235020	1.43152	0.235188
Scorelevel	1.24583	4	0.311458	1.89710	0.119442
Racegroup*Scorelevel	0.17994	4	0.044985	0.27401	0.893904
Error	12.64153	77	0.164176		

Effect	Univariate Tests of Significance for item29 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept	0.677634	1	0.677634	7.374449	0.008164
Racegroup	0.037674	1	0.037674	0.409988	0.523876
Scorelevel	0.834635	4	0.208659	2.270759	0.069170
Racegroup*Scorelevel	0.027218	4	0.006805	0.074052	0.989850
Error	7.075490	77	0.091889		

Effect	Univariate Tests of Significance for item30 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept	0.142892	1	0.142892	3.128496	0.080895
Racegroup	0.024189	1	0.024189	0.529599	0.468983
Scorelevel	0.238575	4	0.059644	1.305845	0.275334
Racegroup*Scorelevel	0.096264	4	0.024066	0.526905	0.716259
Error	3.516934	77	0.045674		

Detailed results by item for Visual Acuity Test

Item number	Uniform bias	In favour of group	Non-Uniform bias
1	No		No
2	No		No
3	No		No
4	No		No
5	No		No
6	No		No
7	No		No
8	No		No
9	No		No
10	No		No
11	No		No
12	No		No
13	No		No
14	No		No
15	No		No

No bias was found in any of the items.

Effect	Univariate Tests of Significance for item1 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept	43.59779	1	43.59779	635.3014	0.000000
Racegroup	0.21750	1	0.21750	3.1694	0.078922
Scorelevel	4.39381	4	1.09845	16.0065	0.000000
Racegroup*Scorelevel	0.07415	4	0.01854	0.2701	0.896376
Error	5.35278	78	0.06863		

Effect	Univariate Tests of Significance for item2 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.07852	1	0.07852	0.4283	0.514736
Scorelevel					
Racegroup*Scorelevel	0.26139	4	0.06535	0.3565	0.838777
Error	14.29802	78	0.18331		

Effect	Univariate Tests of Significance for item3 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.41137	1	0.41137	2.2613	0.136682
Scorelevel					
Racegroup*Scorelevel	0.19421	4	0.04855	0.2669	0.898401
Error	14.18968	78	0.18192		

Effect	Univariate Tests of Significance for item4 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.00146	1	0.00146	0.0136	0.907489
Scorelevel					
Racegroup*Scorelevel	0.51461	4	0.12865	1.1950	0.319712
Error	8.39762	78	0.10766		

Effect	Univariate Tests of Significance for item5 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept	27.53202	1	27.53202	230.4810	0.000000
Racegroup	0.03906	1	0.03906	0.3270	0.569070
Scorelevel	7.38315	4	1.84579	15.4518	0.000000
Racegroup*Scorelevel	0.39361	4	0.09840	0.8238	0.513965
Error	9.31746	78	0.11945		

Effect	Univariate Tests of Significance for item6 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.00872	1	0.00872	0.0906	0.764229
Scorelevel					
Racegroup*Scorelevel	0.52244	4	0.13061	1.3563	0.256839
Error	7.51151	78	0.09630		

Effect	Univariate Tests of Significance for item7 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.00267	1	0.00267	0.0367	0.848525
Scorelevel					
Racegroup*Scorelevel	0.18133	4	0.04533	0.6243	0.646582
Error	5.66429	78	0.07262		

Effect	Univariate Tests of Significance for item8 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.11375	1	0.113750	0.71630	0.399949
Scorelevel					
Racegroup*Scorelevel	0.12075	4	0.030187	0.19009	0.942904
Error	12.38651	78	0.158801		

Effect	Univariate Tests of Significance for item9 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept	4.23026	1	4.230261	32.52112	0.000000
Racegroup	0.02150	1	0.021503	0.16531	0.685430
Scorelevel	6.34513	4	1.586282	12.19491	0.000000
Racegroup*Scorelevel	0.54599	4	0.136498	1.04936	0.387357
Error	10.14603	78	0.130077		

Effect	Univariate Tests of Significance for item10 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.05079	1	0.050795	0.32616	0.569569
Scorelevel					
Racegroup*Scorelevel	0.33604	4	0.084011	0.53945	0.707173
Error	12.14722	78	0.155734		

Effect	Univariate Tests of Significance for item11 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.115910	1	0.115910	1.10770	0.295831
Scorelevel					
Racegroup*Scorelevel	0.534778	4	0.133695	1.27766	0.285974
Error	8.161905	78	0.104640		

Effect	Univariate Tests of Significance for item12 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.000080	1	0.000080	0.000684	0.979206
Scorelevel					
Racegroup*Scorelevel	0.100300	4	0.025075	0.215192	0.929254
Error	9.088889	78	0.116524		

Effect	Univariate Tests of Significance for item13 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept	0.97783	1	0.977827	7.196947	0.008912
Racegroup	0.00615	1	0.006150	0.045262	0.832078
Scorelevel	1.96863	4	0.492157	3.622346	0.009246
Racegroup*Scorelevel	0.23471	4	0.058677	0.431869	0.785197
Error	10.59762	78	0.135867		

Effect	Univariate Tests of Significance for item14 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept	0.007408	1	0.007408	0.215723	0.643612
Racegroup	0.007408	1	0.007408	0.215723	0.643612
Scorelevel	0.036731	4	0.009183	0.267401	0.898084
Racegroup*Scorelevel	0.036731	4	0.009183	0.267401	0.898084
Error	2.678571	78	0.034341		

Effect	Univariate Tests of Significance for item15 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.054450	1	0.054450	0.560824	0.456181
Scorelevel	0.286772	4	0.071693	0.738418	0.568603
Racegroup*Scorelevel	0.114144	4	0.028536	0.293912	0.881099
Error	7.573016	78	0.097090		

Technical Test Battery Differential Item Functioning: Construction Company Workers and Applicants.

Grouping Variable: Race Group

Sample composition

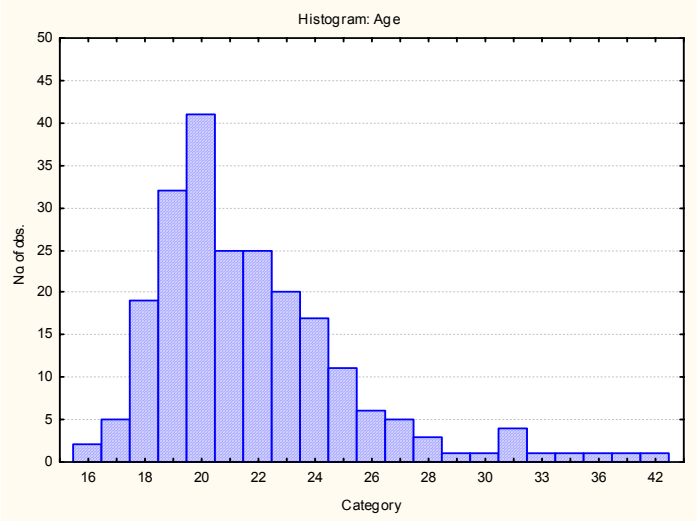
Workers and applicants to a construction company based in the Western Cape.
Data were collected during 2002-2003.

Category	Frequency table: Race			
	Count	Cumulative Count	Percent	Cumulative Percent
BLACKS	124	124	55.60538	55.6054
ASIANS	2	126	0.89686	56.5022
WHITES/COLOUREDS	95	221	42.60090	99.1031
Missing	2	223	0.89686	100.0000

Category	Frequency table: Racegroup			
	Count	Cumulative Count	Percent	Cumulative Percent
non-Black	97	97	43.49776	43.4978
Black	124	221	55.60538	99.1031
Missing	2	223	0.89686	100.0000

Category	Frequency table: Sex			
	Count	Cumulative Count	Percent	Cumulative Percent
MALE	204	204	91.47982	91.4798
FEMALE	18	222	8.07175	99.5516
UNKNOWN	1	223	0.44843	100.0000
Missing	0	223	0.00000	100.0000

Variable	Descriptive Statistics					
	Mean	Std.Dev	Minimum	Maximum	N	No.cases Missing
Age	21.83784	3.751417	16.00000	42.00000	222	1



Method

Applicants were classified into Black and non-Black for the purpose of the analysis, since the size of the sample did not allow for finer distinctions.

Applicants were classified into score levels for the test being evaluated. The cut-offs for the levels were determined by examining the frequency distributions for both race groups, trying to ensure a sufficient number of cases for both races in each category.

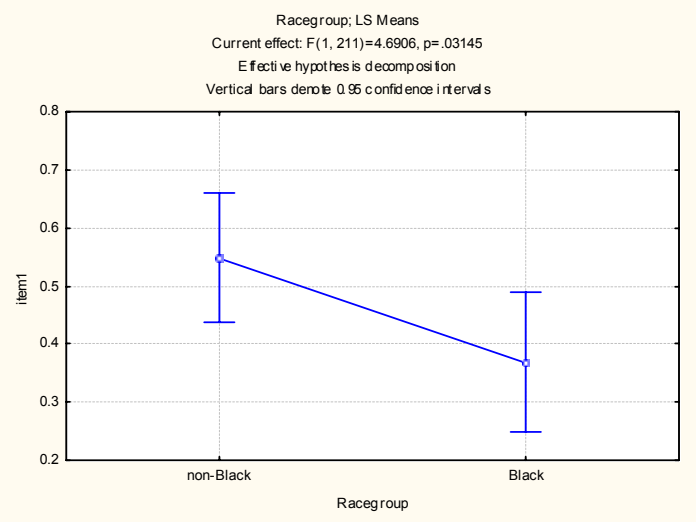
The statistical technique used in this study was factorial analysis of variance. For every item a factorial analysis of variance was done, using the scored item response as dependent variable, and the race group and score level (on the overall test score for the subtest being investigated) as predictor variables. If a significant effect was found for race, that was taken as an indication of uniform item bias, and the least-square difference in the means for that item was plotted graphically to illustrate which race group had a higher probability of getting the item right. If a significant interaction effect was found for race group and score level, that was taken as an indication of non-uniform item bias, and the means at all levels for both race groups were plotted to illustrate the severity of the non-uniform bias that was found.

Detailed results by item for Mechanical Reasoning Test

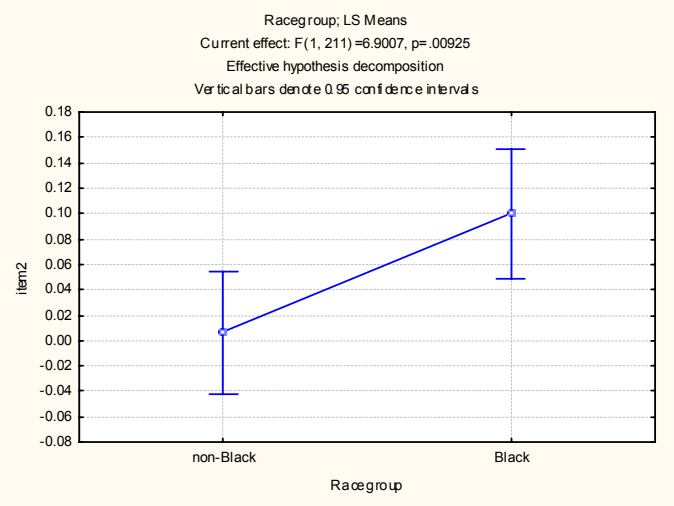
Item number	Uniform Bias	In favour of group	Non-uniform bias
1	Yes	Non-Black	No
2	Yes	Black	No
3	No		No
4	No		No
5	No		No
6	No		No
7	No		No
8	No		No
9	No		No
10	No		No
11	No		No
12	No		No
13	No		No
14	No		No
15	No		No
16	No		No
17	No		No
18	No		No
19	No		No
20	No		No
21	Yes	Non-Black	No
22	No		No
23	Yes	Non-Black	No
24	No		No
25	No		No
26	Yes	Black	No
27	No		No
28	No		No
29	No		No
30	No		No
31	No		No
32	No		No
33	No		No
34	Yes	Black	Yes
35	Yes	Black	Yes
36	Yes	Non-Black	Yes
37	No		No
38	No		No
39	No		No
40	No		No
41	No		No
42	No		No
43	Yes	Black	Yes
44	Yes	Non-Black	No
45	No		No

Uniform bias was found in 10 items.
5 items were biased in favour of the Non-Black group and 5 in favour of the Black group.
Non-Uniform bias was found in 4 items.
More information about this bias can be found in the graphs included in the detailed results that follow.

Effect	Univariate Tests of Significance for item1 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept	28.34186	1	28.34186	121.6907	0.000000
Racegroup	1.09245	1	1.09245	4.6906	0.031449
Scorelevel	0.72583	4	0.18146	0.7791	0.539872
Racegroup*Scorelevel	0.71593	4	0.17898	0.7685	0.546811
Error	49.14206	211	0.23290		



Effect	Univariate Tests of Significance for item2 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup					
Scorelevel	0.219164	4	0.054791	1.276062	0.280463
Racegroup*Scorelevel	0.143084	4	0.035771	0.833096	0.505461
Error	9.059809	211	0.042937		



Effect	Univariate Tests of Significance for item3 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept	18.19307	1	18.19307	80.12244	0.000000
Racegroup	0.00058	1	0.00058	0.00255	0.959736
Scorelevel	1.54553	4	0.38638	1.70163	0.150826
Racegroup*Scorelevel	1.00297	4	0.25074	1.10427	0.355531
Error	47.91089	211	0.22707		

Effect	Univariate Tests of Significance for item4 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.07847	1	0.07847	0.3139	0.575873
Scorelevel	1.00132	4	0.25033	1.0015	0.407749
Racegroup*Scorelevel	0.48305	4	0.12076	0.4831	0.748117
Error	52.74116	211	0.24996		

Effect	Univariate Tests of Significance for item5 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.00132	1	0.00132	0.0053	0.942265
Scorelevel	0.84130	4	0.21033	0.8383	0.502228
Racegroup*Scorelevel	0.33392	4	0.08348	0.3327	0.855752
Error	52.93976	211	0.25090		

Effect	Univariate Tests of Significance for item6 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.27678	1	0.27678	1.13522	0.287882
Scorelevel	0.07128	4	0.01782	0.07309	0.990227
Racegroup*Scorelevel	1.96902	4	0.49226	2.01901	0.092956
Error	51.44405	211	0.24381		

Effect	Univariate Tests of Significance for item7 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept	35.21844	1	35.21844	146.6908	0.000000
Racegroup	0.15807	1	0.15807	0.6584	0.418047
Scorelevel	2.22069	4	0.55517	2.3124	0.058764
Racegroup*Scorelevel	0.49915	4	0.12479	0.5198	0.721296
Error	50.65820	211	0.24009		

Effect	Univariate Tests of Significance for item8 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.08313	1	0.08313	0.36241	0.547819
Scorelevel	1.47156	4	0.36789	1.60379	0.174531
Racegroup*Scorelevel	0.67795	4	0.16949	0.73887	0.566426
Error	48.40084	211	0.22939		

Effect	Univariate Tests of Significance for item9 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.04119	1	0.04119	0.1679	0.682361
Scorelevel	0.77663	4	0.19416	0.7916	0.531785
Racegroup*Scorelevel	0.74791	4	0.18698	0.7623	0.550858
Error	51.75230	211	0.24527		

Effect	Univariate Tests of Significance for item10 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.58700	1	0.58700	2.5749	0.110065
Scorelevel	2.07145	4	0.51786	2.2717	0.062660
Racegroup*Scorelevel	0.29827	4	0.07457	0.3271	0.859591
Error	48.10100	211	0.22797		

Effect	Univariate Tests of Significance for item11 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept	8.59725	1	8.597245	45.02950	0.000000
Racegroup	0.06310	1	0.063101	0.33050	0.565976
Scorelevel	0.85223	4	0.213057	1.11592	0.349966
Racegroup*Scorelevel	0.47799	4	0.119498	0.62589	0.644533
Error	40.28512	211	0.190925		

Effect	Univariate Tests of Significance for item12 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.30939	1	0.30939	1.3591	0.245005
Scorelevel	1.71090	4	0.42772	1.8790	0.115292
Racegroup*Scorelevel	0.86367	4	0.21592	0.9485	0.436872
Error	48.03157	211	0.22764		

Effect	Univariate Tests of Significance for item13 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.13743	1	0.13743	0.58440	0.445447
Scorelevel	1.17512	4	0.29378	1.24930	0.291195
Racegroup*Scorelevel	0.47231	4	0.11808	0.50213	0.734205
Error	49.61783	211	0.23516		

Effect	Univariate Tests of Significance for item14 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.10420	1	0.104197	0.87503	0.350636
Scorelevel	0.49815	4	0.124537	1.04584	0.384525
Racegroup*Scorelevel	0.19164	4	0.047911	0.40235	0.806839
Error	25.12544	211	0.119078		

Effect	Univariate Tests of Significance for item15 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept	15.97573	1	15.97573	70.42269	0.000000
Racegroup	0.36070	1	0.36070	1.59002	0.208716
Scorelevel	0.58580	4	0.14645	0.64556	0.630601
Racegroup*Scorelevel	0.45130	4	0.11282	0.49734	0.737709
Error	47.86639	211	0.22685		

Effect	Univariate Tests of Significance for item16 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.05240	1	0.05240	0.24724	0.619546
Scorelevel	1.91683	4	0.47921	2.26088	0.063731
Racegroup*Scorelevel	0.32882	4	0.08220	0.38784	0.817219
Error	44.72264	211	0.21196		

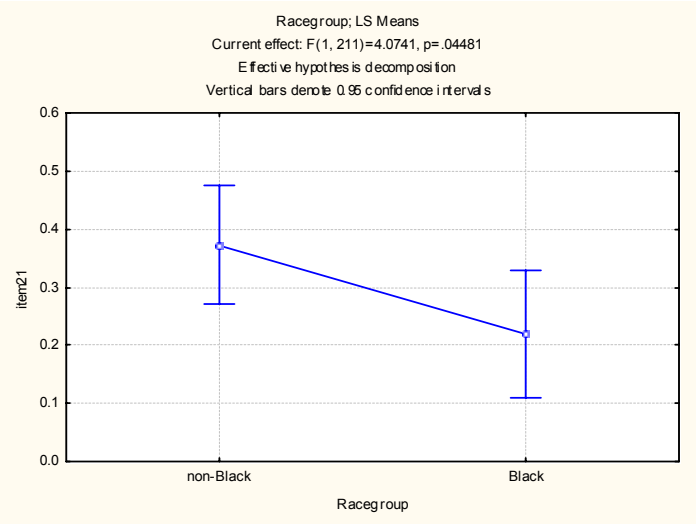
Effect	Univariate Tests of Significance for item17 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.01979	1	0.01979	0.10102	0.750921
Scorelevel	1.44543	4	0.36136	1.84442	0.121533
Racegroup*Scorelevel	0.26984	4	0.06746	0.34432	0.847783
Error	41.33891	211	0.19592		

Effect	Univariate Tests of Significance for item18 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.32415	1	0.32415	1.6689	0.197813
Scorelevel					
Racegroup*Scorelevel	0.84337	4	0.21084	1.0855	0.364628
Error	40.98178	211	0.19423		

Effect	Univariate Tests of Significance for item19 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept	29.46998	1	29.46998	125.2677	0.000000
Racegroup	0.34357	1	0.34357	1.4604	0.228217
Scorelevel	1.51786	4	0.37946	1.6130	0.172167
Racegroup*Scorelevel	0.43536	4	0.10884	0.4626	0.763101
Error	49.63901	211	0.23526		

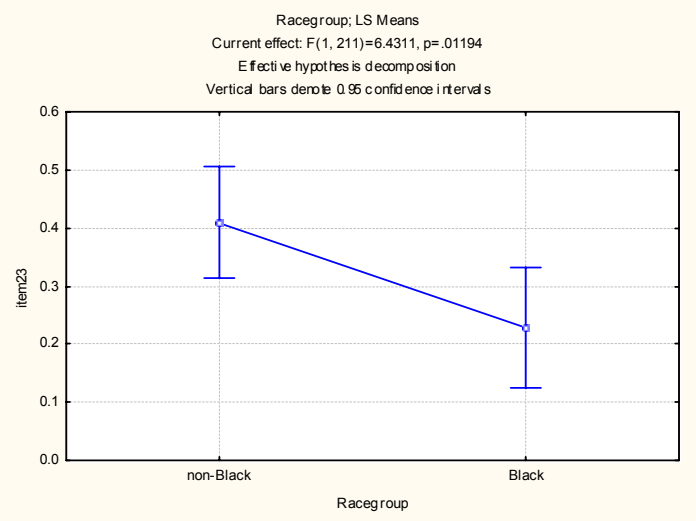
Effect	Univariate Tests of Significance for item20 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.48500	1	0.48500	1.9859	0.160238
Scorelevel	1.60376	4	0.40094	1.6417	0.164957
Racegroup*Scorelevel	0.54843	4	0.13711	0.5614	0.690911
Error	51.52939	211	0.24422		

Effect	Univariate Tests of Significance for item21 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup					
Scorelevel	0.81639	4	0.20410	1.04080	0.387111
Racegroup*Scorelevel	0.76028	4	0.19007	0.96927	0.425280
Error	41.37615	211	0.19610		



Effect	Univariate Tests of Significance for item22 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept	8.16419	1	8.164186	44.42382	0.000000
Racegroup	0.00482	1	0.004820	0.02623	0.871505
Scorelevel	1.02651	4	0.256628	1.39639	0.236329
Racegroup*Scorelevel	0.04350	4	0.010875	0.05917	0.993474
Error	38.77747	211	0.183779		

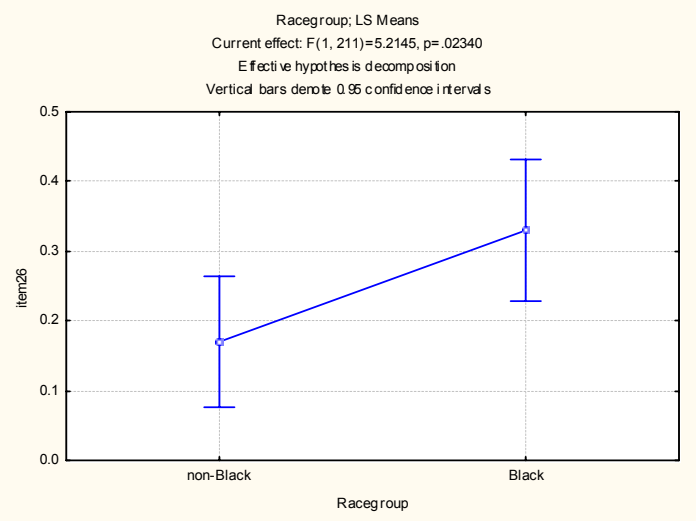
Effect	Univariate Tests of Significance for item23 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup					
Scorelevel					
Racegroup*Scorelevel	0.30831	4	0.07708	0.44496	0.776001
Error	36.54966	211	0.17322		



Effect	Univariate Tests of Significance for item24 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.14461	1	0.14461	0.67166	0.413399
Scorelevel					
Racegroup*Scorelevel	0.17823	4	0.04456	0.20695	0.934372
Error	45.42969	211	0.21531		

Effect	Univariate Tests of Significance for item25 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept	20.27827	1	20.27827	104.5893	0.000000
Racegroup	0.00177	1	0.00177	0.0091	0.924062
Scorelevel	3.78874	4	0.94719	4.8853	0.000870
Racegroup*Scorelevel	0.59038	4	0.14759	0.7612	0.551570
Error	40.90969	211	0.19388		

Effect	Univariate Tests of Significance for item26 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup					
Scorelevel					
Racegroup*Scorelevel	0.44573	4	0.111433	0.67189	0.612156
Error	34.99440	211	0.165850		



Effect	Univariate Tests of Significance for item27 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.01754	1	0.01754	0.08905	0.765684
Scorelevel					
Racegroup*Scorelevel	0.44072	4	0.11018	0.55927	0.692479
Error	41.56867	211	0.19701		

Effect	Univariate Tests of Significance for item28 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept	3.14215	1	3.142154	29.99521	0.000000
Racegroup	0.11677	1	0.116769	1.11469	0.292272
Scorelevel	1.26811	4	0.317027	3.02636	0.018691
Racegroup*Scorelevel	0.62659	4	0.156647	1.49536	0.204739
Error	22.10334	211	0.104755		

Effect	Univariate Tests of Significance for item29 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.05181	1	0.05181	0.28782	0.592187
Scorelevel					
Racegroup*Scorelevel	1.03892	4	0.25973	1.44288	0.220987
Error	37.98160	211	0.18001		

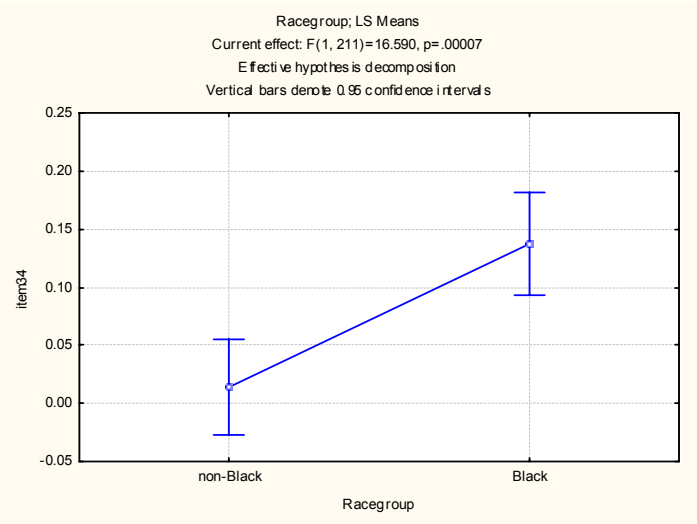
Effect	Univariate Tests of Significance for item30 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.09722	1	0.09722	0.57259	0.450075
Scorelevel					
Racegroup*Scorelevel	0.26343	4	0.06586	0.38788	0.817189
Error	35.82630	211	0.16979		

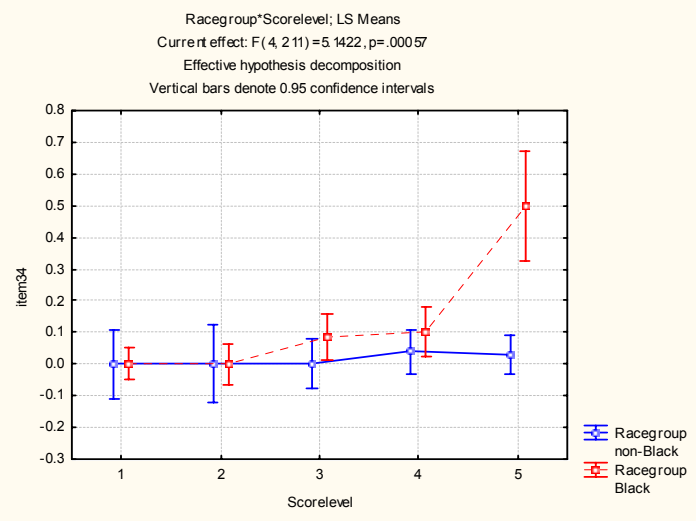
Effect	Univariate Tests of Significance for item31 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.042149	1	0.042149	1.09172	0.297287
Scorelevel	0.160874	4	0.040219	1.04171	0.386645
Racegroup*Scorelevel	0.347389	4	0.086847	2.24945	0.064887
Error	8.146321	211	0.038608		

Effect	Univariate Tests of Significance for item32 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept	2.71836	1	2.718362	28.06657	0.000000
Racegroup	0.05442	1	0.054420	0.56188	0.454339
Scorelevel	2.16019	4	0.540048	5.57589	0.000276
Racegroup*Scorelevel	0.15140	4	0.037849	0.39079	0.815115
Error	20.43621	211	0.096854		

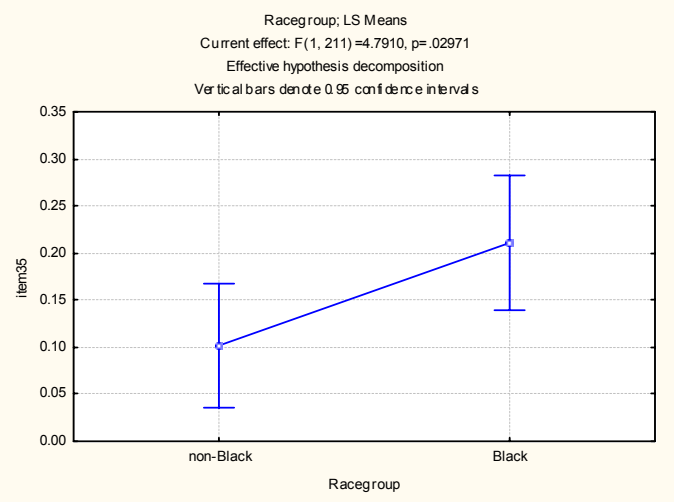
Effect	Univariate Tests of Significance for item33 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.16175	1	0.161745	1.05323	0.305939
Scorelevel					
Racegroup*Scorelevel	0.37069	4	0.092673	0.60345	0.660558
Error	32.40330	211	0.153570		

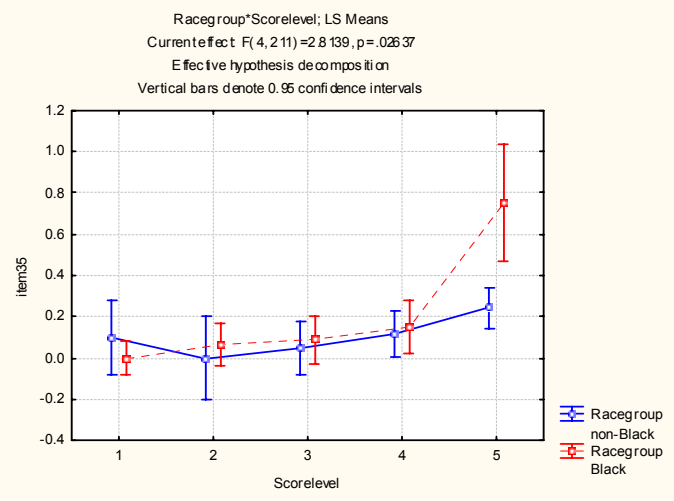
Effect	Univariate Tests of Significance for item34 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup					
Scorelevel					
Racegroup*Scorelevel					
Error	6.557322	211	0.031077		



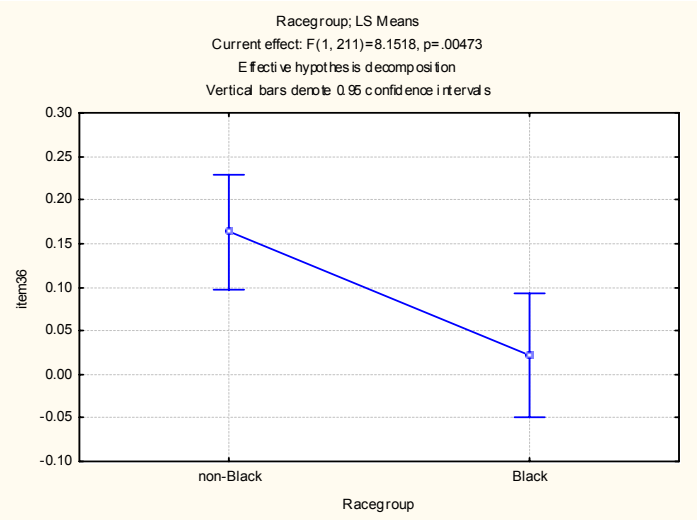


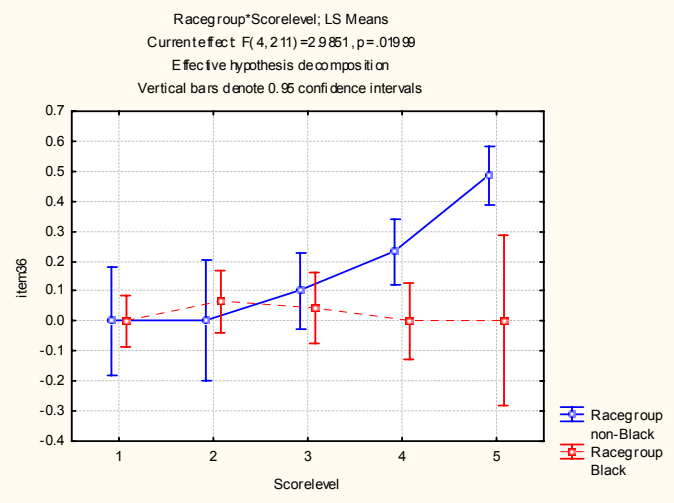
Effect	Univariate Tests of Significance for item35 Sigma-restricted parameterization Effective hypothesis decomposition				
	SS	Degr. of Freedom	MS	F	p
Intercept	3.28012	1	3.280123	39.41040	0.000000
Racegroup	0.39875	1	0.398751	4.79096	0.029707
Scorelevel	2.49352	4	0.623380	7.48986	0.000012
Racegroup*Scorelevel	0.93682	4	0.234205	2.81395	0.026368
Error	17.56151	211	0.083230		





Effect	Univariate Tests of Significance for item36 Sigma-restricted parameterization Effective hypothesis decomposition				
	SS	Degr. of Freedom	MS	F	p
Intercept	1.15085	1	1.150854	13.88768	0.000249
Racegroup	0.67553	1	0.675531	8.15182	0.004731
Scorelevel	0.70379	4	0.175947	2.12320	0.079069
Racegroup*Scorelevel	0.98947	4	0.247369	2.98507	0.019987
Error	17.48530	211	0.082869		





Effect	Univariate Tests of Significance for item37 Sigma-restricted parameterization Effective hypothesis decomposition				
	SS	Degr. of Freedom	MS	F	p
Intercept	3.63783	1	3.637826	32.65936	0.000000
Racegroup	0.00064	1	0.000639	0.00574	0.939689
Scorelevel	2.38889	4	0.597223	5.36170	0.000394
Racegroup*Scorelevel	0.82018	4	0.205046	1.84084	0.122197
Error	23.50264	211	0.111387		

Effect	Univariate Tests of Significance for item38 Sigma-restricted parameterization Effective hypothesis decomposition				
	SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.00492	1	0.004918	0.04732	0.828008
Scorelevel					
Racegroup*Scorelevel	0.14386	4	0.035964	0.34604	0.846594
Error	21.92927	211	0.103930		

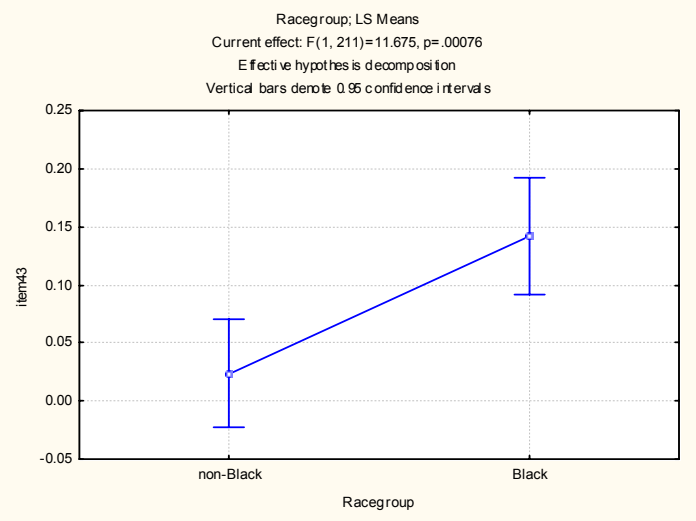
Effect	Univariate Tests of Significance for item39 Sigma-restricted parameterization Effective hypothesis decomposition				
	SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.057688	1	0.057688	1.311787	0.253369
Scorelevel	0.206159	4	0.051540	1.171982	0.324166
Racegroup*Scorelevel	0.157083	4	0.039271	0.892993	0.468994
Error	9.279047	211	0.043977		

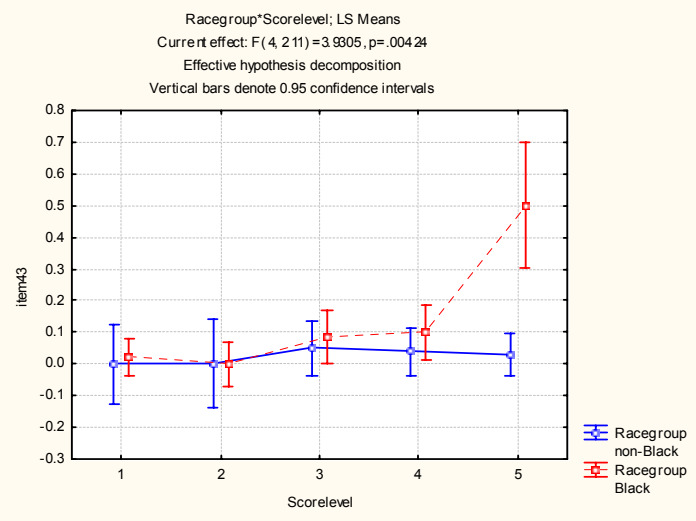
Effect	Univariate Tests of Significance for item40 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept	0.50316	1	0.503160	7.878757	0.005470
Racegroup	0.04004	1	0.040040	0.626973	0.429357
Scorelevel	0.28744	4	0.071860	1.125228	0.345570
Racegroup*Scorelevel	0.39049	4	0.097621	1.528609	0.195009
Error	13.47506	211	0.063863		

Effect	Univariate Tests of Significance for item41 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept	0.141941	1	0.141941	3.753693	0.054026
Racegroup	0.076038	1	0.076038	2.010862	0.157652
Scorelevel	0.169026	4	0.042257	1.117498	0.349218
Racegroup*Scorelevel	0.229260	4	0.057315	1.515725	0.198729
Error	7.978666	211	0.037814		

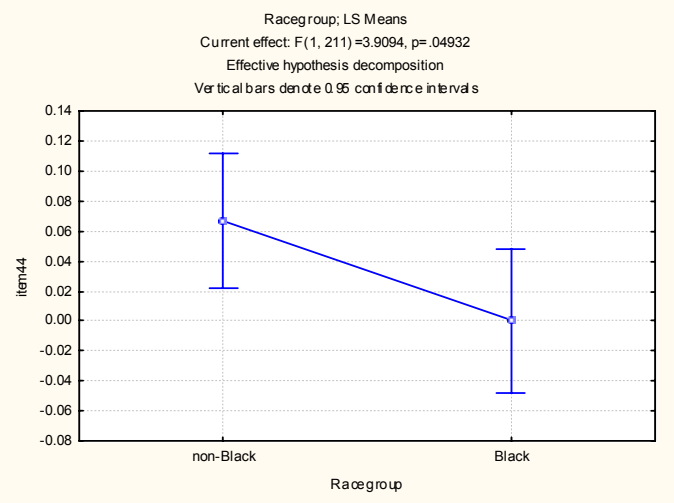
Effect	Univariate Tests of Significance for item42 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.10416	1	0.104163	1.31932	0.252015
Scorelevel	0.51314	4	0.128284	1.62483	0.169164
Racegroup*Scorelevel	0.48792	4	0.121980	1.54498	0.190373
Error	16.65896	211	0.078952		

Effect	Univariate Tests of Significance for item43 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup					
Scorelevel					
Racegroup*Scorelevel					
Error	8.485583	211	0.040216		





Effect	Univariate Tests of Significance for item44 Sigma-restricted parameterization Effective hypothesis decomposition				
	SS	Degr. of Freedom	MS	F	p
Intercept	0.147706	1	0.147706	3.909351	0.049320
Racegroup	0.147706	1	0.147706	3.909351	0.049320
Scorelevel	0.169293	4	0.042323	1.120173	0.347952
Racegroup*Scorelevel	0.169293	4	0.042323	1.120173	0.347952
Error	7.972145	211	0.037783		



Effect	Univariate Tests of Significance for item45 Sigma-restricted parameterization Effective hypothesis decomposition				
	SS	Degr. of Freedom	MS	F	p
Intercept	0.001239	1	0.001239	0.269563	0.604169
Racegroup	0.001239	1	0.001239	0.269563	0.604169
Scorelevel	0.002985	4	0.000746	0.162372	0.957166
Racegroup*Scorelevel	0.002985	4	0.000746	0.162372	0.957166
Error	0.969697	211	0.004596		

Detailed results by item: Spatial Reasoning Test

Item number	Uniform bias	In favour of group	Non-uniform bias
1	No		No
2	No		No
3	No		No
4	No		No
5	No		No
6	No		No
7	No		No
8	No		No
9	No		No
10	No		No
11	No		No
12	No		No
13	No		No
14	No		No
15	No		No
16	No		No
17	Yes	Non-Black	No
18	No		No
19	No		Yes
20	No		No
21	Yes	Non-Black	No
22	No		No
23	No		No
24	No		No
25	No		No
26	No		No
27	No		No
28	No		No
29	No		No
30	No		No

Uniform bias was found in two items, both in favour of the Non-Black group.
Non-uniform bias was found in one item.
More information about the bias that was found is given in the graphs that are included in the detailed results that follow.

Effect	Univariate Tests of Significance for item1 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept	34.46339	1	34.46339	145.8782	0.000000
Racegroup	0.18867	1	0.18867	0.7986	0.372523
Scorelevel	2.81327	4	0.70332	2.9770	0.020250
Racegroup*Scorelevel	0.89982	4	0.22495	0.9522	0.434795
Error	49.84826	211	0.23625		

Effect	Univariate Tests of Significance for item2 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.30780	1	0.30780	1.2857	0.258136
Scorelevel					
Racegroup*Scorelevel	1.57312	4	0.39328	1.6427	0.164725
Error	50.51594	211	0.23941		

Effect	Univariate Tests of Significance for item3 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.00084	1	0.00084	0.0037	0.951328
Scorelevel					
Racegroup*Scorelevel	1.11486	4	0.27871	1.2394	0.295230
Error	47.44751	211	0.22487		

Effect	Univariate Tests of Significance for item4 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.57953	1	0.57953	2.4387	0.119871
Scorelevel	1.26226	4	0.31557	1.3279	0.260633
Racegroup*Scorelevel	1.00849	4	0.25212	1.0609	0.376857
Error	50.14167	211	0.23764		

Effect	Univariate Tests of Significance for item5 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept	4.38297	1	4.382970	32.18042	0.000000
Racegroup	0.01749	1	0.017485	0.12838	0.720478
Scorelevel	0.90316	4	0.225790	1.65778	0.161057
Racegroup*Scorelevel	0.41882	4	0.104706	0.76876	0.546629
Error	28.73817	211	0.136200		

Effect	Univariate Tests of Significance for item6 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.01355	1	0.01355	0.0569	0.811670
Scorelevel					
Racegroup*Scorelevel	0.92958	4	0.23239	0.9761	0.421507
Error	50.23479	211	0.23808		

Effect	Univariate Tests of Significance for item7 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.48043	1	0.48043	2.1156	0.147289
Scorelevel	1.00238	4	0.25059	1.1035	0.355890
Racegroup*Scorelevel	1.82714	4	0.45678	2.0115	0.094040
Error	47.91501	211	0.22709		

Effect	Univariate Tests of Significance for item8 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.03362	1	0.03362	0.1447	0.704022
Scorelevel					
Racegroup*Scorelevel	1.32277	4	0.33069	1.4233	0.227332
Error	49.02361	211	0.23234		

Effect	Univariate Tests of Significance for item9 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept	8.01138	1	8.011379	45.71650	0.000000
Racegroup	0.03118	1	0.031179	0.17792	0.673594
Scorelevel	2.12095	4	0.530239	3.02578	0.018708
Racegroup*Scorelevel	0.77136	4	0.192841	1.10044	0.357379
Error	36.97573	211	0.175240		

Effect	Univariate Tests of Significance for item10 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.04350	1	0.04350	0.23590	0.627689
Scorelevel					
Racegroup*Scorelevel	0.98453	4	0.24613	1.33467	0.258147
Error	38.91157	211	0.18442		

Effect	Univariate Tests of Significance for item11 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.02931	1	0.02931	0.1477	0.701172
Scorelevel					
Racegroup*Scorelevel	0.57850	4	0.14462	0.7285	0.573408
Error	41.89045	211	0.19853		

Effect	Univariate Tests of Significance for item12 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.01452	1	0.014518	0.11166	0.738597
Scorelevel	0.98896	4	0.247240	1.90148	0.111388
Racegroup*Scorelevel	0.30754	4	0.076886	0.59132	0.669282
Error	27.43517	211	0.130025		

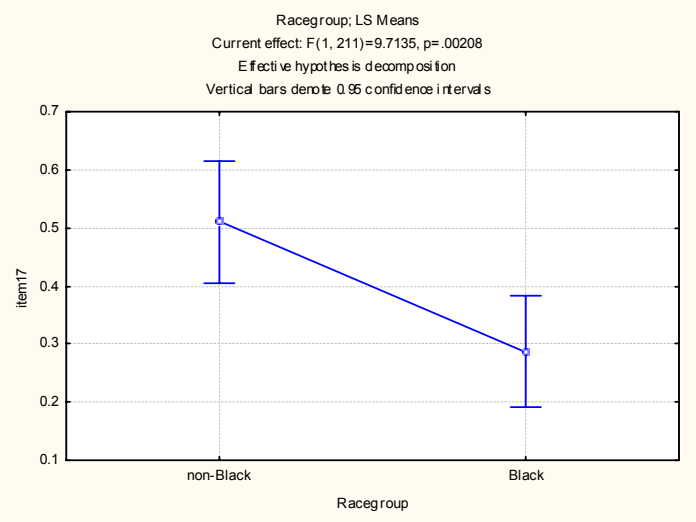
Effect	Univariate Tests of Significance for item13 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept	23.88500	1	23.88500	105.6173	0.000000
Racegroup	0.01651	1	0.01651	0.0730	0.787271
Scorelevel	3.03051	4	0.75763	3.3502	0.011018
Racegroup*Scorelevel	1.93734	4	0.48434	2.1417	0.076820
Error	47.71695	211	0.22615		

Effect	Univariate Tests of Significance for item14 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.21245	1	0.21245	1.4189	0.234917
Scorelevel					
Racegroup*Scorelevel	0.80277	4	0.20069	1.3404	0.256040
Error	31.59164	211	0.14972		

Effect	Univariate Tests of Significance for item15 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.52942	1	0.52942	2.4406	0.119730
Scorelevel					
Racegroup*Scorelevel	0.17928	4	0.04482	0.2066	0.934550
Error	45.77047	211	0.21692		

Effect	Univariate Tests of Significance for item16 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.01812	1	0.018124	0.14973	0.699187
Scorelevel	0.57933	4	0.144832	1.19647	0.313401
Racegroup*Scorelevel	0.38937	4	0.097343	0.80416	0.523727
Error	25.54136	211	0.121049		

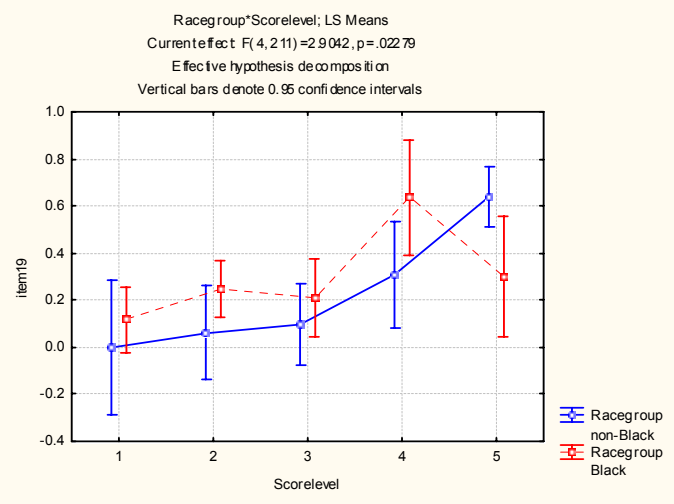
Effect	Univariate Tests of Significance for item17 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept	25.49777	1	25.49777	122.2796	0.000000
Racegroup	2.02545	1	2.02545	9.7135	0.002084
Scorelevel	2.00881	4	0.50220	2.4084	0.050481
Racegroup*Scorelevel	1.25352	4	0.31338	1.5029	0.202502
Error	43.99776	211	0.20852		



Effect	Univariate Tests of Significance for item18 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.01668	1	0.016677	0.12081	0.728509
Scorelevel					
Racegroup*Scorelevel	1.29912	4	0.324780	2.35269	0.055139
Error	29.12775	211	0.138046		

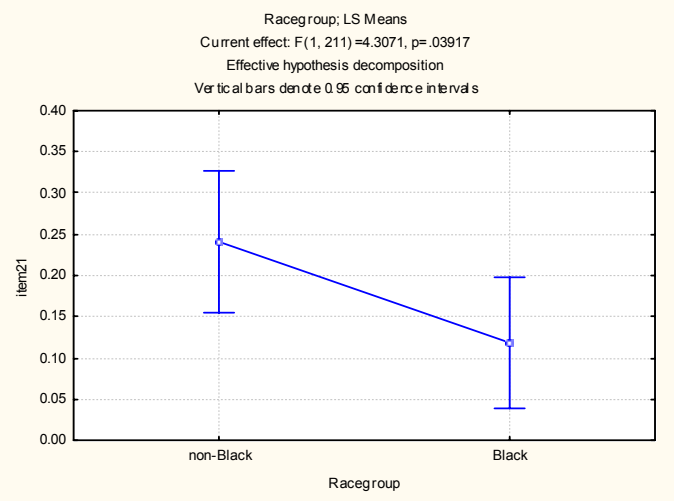
Effect	Univariate Tests of Significance for item18 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.01668	1	0.016677	0.12081	0.728509
Scorelevel					
Racegroup*Scorelevel	1.29912	4	0.324780	2.35269	0.055139
Error	29.12775	211	0.138046		

Effect	Univariate Tests of Significance for item19 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept	10.98107	1	10.98107	66.32346	0.000000
Racegroup	0.25771	1	0.25771	1.55650	0.213562
Scorelevel	4.52712	4	1.13178	6.83572	0.000034
Racegroup*Scorelevel	1.92337	4	0.48084	2.90419	0.022788
Error	34.93492	211	0.16557		



Effect	Univariate Tests of Significance for item20 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.24552	1	0.24552	1.1430	0.286232
Scorelevel					
Racegroup*Scorelevel	0.39256	4	0.09814	0.4569	0.767298
Error	45.32245	211	0.21480		

Effect	Univariate Tests of Significance for item21 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup					
Scorelevel	0.19931	4	0.049828	0.35171	0.842664
Racegroup*Scorelevel	0.96414	4	0.241034	1.70132	0.150896
Error	29.89328	211	0.141674		



Effect	Univariate Tests of Significance for item22 Sigma-restricted parameterization Effective hypothesis decomposition				
	SS	Degr. of Freedom	MS	F	p
Intercept	1.16555	1	1.165549	14.70917	0.000166
Racegroup	0.08955	1	0.089555	1.13018	0.288953
Scorelevel	1.97348	4	0.493369	6.22629	0.000094
Racegroup*Scorelevel	0.09733	4	0.024332	0.30707	0.873048
Error	16.71956	211	0.079240		

Effect	Univariate Tests of Significance for item23 Sigma-restricted parameterization Effective hypothesis decomposition				
	SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.15847	1	0.158472	1.24716	0.265365
Scorelevel					
Racegroup*Scorelevel	0.50017	4	0.125043	0.98408	0.417152
Error	26.81084	211	0.127066		

Effect	Univariate Tests of Significance for item24 Sigma-restricted parameterization Effective hypothesis decomposition				
	SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.02517	1	0.025166	0.17014	0.680409
Scorelevel					
Racegroup*Scorelevel	0.59533	4	0.148832	1.00619	0.405236
Error	31.21022	211	0.147916		

Effect	Univariate Tests of Significance for item25 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept	4.52336	1	4.523365	34.86124	0.000000
Racegroup	0.25931	1	0.259307	1.99846	0.158933
Scorelevel	3.04333	4	0.760834	5.86369	0.000171
Racegroup*Scorelevel	0.31208	4	0.078021	0.60130	0.662104
Error	27.37797	211	0.129753		

Effect	Univariate Tests of Significance for item26 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.00205	1	0.002050	0.02311	0.879322
Scorelevel					
Racegroup*Scorelevel	0.03782	4	0.009454	0.10659	0.980126
Error	18.71481	211	0.088696		

Effect	Univariate Tests of Significance for item27 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.07687	1	0.076869	0.85071	0.357404
Scorelevel					
Racegroup*Scorelevel	0.07690	4	0.019224	0.21276	0.931160
Error	19.06561	211	0.090358		

Effect	Univariate Tests of Significance for item28 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.13699	1	0.136992	2.520618	0.113864
Scorelevel	0.45324	4	0.113309	2.084858	0.083932
Racegroup*Scorelevel	0.08885	4	0.022213	0.408721	0.802258
Error	11.46752	211	0.054348		

Effect	Univariate Tests of Significance for item29 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept	0.64677	1	0.646772	8.903550	0.003182
Racegroup	0.06523	1	0.065231	0.897981	0.344408
Scorelevel	0.19509	4	0.048772	0.671407	0.612493
Racegroup*Scorelevel	0.39361	4	0.098402	1.354619	0.250909
Error	15.32748	211	0.072642		

Effect	Univariate Tests of Significance for item30 Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept					
Racegroup	0.004644	1	0.004644	0.111249	0.739058
Scorelevel					
Racegroup*Scorelevel	0.041915	4	0.010479	0.251036	0.908809
Error	8.807585	211	0.041742		