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RANKINGS OF SCIENCE AND TECHNOLOGY RELATED GLOBAL PROBLEMS: A COMPARISON OF GENDER DIFFERENCES AMONG SCHOOL PUPILS IN THE NORTHERN AND WESTERN CAPE PROVINCES

by

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ABSTRACT

In 1984 Bybee used 262 science educators from 41 countries to develop an instrument for measuring their ranked priorities of science and technology related global problems. In 1995 the original Bybee scale was updated and clarified, and a new 15-item version, the Le Grange Global Priorities Instrument (LGPI), was piloted, refined and validated.

The new Le Grange Global Priorities Instrument (LGPI) was administered to 421 North Sotho, 233 urban Xhosa and 348 suburban Coloured high school pupils in the Northern Province and Western Cape Province respectively.

The study is an enlargement of the work of Bybee and Mau (1986); Bybee and Najafi (1986); Ndodana, Rochford and Fraser (1994); and Le Grange, Rochford and Sass (1995) and it is to date the first one of its kind to be extended to school pupils.

Data was collected during a seven month period from January to July 1995 as part of the normal class schedule, with the help of science teachers and school principals. The data gathered were analysed with the Statgraphics package available in the standard computer. More than 96 percent of the data gathered were used for this analysis.

Using the Spearman rank order correlation, this study found that high correlation coefficients ranging from $r=0.78$ to $r=0.94$ existed between the global priorities of male and female pupils ' mean ranks on the LGPI scale as a whole within the three samples. With gender held constant, however, lower correlation coefficients ranging from $r=0.60$ to $r=0.36$ were obtained across language and geographical region.

Using the Mann-Whitney U-test, for the purpose of establishing the extent of differences between the genders and regional responses to the LGPI, this study found that significant intracultural gender differences did not exist in the three samples, except for several priority differences between genders in the Coloured sample. Few statistically significant differences existing between the three samples could be attributed to the gender variable alone.

With gender held constant, however, large intercultural differences occurred between almost every pair of samples studied. The gender variable emerged as only a minor one compared to other sociocultural variables such as region or language.

Using the Mann-Whitney U-test global concerns for the **provision of mass housing and fresh water supplies** emerged as the greatest discriminating items on six out of nine pairs of contrasted samples compared across regions and languages. However, concerns for items like **unsafe substances, population growth, and the extinction of species** also appeared as discriminating items in five of the nine hypotheses investigated.

It was found that all the items top-ranked by the three samples concerned basic needs for long-term human survival namely, **human health and disease, population growth, fresh water supplies** and **world hunger**. These preliminary findings provide initial empirical support for several important stated policies of the new South African Government of National Unity's Reconstruction and Development Programme of 1994.

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"LIVE AND LET LIVE"

"MONTSHEPETSA BOSEGO KE MO LEBOGA BOSELE"

TABLE OF CONTENTS

CHAPTER 1

INTRODUCTION TO THE STUDY

CHAPTER 2

THEORETICAL FRAMEWORK AND PREVIOUS RESEARCH FINDINGS

CHAPTER 3

METHODOLOGY, SAMPLE AND INSTRUMENTATION

CHAPTER 4

PRESENTATION OF RESULTS

CHAPTER 5

DISCUSSION AND IMPLICATIONS OF RESULTS

CHAPTER 6

CONCLUSION AND RECOMMENDATIONS

LIST OF FIGURES

LIST OF TABLES

TABLE

LIST OF APPENDICES

LIST OF ABBREVIATIONS

AIDS	Acquired Immune Deficiency Syndrome
ANC	African National Congress
CPA	Cape Provincial Administration
HDE	Higher Diploma in Education
HIV	Human Immunodeficiency Virus
LGPI	Le Grange Global Priorities Instrument
NARST	National Association of Research in Science Teaching
RAU	Randse Afrikaanse University
RDP	Reconstruction and Development Programme
RSA	Republic of South Africa
STS	Science-Technology-Society
TPA	Transvaal Provincial Administration
UCT	University of Cape Town
WCEEAT	World Conference on Engineering Education for Advancing Technology

CHAPTER 1

INTRODUCTION TO THE STUDY

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INTRODUCTION TO THE STUDY

1.1 ORIGIN OF THE PROBLEM

South Africans are faced with a complex task of solving problems for long-term survival that include the provision of food, water, health and quality air; and the management of population growth, waste disposal, pollution, scarce resources and the environment.

While there is almost universal agreement that a well educated nation is a pre-requisite for finding eventual solutions to these problems, in South Africa educational inadequacies remain widespread, particularly with regard to facilities and human resources in science and mathematics in Black schools (Spargo 1995; Hope and Timmel 1987; Government White Paper on the Reconstruction Development Programme 1994; and Cross 1993).

Currently the Government of National Unity has made a priority commitment to redressing this. In its White paper on Education and Training, the Ministry of Education says:

> "The improvement of the quality of education and training services is essential. In many of the schools and colleges serving the majority of the population there has been a precipitous decline in the quality of educational performance, which must be reversed. But quality is required across the board. It is linked to the capacity and commitment of the teacher, the appropriateness of the curriculum, and the way standards are set and assessed" (Government White Paper on Education and Training 1995:21).

On Science education, the White paper continues:

> "An **appropriate mathematics, science and technology education initiative** is essential to stem the waste of talent, and make up the chronic national deficit, in these fields of learning, which are crucial to human understanding and to economic advancement" (Government White Paper on Education and Training 1995: 22).

On the same page the paper points out the direction in which efforts are to be put, saying:

> "Environmental education, involving an inter-disciplinary, integrated and active approach to learning, must be a vital element of all levels and programmes of the education and training system, in order to create environmentally literate and active citizens and ensure that all South Africans, present and future, enjoy a decent quality of life through the sustainable use of resources (Government White Paper on Education and Training 1995:22).

Thus, there is little doubt that the Ministry of Education intends to develop a holistic and integrated approach which recognises that issues of health, social, psychological, academic and vocational development, and support services for learners with special education needs in mainstream schools are inter-related (Government White Paper on Education and Training 1995:28).

The writers of the Government White Paper on the Reconstruction and Development Programme have realised the importance of restructuring the education system, and particularly science and technology education. The paper says that in the past it was poorly managed to serve the political goals of apartheid and it continues:

> "Science and technology have an important role to play in the development of all sectors in our society. Technology policy must address the development of both indigenous and exogenous science and technology, in order to meet the challenges of South Africa's people" (33 - 34).

This may be realised by letting each province develop a strategy for implementing the Reconstruction and Development Programme in the context of its particular circumstances.

Of particular relevance to the philosophy of the 1994 White Paper is the recent work in South Africa of Ndodana et al (1994). They used Bybee's (1984) scale in 1993 to show that different groups (e.g. biology teachers and engineering students) ranked the importance of these global problems differently in some respects, but similarly in other ways. Bybee's 1984 scale is reproduced in Table 1.1 on page 4.

As a sequel to Ndodana's work in 1993, Le Grange updated and modified the 1984 Bybee scale to produce the Le Grange Global Priorities Instrument in 1995, for use with school pupils in different cultural contexts, as part of a science curriculum initiative for the 1995 Reconstruction and Development Programme. Le Grange's 1995 scale, the LGPI, is set out in Table 1.2 on page 5, together with the Xhosa translation in Table 1.3 on page 6.

One of the main goals of STS programmes is fostering a sense of cultural and intellectual awareness of such issues. The understanding and prioritisation of these problems may be influenced by the cultural contexts of individuals and this is very relevant to the Reconstruction and Development Programme policy statement of meeting the basic needs of the people of South Africa.

Table 1.1 **Ranking of science and technology related global problems**

What do you see as the most important global problems related to science and technology? Rank the following from 1 to 12 (with 1 indicating your top priority). Insert your numbers in the appropriate brackets.

GLOBAL PROBLEM

[ ] HAZARDOUS SUBSTANCES (waste dumps, toxic chemicals, lead paints)

[ ] HUMAN HEALTH AND DISEASE (infectious and non-infectious disease, stress, noise, diet and nutrition, exercise, mental health)

[ ] MINERAL RESOURCES (non fuel minerals, metallic and non-metallic minerals, mining, technology, low-grade deposits, recycling, refuse)

[ ] WATER RESOURCES (waste disposal, estuaries, supply, distribution, ground water contamination, fertilizer contamination)

[ ] POPULATION GROWTH (world population, immigration, carrying capacity, foresight capability)

[ ] EXTINCTION OF PLANTS AND ANIMALS (reducing genetic diversity, widlife protection)

[ ] ENERGY SHORTAGES (synthetic fuels, solar power, fossil fuels, conservation, oil production)

[ ] WAR TECHNOLOGY (nerve gas, nuclear developments, nuclear arms threat)

[ ] AIR QUALITY AND ATMOSPHERE (acid rain, CO_2, depletion of ozone, global warming)

[ ] WORLD HUNGER AND FOOD RESOURCES (food production, agriculture, cropland conservation)

[ ] LAND USE (soil erosion, reclamation, urban development, wildlife habitat loss, deforestation, desertification, salinization)

[ ] NUCLEAR REACTORS (nuclear waste management, breeder reactors, cost of construction, safety, terrorism)

Bybee and Mau (1986 : 604).

Table 1.2 The **LGPI** (The Le Grange Global Priorities Instrument)

RANKING OF SCIENCE AND TECHNOLOGY - RELATED GLOBAL PROBLEMS

What do you see as the most important global problems related to science and technology for the human race? Rank the following from 1 to 15 (with 1 indicating your top priority). Insert your numbers in the appropriate brackets.

GLOBAL (WORLD) PROBLEM

[ ] **THE PROVISION OF MASS HOUSING FOR HUMAN BEINGS** (homes for all including garbage collection and sewage disposal, shelter, protection, street lighting, social services such as police force and postmen).

[ ] **UNSAFE SUBSTANCES** (waste dumps, poisonous chemicals, lead paints, electromagnetic wave radiation, e.g. ultraviolet radiation from the sun and microwave oven radiation).

[ ] **HUMAN HEALTH AND DISEASE** (catching and non-catching disease such as AIDS, exercise, mental health, stress, noise, diet and nutrition).

[ ] **MINERAL RESOURCES** (non-fuel minerals, metallic and non-metallic minerals, mining, technology, low grade deposits, recycling, refuse).

[ ] **FRESH WATER SUPPLIES** (waste disposal, river mouths, water supply and distribution, ground water contamination, fertilizer contamination, waste water treatment, prediction and control of floods and droughts).

[ ] **POPULATION GROWTH** (increase in world population, immigration, living space, town planning).

[ ] **EXTINCTION OF PLANTS AND ANIMALS** (fewer types of animals remaining, over-fishing, pollution and reduction of life in the oceans, wildlife protection).

[ ] **ENERGY SHORTAGES** (human manufactured fuels, solar power, fossil fuels, fewer resources, conservation, oil production).

[ ] **WAR TECHNOLOGY** (nerve gas, nuclear developments, nuclear weapons threat).

[ ] **AIR POLLUTION** (acid rain, CO_2, depletion of ozone layer, smoky smog, global warming).

[ ] **WORLD HUNGER AND FOOD SUPPLIES** (food production, crops and agricultural methods).

[ ] **BAD LAND USE** (soil erosion, reclaiming of land, city spread and growth, wildlife habitat loss, removal of forests, spreading of deserts, increase in the salt content of soils).

[ ] **NUCLEAR POWER STATIONS** (nuclear waste management and disposal, cost of construction, safety, sabotage).

[ ] **USE AND ABUSE OF TECHNOLOGY** (the electronic information explosion, education and the distribution of knowledge, genetic engineering, worldwide communication networks, job creation, indoctrination by television, the rapid sharing of controversial information by satellite).

[ ] **IGNORANT DECISION MAKERS** (scientifically and technologically illiterate community leaders, science and the humanities as two different cultures).

* Adapted, modified and updated from Bybee (1986) and Ndodana et al. (1994)

Table 1.3

The Xhosa-version of the **LGPI** (The Le Grange Global Priorities Instrument)

UKUBEKWA EZINGENI KWEZENZULULWAZI KWANEZOBUNGCALI-IINGXAKI ZELIZWE EZICHAPHAZELEKAYO

-iziphi ezona ngxaki uzibona njengezona zibalulekileyo ehlabathini ngokuphathelele ekusetyenzisweni kwezengcali -ezenzululwazi entlalweni yabantu? Linganisela ezi zilandelayo ukususela ku 1 - 15 (ubonise okuthatha njengokona -ubalulekileyo kuwe). Fakela amanani akho kwizivalelo (brackets) ezifanelekileyo.

NGXAKI ZELIZWE

] **UKWAKHIWA KWEZINDLU EZININZI ZOKUHLALISA ABANTU** (amakhaya alungele wonke umntu, kwanokuthuthwa kwenkunkuma nococeko lwangasese, iindawo zokufihla intloko, ukhuseleko, izibane ezitalatweni, iinkonzo zentlalontle ezinjengomkhosi wamapolisa noonoposi).

] **IZINTO EZINOBUNGOZI** (iindawo zokulahla inkunkuma, iikhemikhali ezinobungozi, iilead paints, ielectro-magnetic wave radiation umz: iultraviolet radiation evela elangeni ne microwave oven radiation).

] **IMPILO NEZIFO** (izifo ezibulalayo nezingabulaliyo ezifana ne gawulayo, umthambo, izigulo zengqondo, ukudinwa, ingxolo ukutya nesondlo).

] **IZIMBIWA EZIVUTHAYO NEZINGAVUTHIYO** (ezisisinyithi nezi ngesiso sinyithi, ezemigodi, ezengcali, ezikwinqanaba eli phantsi, irecycling, imigqomo).

] **AMANZI ACOCEKILEYO** (inkunkuma, umlambo, ukusetyenziswa kwamanzi, ukungcoliseka kwamanzi asemhlabeni, ukungcolisa kwezichumisi, ukuphathwa kwamanzi angasese, uqaphelo nolawulo lwezantyala tyala zemvula kwanembalela).

] **UKWANDA KOLUNTU** (Ehlabathini, uthutho/imfuduko, indawo yokuhlala, ucwangwiso lwedolophu).

] **UKUTSHITSHA KWEZITYALO NEZILWANYANA** (ukusala kwentlobo zezilwanyana ezimbalwa, ukuloba okubaxwayo, ukungcoliseka nokucutheka kwezilwanyana nezityalo zaselwandle, ukukhuseleka kobomi basendle izityalo nezilwanyana).

] **UKUNQONGOPHALA KWAMANDLA** (amandla enziwe ngabantu, amandla elanga, amandla embiwayo/amalahle, ukunqongophala kwemithombo ugcino lwamahlathi, imveliso ye-oli).

] **UBUNGCALI BEZEMFAZWE** (i-nerve gas, ukwakhiwa kweze-nuclear, ilifu lezixhobo ze-nuclear elothusayo).

] **UNGCOLISEKO LOMOYA** (imvula ye-acid, CO_2, ukucutheka kwe-Ozone, umsi ongcolisayo, i-global warming).

] **INDLALA NOKUFUMANEKA KOKUTYA** (imveliso yokutya, izityalo nendlela zolimo).

] **UKUSETYENZISWA OKUNGEKUKO KOMHLABA** (ukhukuliseko lomhaba, ukuncipha komhlaba, ukwanda nokukhula kwedolophu, ukuswela kwendle indawo zokuhlala, ukususwa kwamahlathi, ukukhula kwentlambo, ukwanda kwetyuwa emhlabeni).

] **IZITISHI ZE-NUCLEAR** (ulawulo lolahlo lwenkunkuma ye-nuclear, uxabiso lokwakhiwa, ukhuseleko,izenzo zobhukuqo).

] **UKUSETYENZISWA OKULUNGILEYO NOKUNGALUNGANGA KWEZOBUNGCALI OBUKWINQANABA ELIPHEZULU** (i-electronic information explosion, imfundo nokusasazwa kolwazi, i-genetic engineering, unxibelelwano lomhlaba, ngokubanzi ukwakhiwa kwemisebenzi, imfundiso zomabonakude, ukwahlulelana okukhawulezileyo ngenkcukacha ezingaginyisi mathe/ezixhalabisayo nge-satelite).

] **ABAQULUNQI MTHETHO ABANGACHUBEKANGA** (inkokheli zasekuhlaleni ezingenalwazi ngenzululwazi nezengcali, inzululwazi nezoluntu njengezithethe ezahlukeneyo).

It is in this context that the LGPI may be a useful, convenient and appropriate instrument for obtaining ranked priorities at high school level in respect to fifteen of the most important and recognised major global problems related to science and technology. Data obtained can be collected and analysed according to gender, age, home language or geographical area; or any other factors which may be educationally relevant, such as pupils' academic achievement in science.

1.2 OBJECTIVES

The objectives of this study are:

(a) to determine the significance of rank order correlation coefficients obtained using the LGPI, between the males and females of three samples of North Sotho pupils in the Northern Province and Xhosa and Coloured pupils in the Western Cape Province;

(b) to determine which global science-technology-society (STS) problems are consistently highly prioritised by the males and females in all three samples, irrespective of geographical area or home language;

(c) to determine the extent and the significance of differences which occur among the three samples on each one of the fifteen items taken individually on the LGPI in 1995;

(d) to suggest possible explanations for similarities and differences which occur among the three samples' rankings;

(e) to discuss the rankings in terms of priority policies set out in the Government White Paper on South Africa's new Reconstruction and Development Programme. Areas of agreement, or of different prioritisation, emerging from among the three samples will be analysed and discussed.

1.3 CLARIFICATION OF TERMS

Culture. This is defined as a complex multifaceted phenomenon which encompasses the human acquisition of knowledge, beliefs, customs and religions described as an ordered system of meaning and symbols in terms of which social interaction takes place (Jegede and Okebukola 1992; Ogawa 1986; Hunt 1975; Dusch 1988; Buseri 1987; Catsambis 1995; Haggerty 1995; Jegede and Okebukola 1995; Manzelli 1980; and Smolska 1995).

Global problems. These are problems related to science and technology as determined in 1984 by acknowledged science educators from 41 countries, but updated and modified in the LGPI (Ndodana et al 1994; Bybee and Najafi 1986; Bybee and Mau 1986; and Paldy 1984).

LGPI (the Le Grange Global Priorities Instrument). This is the modified, adapted, updated, validated and reliable version of the original 1984 Bybee scale, consisting of 15 items.

RDP (Reconstruction and Development Programme). This is defined as an integrated, coherent, socio-economic policy framework that seeks to mobilise all the people and the country's resources toward the final eradication of apartheid and the building of a democratic, non-racial and non-sexist future society (ANC 1994 and Government White Paper on Reconstruction and Development Programme 1994).

STS (Science-technology-society). This term is used to describe an ongoing effort to provide a real world context for the study of science and for the pursuit of science itself. It focusses on current issues and attempts at their resolution as the best way of preparing people for current and future citizenship roles (Bybee and Mau 1986; Ndodana et al 1994; Ost and Yager 1993; Black 1993; Brody and Bozemen 1994; Slaughter 1993; Thier 1985; and Aikenhead 1987).

1.4 VARIABLES

The independent variables chosen for this study are gender and geographical/cultural context.

Dependent variables investigated are the pupils' mean priority rankings on the LGPI, and the mean scores assigned to each one of the 15 items on the LGPI individually by the samples or sub-samples of surveyed groups of pupils.

1.5 HYPOTHESES

This study tests nine hypotheses, grouped into two sections:

Hypothesis 1. Gender correlations for the LGPI as a whole

There are no statistically significant correlations between the 15 mean rankings on the LGPI as a whole, for the following pairs of samples:

1(a) (i) North Sotho males and North Sotho females
(ii) Xhosa males and Xhosa females
(iii) Coloured males and Coloured females

1(b) (i) North Sotho males and Xhosa females
(ii) Xhosa males and Coloured males
(iii) North Sotho males and Coloured males
(iv) North Sotho females and Xhosa females
(v) Xhosa females and Coloured females
(vi) North Sotho females and Coloured females

Hypothesis 2. Differences in responses to 15 individual items on the LGPI

There will be no statistically significant differences between the mean scores given to each one of the 15 items of the LGPI taken individually, for the following pairs of samples:

2(a) (i) North Sotho males and North Sotho females
(ii) Xhosa males and Xhosa females
(iii) Coloured males and Coloured females

(b) (i) North Sotho males and Xhosa males

(ii) Xhosa males and Coloured males

(iii) North Sotho males and Coloured males

(iv) North Sotho females and Xhosa females

(v) Xhosa females and Coloured females

(vi) North Sotho females and Coloured females

1.6 ASSUMPTIONS

The basic assumption underlying this study is that the prioritisation of the 15 global problems in science and technology on the LGPI in 1995 may reflect, in some respects, the cultural and regional contextual backgrounds of responding individuals.

The second assumption underlying this study is that a universal concern for basic human needs like food, water and freedom from disease may consistently receive preferential prioritisation across cultural and regional boundaries.

1.7 DELIMITATION OF THE INVESTIGATION

The samples surveyed in this study are limited to conveniently available groups of high school pupils in the rural Northern Province and in the urban and suburban Western Cape Province areas.

1.8 LIMITATIONS

The generalisability of the findings will be limited to the samples used in this study, and to only 15 global problems of widespread concern to the human race. Some pupils may feel that more than 15 items should have been included on the LGPI, but these will not be investigated in this study.

CHAPTER 2

THEORETICAL FRAMEWORK AND LITERATURE REVIEW

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THEORETICAL FRAMEWORK AND LITERATURE REVIEW

2.1 INTRODUCTION

In this chapter the theoretical framework of the study is outlined, and relevant recommendations from the available literature are highlighted and critiqued for their strengths and weaknesses. The chapter concludes with a summary of the main points that have emerged from the literature survey.

2.2 THE USE OF RANKINGS FOR DATA GATHERING

- Nearly twenty years ago the National Association for Research in Science Teaching (NARST) commissioned Butts et al (1978) to investigate the feasibility of prioritising research areas in science education. They sent questionnaires to 780 respondents and asked them to rank a list of 35 generic statements of research on science education areas of concern on a priority scale in terms of importance, with 1 indicating the highest priority and 10 the lowest priority. In this way the common basic needs in science and technology research were established at that time; however, it was found from the responses received that the study could not identify the top priority for research in science education using the Delphi-technique. Nevertheless, research areas which were a high priority were indicated.

The mailing of questionnaires in survey research of this kind is, in my view, one of its weaknesses, because the response rate is usually well below 100 percent. In the NARST study only 327 (44%) of respondents returned the questionnaires, and there is no indication as to whether the

56% of non-respondents were experienced or inexperienced researchers; whether they failed to respond because they considered some of the items or instructions to be unclear or ambiguous; etc.

- In the same year reports of other studies appeared in the literature. Gould (1978) had conducted a survey requiring 1500 sixth form teachers to rank in terms of relative importance 20 possible aims of A-level practicals. The rankings strategy was found to be a sound research technique because, from the responses, areas of concern in appraising practicals in the course were identified, thus enabling course designers to adopt special strategies. However, as a research strategy its weakness, in my view, was the use of a 20 item instrument, because difficulty was reported in trying to calculate any statistical significance differences between the respondents with such an instrument (Gould 1978).

- Almost one year after the 1978 reports the National Association for Research in Science Teaching (NARST) then commissioned Abraham et al (1982) to conduct an in-depth follow-up study on the rankings of the top five most important research needs. In this study the apparent weakness was that no statistical analytical instrument was used, but this did not detract from the useful information trends gathered.

- In 1984-1985 Gayford (1988) undertook a survey to determine the relative importance of four aspects of practical work in biology at advanced level. He asked 447 biology teachers in England and Wales to prioritise, in terms of rating, whether an aspect was very important, important, fairly important or unimportant. The study found significant differences between the mean ranks of the two samples when compared using the Kolmogorov-Smirnov technique. At the same time Maloney (1987) published "Ranking Tasks: a new type of test item" in which students were required to rank items in terms of relative importance.

Emerging from these two studies were the recommendations that (a) rankings could be used for several different aspects of environmental research studies and (b) curriculum developers could utilise survey results and information for formulating policies that may affect their environment.

- In his address at the World Conference on Engineering Education for Advancing Technology (WCEEAT), Woods (1989) identified some of the problem areas in educating for advancing technology, and commented on educational considerations and future priorities. In his presentation, both the highest priority rankings and lowest priority rankings were suggested for use in determining a policy for trained engineers. The two highest instructional priorities were that engineering students should know and understand the fundamental principles, and master the skills of the current technology.

2.3 ENVIRONMENTAL AND GLOBAL STS PRIORITIES AND RANKINGS

The shifting of research to environmental and global issues gained momentum in the 1980s as more reports appeared regularly in the literature.

- De Caprariis (1985) collected information about the community's preferences among different water quality projects and the kind of an environment in which they would prefer to live. The respondents were required to rank their basic needs in terms of priorities. One of the recommendations emerging from this study was that the ranking of priorities should be thoroughly and clearly explained to respondents to elicit unambiguous and informed responses for use in decision-making.

- Bybee and Najafi (1986) used Bybee's 1984 12 - item scale with 216 students from college campuses in Minnesota and Colorado and one university in Iowa. The students were asked to rank, in priority, the relative importance of 12 current global problems in science and technology. Part of the questionnaire also asked students how they thought each problem would change, and their source of information. The students ranked air quality, world hunger, and war technology as their top three priorities, and of least concern to the students were mineral resources, nuclear reactors and extinction of plants and animals.

  Bybee et al recommended that:

  (a) a college science education should enable non-specialists to gain sufficient scientific and technical knowledge to fulfill their civic responsibilities in an increasingly technological society;

  (b) the survey results should be of interest to those teaching courses in the general area of science, technology and society; and to those designing new courses based on STS themes; and to those who include current social and global issues in introductory courses for non-science;

  (c) students should be informed of the global problems so that they might desire to develop some strategies towards resolving these problems;

  (d) educators, administrators and curriculum designers should consider having a socially oriented form of science and technology.

- A socially oriented form of science and technology study was proposed by the Nairobi City Council who commissioned Hope and Timmel (1987) to gather information from 2000 families resident in Mathari Valley. The local respondents were asked to rank, in order of priority from 1 to 10 on the data gathering instrument, problems they saw as most important in

their lives. The results from this survey were used to implement the government policy of meeting their basic needs. From its findings the study recommended that:

(a) instructions for respondents should be spelt out clearly at the time of administration of the questionnaires;

(b) before questionnaires are distributed researchers must take steps to ensure that no one from the sample has seen the instrument before; and

(c) before using the questionnaires the researcher should be clear on what main problems to focus the discussion with respondents.

- Bybee and Mau (1986) required 262 international science educators to rank in terms of relative priority twelve major global problems related to science and technology. The respondents' mean rankings were as follows: world hunger, population growth, air quality, water resources, war technology, human health and disease, energy shortages, land use, hazardous substances, extinction of plants and animals, nuclear reactors and mineral resources. It emerged from this investigation that:

  (a) curriculum developers should be aware of the importance of science-related social issues;

  (b) there was a need for a rationale for teaching about global problems from lower to higher institutions;

  (c) research should be conducted to identify appropriate context, structure and practices for teaching about global problems;

  (d) models for integrating science and social studies (STS) should be researched and developed;

  (e) it should be required of all students to study science-technology-society related problems.

- Using the 1984 Bybee 12-item scale Ndodana et al (1994) undertook a survey study with samples of 76 South African science educators and 129 chemical engineering students at the University of Cape Town. This was immediately followed up with a more open-ended survey with 20 lecturers in the Faculty of Engineering in 1993. The investigations aimed to determine which global STS problems remained highly prioritised in 1993 compared with the earlier prioritisation made in 1984.

  The investigation found that:

  (a) the top-ranked items related to basic needs for long-term survival and remained so over the ten year period with the exception of war technology;

  (b) there was evidence to support the policies of stability and relevance in modern chemical engineering curricula;

  (c) population growth, with first and second rankings, suggested a common concern linking the other eleven problems directly or indirectly;

  (d) high-quality education, geared towards finding creative solutions to pertinent and pervasive problems suchasthese, remains crucial for the development and practice of relevant engineering for the wider benefit of humanity.

- In 1995 an extended, modified and simplified version of the Bybee 1984 12-item scale, the 15 item Le Grange Global Priorities Instrument, (LGPI) was used with samples of 214 engineering students at the University of Cape Town and 78 marketing/business students at the Peninsula Technikon. The study by Le Grange et al (1995) found high correlations ranging from **0.74** to **0.91** among the engineering and marketing/business male and female students' mean ranked priorities on the LGPI scale. Males and females in both samples agreed on a high prioritisation for **population growth, fresh water supplies** and **human health** and

disease. The study recommended:

(a) interdisciplinary approaches in engineering and commerce curricula;

(b) the inclusion of aspects of the humanities in engineering courses;

(c) data gathering from more samples of South African female engineering students to determine whether the item **mass housing** remains of high priority.

2.4 GENDER DIFFERENCES AMONG SCIENCE PUPILS

Persistent gender differences have been reported in the science education literature, though the differences have only accounted for a small proportion of the variance in a range of dependent variables.

- It is reported in Haggerty (1995) that gender and science issues appear frequently in the literature on gender issues, with varying emphasis. For example, gender issues occur in Brown et al 1986; Fensham 1988; and Tobin et al 1990; gender and science in Byrne 1993; Harding 1986 and 1991; Kahle 1985; Tuana 1989; gender bias in textbooks in Gough and Griffiths 1994; and Haggerty and Homes 1993; women underrepresentation in science in Sadker and Sadker 1986; Kahle 1987; Manthorpe 1985; Schiberi 1986; Byrne 1993; Kelly 1978; Lewis 1993 and Scantlebury 1987; and gender experiential differences are reported in Erickson and Erickson 1984; Galton 1981; Kahle 1990; Tobin and Garnett 1987; and Wolffensperger 1993.

- Sjoberg and Imsen (1988) in Haggerty (1995) introduced the conception of gender culture to account for the different societal influences on males and females and also to investigate the differential experiences of boys and girls who developed distinctly different gender roles while in attendance

of the same classes at school. These scholars, in responding to their observed differences, said:

> "A key to this lies in understanding what gender identity means in an egalitarian society. Gender is a fundamental attribute in most cultures. To be a genderless identity is inconceivable. The underrepresentation of girls in natural science has to be interpreted in terms of culture" (Sjoberg and Imsen 1988: 224).

In their study they established that, in most cultures, science is socially defined as a masculine domain. Consequently this stereotype resulted in more boys engaging in science and technology to reinforce their masculinity whilst it was not the way of girls to become feminine.

- The issue of differential gender achievement as reported in Zoller and Ben-Chaim (1990) also received wide literature coverage. Strategies and intervention programs toward equity in science and technology education are outlined in Steinkamp and Maehr 1983 and 1984; Keller 1985; Kahle 1986; Whyte 1986; Burton 1986; Ditchfield and Scott 1987; Kelly 1987; Fraser and Gidding 1987; and in Parsons-Chatman and Bateson 1988. All these studies revealed that the magnitudes of gender differences in science achievement varied according to subject matter under study, yet conceded that males showed significant advantage in studies of biology and earth sciences and technology, whilst girls would prefer literature, foreign languages, biology and home economics (Spear 1987) when they become optional. These studies agree that gender differences in achievement are a possible artifact of testing explained in terms of sociological perspective, and that there are no significant differences in the levels of trait anxiety between males and females in science.

- Advancing this sociological perspective Catsambis (1995) introduced intervening variables of race and ethnicity. She argued that it was necessary to examine further the interrelationships between gender and race or ethnicity in an effort to understand the process leading to women's limited participation in science-related careers. She contended that the

numerous findings documenting gender differences in science achievements and interests remained unclear largely due to weaknesses in the existing researches which often have not been generalisable in extent to race or specific ethnicity. She also argued that most of them were based on very small samples that were not nationally comparable with the diverse racial or ethnic groups (Clewell and Anderson 1991; Lockheed et al 1985; and Oakes 1990). However, she conceded that significant differences may exist in some cases whilst in other cases such significant differences were non-existent. In career preferences, for example, she found that when educational and social backgrounds were held constant, girls were not more likely to enrol in high-ability science classes than boys and that student career choices showed strong gender differences among racial or ethnic groups, although it tended to vary according to racial or ethnic background.

- In his study Conwell (1993) found that, when gender and ethnicity were considered, gender always received less notice than ethnicity. The study found that most gender studies that appeared in the literature have focused only on gender differences in both perceptions of behaviour and behaviour within mixed sex groups and, as such, patterns of inequitable behaviour have been found. Thus, these merely reinforced the different roles men and women played in society.

- In this context Kahle and Lakes (1983) in Jones (1991) reported that females reported fewer reasons than males for visiting an electric plant, a sewage plant, a weather station and a rocky quarry. Thus these data suggested that females and males were having very different science-related experiences outside the classrooms. Their study also noted that gender differences in science competitions mirrored the gender differences seen in course enrolment and career selection. This was evident with the

type of projects presented with females presenting more biological projects than males, and males presenting more physical science projects than females.

- Advancing the sociological argument further, Jegede and Okebukola (1992) reported that the location of the school exerted a strong influence on students' perception of the socio- cultural environment. According to them evidence has been repeatedly found that certain social pressures and innate capabilities influence girls' and boys' pursuit of science and technology. Other studies have also reported that science has never been shown to be a woman's subject (Nwana 1987; Sutherland 1987; Wavering et al 1986; Zeregg et al 1986; and Parker and Offer 1987).

- However, Hacker (1986) appears to contradict popular research findings on gender related differences. According to him the claims that gender differences were based on direct observation of classroom events were unsatisfactory as they were based solely on anecdotal impressionistic reports. He also noted that these study reports were selective and lacked observer objectivity, and that their reliability could not be demonstrated. He reasoned that often one is left with a better understanding of merely the beliefs and prejudices of research workers carrying out these studies, than of actual classroom events. He also asserts that most of these studies were flawed in terms of research design and data analyses whilst ignoring important factors other than gender that probably influenced their findings, such as observer training, reliability, small samples atypical of the general population they purported to have been representing, and lastly, failing to examine the statistical significance of the results.

- Apparently Sanders (1995) has the same problem with the literature available on gender differences. She mentions that research evidence does not fully support the belief that the gender difference is large or consistent,

and that it is clouded by conflicting research results. She points out, as also mentioned in Collins (1985), that the research on gender differences is often a by-product of other research and that, despite the vast body of literature, the majority of them are not helpful in resolving gender-related issues. She mentions that this occurs because the research has not been carefully enough designed specifically to answer unresolved questions. As Hurd (1991: 729) says:

> "the largest fraction of the research in science education is a first, and usually a last, effort of a novice"

and he reasons that such studies are often limited by practical constraints (the availability of convenient samples, and time) which affect the effectivity of dealing with crucial issues. Sanders reiterates the problem of selected small samples, and she suggests that results of such studies should not be generalised to the population as a whole, as has occurred in some studies available in literature.. She also cautions on the use of data analysis techniques saying that the alpha levels chosen to determine significance of gender differences may be a serious problem by

> "creating false impressions in those who are not aware of how to interpret the results of statistical tests" (Sanders 1995: 47).

In supporting her argument, Parlett 1974:14 quoted in Sanders (1995:41) observes that:

> "So many random, unpredicted, and human factors intervene that neat experimental designs cannot contain them all ..... the results from such studies.....present an emaciated and artificial picture of real-world life"

2.5 SUMMARY

Using theories and recommendations advanced by different researchers such as Butts et al (1978); Gould (1978); Abraham et al (1982); De Caprariis (1985); Bybee and Najafi (1986); Hope and Timmel (1987); Gayford (1988); Maloney (1987); Woods (1989); Bybee and Mau (1986); Ndodana et al (1994) and Le Grange et al (1995); this study is designed to extend the findings of Le Grange et al (1995) and Ndodana et al (1994) in a different South African context. The assumption is that different cultural and geographical backgrounds and genders may influence rank order prioritisations of science and technology-related global problems amongst high school science pupils, and the literature review has added support to this research thrust adopted in the present study.

Since the literature review has also identified gender as a possible influential variable, the study also aims to measure differences in priorities by gender across cultural boundaries. In this respect this study is, to date, the first of its kind in South Africa extended to high school level.

The methodologies and target populations of this study are discussed in Chapter 3.

CHAPTER 3

METHODOLOGY, SAMPLE AND INSTRUMENTATION

CHAPTER 3

METHODOLOGY, SAMPLE AND INSTRUMENTATION

3.1 INTRODUCTION

In this chapter the context, samples, methodology and instrument used in this study are presented and discussed. The chapter concludes with a summary of the main points.

3.2 THE SOUTH AFRICAN CONTEXT

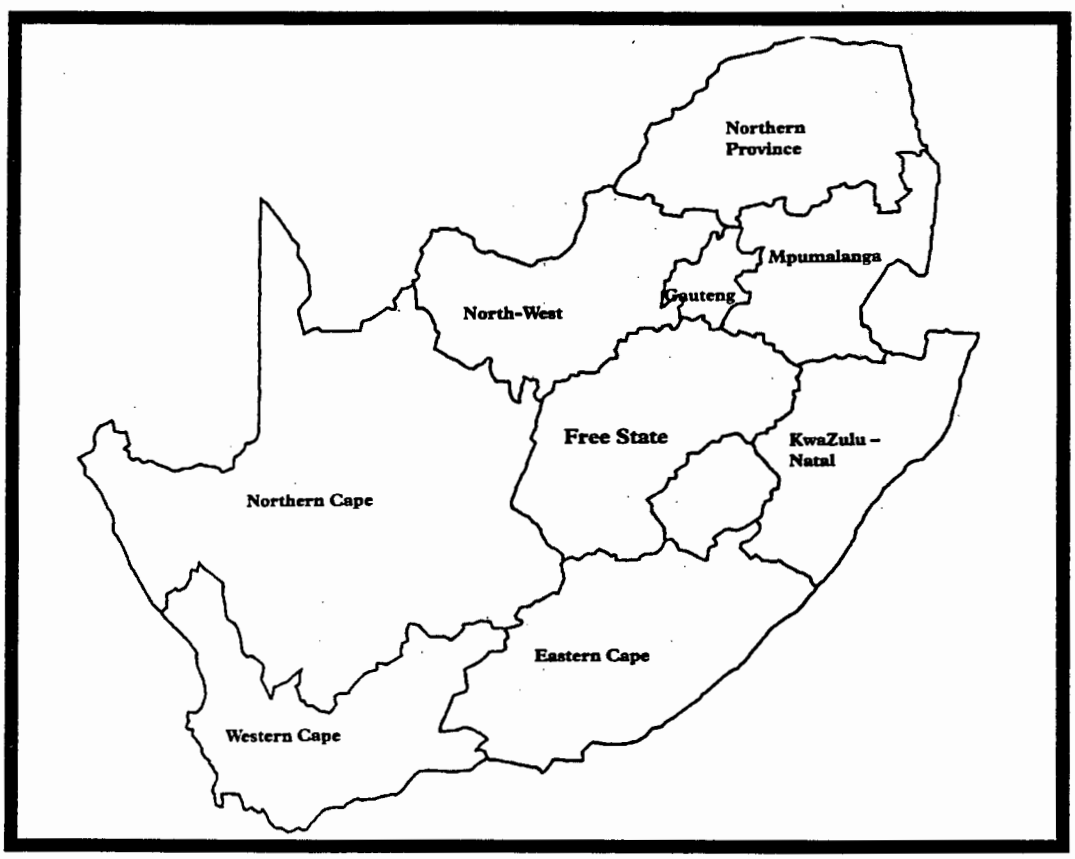

Figure 3.1 Map of South Africa (Nine Provinces)

South Africa is a very complex country. It is characterised by uneven development, varying from extreme poverty in some regions to the advanced industrial features of first world countries in other areas (Government White Paper on the Reconstruction and Development Programme 1994; Spargo 1995; Joubert and Steenkamp 1995; and Harber and Ludman 1995). Figure 3.1 on page 26 illustrates the boundaries of nine new provincial governments in South Africa. Among those participating in this research are the Northern Province (formerly known as Northern Transvaal) and the Western Cape Province.

3.2.1 The Northern Province

Governed from Pietersburg, this is one of the nine provinces of the new South Africa. It includes areas formerly administered by Lebowa, Gazankulu, Venda and the Transvaal Provincial Administration (TPA). It is bordered by Zimbabwe in the north, Botswana in the west, Mozambique and Mpumalanga (formerly Eastern Transvaal) in the north-east and east respectively, and Gauteng in the south.

The Northern Province has a population of about 5 120 600 people (12.6% of the total South African population). Of, these, 2 867 536 or 56% of the population are Northern Sotho speaking, 1 126 532 or 22% are Tsonga speaking (Shangaan), 614 472 or 12% are Venda speaking, and 512 060 or 10% are either Afrikaans/English and other minorities, with the majority being Afrikaans speaking (Harber and Ludman 1995: 289 and Letsoalo 1996, in press).

The population of the Northern Province is 96% black, and it is the most rural of the nine provinces with only 12% of its population urbanised. It lacks basic infrastructure, and had a per capita income of about R2 112 in 1994. The majority of the rural population depends largely on subsistence

farming, an unreliable source of income in a country susceptible to long periods of drought (Harber and Ludman 1995; Nganunu 1988 and Tema 1989).

Life in the Northern Province is largely traditional and rural. Communities are administered by traditional leaders and are racially homogeneous. Even the designated "urban areas" are 99% homogeneous in respect to cultural and language background. Each community has its own schools financed from its own resources. This may account for the low literacy level of only 52%. However, the province has 3 466 schools of which 87.5% are rural community schools, 10% state schools including the Model C schools, and 2.5% are private schools. These schools have a total enrolment of about 1 176 713 pupils of whom 658 959 study in Northern Sotho first language, 258 877 in Tsonga first language, 141 205 in Venda and the remaining 117 205 in either Afrikaans or English (Deutrom and Wilson 1986; Heikkinne 1988; Kershaw 1975; Graham-Brown 1991; Peacock 1995; and Tema 1989).

The Northern Province is the least resourced in terms of health facilities. It has the highest number of typhoid fever cases associated with inadequate water supply and sanitation, while chronic malnutrition is prevalent. On the other hand it has a population growth rate of 3.95% per annum (Harber and Ludman 1995).

3.2.2 The Western Cape Province

This is one of the nine Provinces of the new South Africa governed from Cape Town. It includes administrations formerly under the Republic of South Africa (CPA), House of Representatives and the House of Delegates, for both Coloureds and Indians respectively. It is bordered by the sea in the south-west and east-south, and shares borders with the Northern Cape Province in the north, and Eastern Cape Province in the east.

The Western Cape Province has a population of about 3 620 200 (8.9% of the total South African population). Of these 2 280 726 or 63% are Afrikaans speaking, 724 040 or 20% English speaking, 579 232 or 16% Xhosa speaking and 36 202 or 1% other population groups including Indians (Harber and Ludman 1995).

The Western Cape Province is predominantly Afrikaans, the majority of whom are Coloureds. It is one of the two highly urbanised provinces in South Africa (the other being Gauteng), with an urbanisation level of 95.6%. It has the best infrastructure with a per capita income of about R12 387 in 1994. Life in the Western Cape Province is modern, advanced and compares favourably with that in first world countries. However, some peripheral urban areas in the Western Cape Province are typical third world developing areas. These are predominantly black, overcrowded, and burdened by waste dumps, shacks or squatters after decades of mismanagement aggravated not only by an institutionalised apartheid policy, but also by rent and service boycotts. Throughout their existence these townships have been a haven for migrant labourers from the former Transkei and Ciskei, and are consequently predominantly Xhosa speaking.

The Western Cape Province is generally well resourced with health and educational facilities. It has 1 948 schools with a total enrolment of 936 000 pupils. Of these 597 168 or 63.8% study in Afrikaans, 275 185 in English, 61 776 in Xhosa and 1 872 in other languages. This accounts for the highest literacy rate of more than 71% and the lowest teacher pupil ratio nationally. However, studies report the highest incidence of tuberculosis of any province. For example, 25 000 cases occurred in 1992. It has the highest human development index in the country and the lowest infant mortality rate (Streek 1995; and Harber and Ludman 1995).

3.3 THE SAMPLES

3.3.1 Sample 1 (North Sotho pupils)

This sample consisted of 421 rural North Sotho high school science pupils in the Northern Province, under the Northern Province Department of Education and Culture. Of these, 254 (60.3%) were males and 167 (39.7%) females. The pupils' ages ranged from 16 to 19 years. Data was collected from schools during June and July 1995 personally by the researcher with the assistance of school principals and science teachers.

3.3.2 Sample 2 (Xhosa pupils)

This sample consisted of 223 urban Xhosa high school science pupils in the Western Cape Province, under the Western Cape Province Department of Education and Culture. Of these 109 (46.8%) were males and 124 (53.2%) females. The pupils' ages ranged from 16 to 19 years. Data was collected in August 1995 with the assistance of the biology teachers during normal school classes.

3.3.3 Sample 3 (Coloured pupils)

This sample consists of 348 suburban Coloured high school science pupils in the Western Cape Province, under the Western Cape Province Department of Education and Culture. Of these, 153 (44%) were males and 195 (56%) females. The pupils' ages ranged from 16 to 19 years. Data was collected during January to March 1995 with the assistance of science teachers.

The overall population sampled thus comprised a final total of 1002 pupils from three South African localities. Hence the target samples were stratified for this study into naturally homogeneous geographical and cultural regions with well defined variables.

3.4 RESEARCH METHODOLOGY

3.4.1 Survey Research Method

The only method available for gathering information of this type of research is the survey. The survey method is a recognised way to obtain information directly on an identified topic in science education (e.g. Bybee 1984; Butts et al 1978; Ndodana et al 1994; Butts 1983; etc.).

3.4.2 The Instrument

The Le Grange Global Priorities Instrument (LGPI) in Table 1.2 on page 5 was used in this research. The LGPI, updated in 1995, is a modified form of an earlier instrument designed for use with scientists (Bybee 1984), citizens (Bybee 1984), college students (Bybee and Najafi 1986), science educators and undergraduate chemical engineering students (Ndodana, Rochford and Fraser 1994) and engineering and

marketing/business students (Le Grange, Rochford and Sass, 1995). The original 1984 Bybee instrument, reproduced in Table 1.1 on page 4 contained 12-items but the updated LGPI contains 15 items. The LGPI was adapted and simplified linguistically in 1995 by a panel of twelve science and English language specialists at the University of Cape Town.

3.4.2.1 The Reliability of the LGPI

Theory

The reliability of a test refers to the consistency with which it yields the same ranks for an individual taking the test several times. The test is reliable if it consistently yields the same or nearly the same ranks over repeated administrations during which we would not expect a trait or response being measured to have changed. The consistency of a test is obtained by determining the reliability coefficient (r). The reliability coefficient is obtained from the correlation coefficients, +1.00 being the perfect correlation, 0.80 to 0.99 a very high correlation, 0.60 to 0.79 a high correlation, 0.40 to 0.59 a moderate correlation, 0.20 to 0.39 a low correlation, 0.01 to 0.19 a very low correlation and 0 being no correlation, while -1.00 would be the strongest inverse correlation (Tuckman 1978: 160-161 and Mulder 1982: 209).

Test-Retest Coefficients for the LGPI

In 1995 a test-retest study conducted with a sample of 58 Cape Town secondary school pupils yielded a reliability correlation coefficient of r=0.93 when the intact sample was retested after an interval of one day (Le Grange and Rochford 1995). The raw data and summary obtained from this group are recorded in Appendices A1 (i) - (iii).

A second test-retest reliability coefficient was obtained by the writer in 1995 with a class of HDE biology teachers in training at the University of Cape Town. Over a period of two weeks, this intact group yielded a correlation coefficient of r=0.94 (N=11) for the LGPI. The raw data obtained from this group is recorded in Appendices A2 (1) - (ii).

The Spearman rank-order correlation was used to calculate the reliability coefficient, using the ranks of the mean scores of the test items and the corresponding retest scores. The formula used for calculating nonparametric Spearman is:

$$rho = 1 - \frac{6 \Sigma D^2}{N (N^2 - 1)}$$

Where D = the difference in ranks

N = number of items on scale.

The mean scores and ranks of the second test and retest groups are presented in Table 3.1 on page 34.

3.4.2.2 Validity of the LGPI

The content validity of the LGPI was obtained from the original 1984 Bybee scale, the twelve items of which had been corroborated by the consensus of 262 international science educators from 41 countries. The three new items added to the LGP1 (**mass housing, use and abuse of high technology,** and **ignorant decision makers**) were included by consensus of 20 lecturers in engineering in 1994.

Table 3.1

The mean priority scores, and ranks of relative importance on the LGPI as rated by 11 HDE science students in 1995.

	TEST		RETEST	
Global problem	**Mean score**	**Rank**	**Mean score**	**Rank**
Mass housing	8.6	9	8.2	8
Unsafe substances	7.4	8	9.1	10
Human health & disease	6.5	5	6.2	4
Mineral resources	10.5	12	9.4	11
Fresh water supplies	3.3	1	2.9	1
Population growth	4.7	2	6.1	3
Extinction of species	7.1	6	7.5	6
Energy shortages	9.5	11	8.5	9
War technology	10.8	13	9.7	12
Air pollution	5.5	3	6.6	5
World Hunger	6.0	4	5.8	2
Bad land use	7.3	7	8.0	7
Nuclear power stations	9.1	10	9.8	13
High technology	12.2	15	10.4	14
Decision makers	11.4	14	11.9	15

rho = 0.94; n = 15; p = 0.01.

3.5 DATA SCREENING

All 1002 of the returned questionnaires were individually screened for completion errors or omissions. The response return figure of 1002 was reduced to a final total of 946 because 7 out of 421 North Sotho returned questionnaires were discarded and 414 (98.3%) were used, 44 of the 233 Xhosa questionnaires were discarded (mostly from young standard 6 pupils) and only 189 (81%) used; and 5 of the 348 Coloured questionnaires were discarded with 343 (98.5%) being used. The useable raw data thus obtained for the three samples is recorded in Appendices B1 - B3.

3.6 STATGRAPHICAL PROCESSING AND ANALYSIS

The data were processed and analysed by a standard computer programme called Statgraphics. The summary statistics for all three samples are presented in Appendices C1 - C6. the Statgraphics programme was also used to compute Spearman rank-order correlation coefficients between pairs of samples.

The Statgraphics packages provided the Mann-Whitney U-test to determine whether any significant differences occurred on the responses to individual items of the LGPI across the samples. The correlations, mean scores and p-values obtained from this analysis are presented in Chapter 4. Additional information on the data is provided in Appendices D1 - E6.

The formula for the Mann-Whitney U-test is:-

$$Z = \frac{U - U_E}{\sigma_U}$$

Where Z = Z score
U = U-statistic
U_E = expected value of U
σ_U = standard deviation of U

3.7 SUMMARY

In this chapter the study has been placed in its geographical and cultural context. The population samples have been explained and defined, and methods for data collection, coding and analysis have been identified. The results and findings of this investigation now follow in Chapter 4.

CHAPTER 4

RESULTS

CHAPTER 4

RESULTS

4.1 INTRODUCTION

In this chapter the findings of the investigation are presented. Nine tables summarise the data and the results obtained.

Table 4.1 presents the results obtained to test hypothesis 1 (a) (i) and hypothesis 2 (a) (i), for the **North Sotho** sample.

Table 4.2 presents the results obtained to test hypothesis 1 (a) (ii) and 2 (a) (ii), for the **Xhosa** sample.

Table 4.3 presents the results obtained to test hypothesis 1 (a) (iii) and 2 (a) (iii), for the **Coloured** sample.

Tables 4.4 to 4.6 present the results obtained for the sub-samples of **male** pupils in the North Sotho, Xhosa and Coloured schools. These are used to test the six hypotheses 1 (b) (i) - (iii) and 2 (b) (i) - (iii).

Tables 4.7 to 4.9 present the results obtained for the sub-samples of **female** pupils in the three regions. These are used to test the six hypothesis 1 (b) (iv) - (vi) and 2 (b) (iv) - (vi).

The chapter concludes by giving a brief overview of all the major findings. This summarises areas of significant agreement and areas of significant disagreement found between the three pupil samples and their male and female sub-samples.

4.2 *TESTING OF THE HYPOTHESES*

Hypothesis 1 (a) (i) **North Sotho pupils' gender correlation**

The null hypothesis "that there is no significant correlation between the male and the female North Sotho pupils' mean rankings of the 15 items on the LGPI scale as a whole" is rejected.

Table 4.1 on page 39 shows that a statistically high significant correlation of **r=0.78** occurs between the mean rank scores of the two genders in 1995, for the sample of 414 North Sotho pupils. Thus there is a very substantial measure of agreement on the LGPI between the male and female pupils' responses in the Northern Province schools sampled.

Table 4.1

The mean priority scores, and ranks of relative importance, of global problems in science and technology rated by North Sotho male and female pupils in 1995.

		North Sotho males n = 250		North Sotho females n = 164		p
	Global problem	**Mean priority score**	**Rank of relative importance**	**Mean priority score**	**Rank of relative importance**	**value**
	Mass housing	10.2	14	9.6	11	0.06
	Unsafe substances	9.3	9	9.2	9	0.66
*	Human health & disease	3.9	2	4.2	2	0.03
	Mineral resources	9.5	11	9.3	10	0.77
	Fresh water supplies	1.8	1	1.8	1	0.31
	Population growth	4.4	3	4.8	3	0.21
	Extinction of species	10.3	15	9.9	14	0.41
*	Energy shortages	7.9	5	9.7	7	0.02
**	War technology	9.4	10	10.7	15	0.00
**	Air pollution	8.8	6	9.8	13	0.01
	World Hunger	6.1	4	5.9	4	0.47
	Bad land use	8.9	7	8.5	5	0.37
	Nuclear power stations	9.6	12	9.7	12	0.78
**	High technology	10.0	13	9.0	8	0.00
	Decision makers	9.2	8	8.6	6	0.08
		r = 0.78; p = 0.003 Highly significant correlation between males and females				

* $p < 0.05$ North Sotho males' and females' scores are statistically significantly different for this item

** $p < 0.01$ North Sotho males' and females' scores are statistically highly significantly different for this item.

Hypothesis 2 (a) (i) **North Sotho pupils' gender differences**

The null hypothesis "that there are no statistically significant differences between the mean scores given to each one of the 15 items of the LGPI taken individually for the North Sotho male and female pupils in 1995" is rejected for items 3, 8, 9, 10 and 14.

Table 4.1 on page 39 presents the findings that significant gender differences occur in the Sotho pupils' perceptions of the relative importance of the problems of **human health and disease, energy shortages, war technology, air pollution and high technology**. The greatest gender differences occur on the items **war technology** (males ' mean score 9.4; females' mean score 10.7) and high technology use and abuse (males' mean score 10.0; females' mean score 9.0).

On item 1, **mass housing**, the ranking difference between males and females is almost statistically significant ($p=0.06$). This suggests further investigation with a larger sample of North Sotho pupils if possible.

Possible reasons for the gender differences discovered on items 3, 8, 9, 10 and 14 are discussed in the next chapter.

Hypothesis 1 (a) (ii) **Xhosa pupils' gender correlation**

The null hypothesis "that there is no significant correlation between the male and female Xhosa pupils' mean rankings of the 15 items on the LGPI scale as whole" is rejected.

Table 4.2 on page 42 shows that a statistically highly significant correlation of **r=0.94** exists between the mean rank scores of the two genders in 1995, for the sample of 189 Xhosa pupils. Thus there is a very substantial measure of agreement on the LGPI between the male and female pupils' responses in the Western Cape Province schools sampled.

Table 4.2

The mean priority scores, and ranks of relative importance, of global problems in science and technology rated by Xhosa male and female pupils in 1995.

		Xhosa males n = 76		Xhosa females n = 113		p
	Global problem	**Mean priority score**	**Rank of relative importance**	**Mean priority score**	**Rank of relative importance**	**value**
	Mass housing	1.9	1	2.1	1	0.26
	Unsafe substances	7.3	6	6.6	5	0.40
**	Human health & disease	5.0	3	3.8	2	0.00
	Mineral resources	9.1	9	8.6	7	0.34
	Fresh water supplies	4.4	2	5.0	3	0.22
	Population growth	7.1	5	7.2	6	0.86
	Extinction of species	8.8	7	9.5	11	0.21
	Energy shortages	9.0	8	9.2	8	0.94
*	War technology	10.6	14	11.7	15	0.05
	Air pollution	9.8	11	9.3	9	0.21
	World Hunger	5.7	4	6.0	4	0.40
	Bad land use	9.2	10	9.4	10	0.79
	Nuclear power stations	11.5	15	11.0	14	0.52
	High technology	9.9	12	9.6	12	0.79
	Decision makers	10.1	13	10.6	13	0.29
		r = 0.94; p = 0.004 Highly significant correlation between males and females				

* $p < 0.05$ Xhosa males' and females' scores are statistically significantly different for this item.

** $p < 0.01$ Xhosa males' and females' scores are statistically highly significantly different for this item.

Hypothesis 2 (a) (ii) **Xhosa pupils' gender differences**

The null hypothesis "that there are no statistically significant differences between the mean scores given to each one of the 15 items of the LGPI taken individually for the Xhosa male and female pupils in 1995" is rejected for items 3 and 9.

Table 4.2 on page 42 presents the findings that significant gender differences occur in the Xhosa pupils' perceptions of the relative importance of the problems of **human health and disease and war technology.** The greatest difference occurs on the item **human health and disease** (males' mean score 5.0; females' mean score 3.8).

On item 3 **human health and disease**, the ranking difference between males and females appears to be close, being ranked third and second respectively, but on the Mann-Whitney U-test there is found to exist a highly significant difference between their skewed score distributions ($p=0.00$).

Hypothesis 1 (a) (iii) **Coloured pupils' gender correlation**

The null hypothesis "that there is no significant correlation between the male and female Coloured pupils' mean rankings of the 15 items on the LGPI scale as a whole" is rejected.

Table 4.3 on page 45 shows that a statistically highly significant correlation of **r=0.92** occurs between the mean rank scores of the two genders in 1995, for the sample of 343 coloured pupils. Thus there is a very substantial measure of agreement on the LGPI between the male and female pupils' responses in the Western Cape Province schools sampled.

Table 4.3

The mean priority scores, and ranks of relative importance, of global problems in science and technology rated by Coloured male and female pupils in 1995.

		Coloured males n = 151		Coloured females n = 192		p
	Global problem	**Mean priority score**	**Rank of relative importance**	**Mean priority score**	**Rank of relative importance**	**value**
**	Mass housing	9.9	11	9.0	8	0.01
*	Unsafe substances	5.9	6	6.5	6	0.04
*	Human health & disease	5.4	2	4.4	2	0.04
	Mineral resources	10.7	13	10.6	14	0.53
	Fresh water supplies	6.1	7	6.4	5	0.39
**	Population growth	5.7	4	4.7	3	0.01
*	Extinction of species	5.8	5	6.8	7	0.02
	Energy shortages	10.1	12	10.2	12	0.73
	War technology	9.5	10	9.9	10	0.31
	Air pollution	5.2	1	5.7	4	0.07
**	World Hunger	5.5	3	4.3	1	0.00
**	Bad land use	8.3	8	9.7	9	0.00
	Nuclear power stations	9.3	9	10.0	11	0.06
	High technology	10.8	14	10.7	15	0.84
	Decision makers	11.0	15	10.5	13	0.40
		$r = 0.92$; $p = 0.005$ Highly significant correlation between males and females				

* $p < 0.05$ Coloured males' and females' scores are statistically significantly different for this item.

** $p < 0.01$ Coloured males' and females' scores are statistically highly significantly different for this item.

Hypothesis 2 (a) (iii) **Coloured pupils' gender differences**

The null hypothesis "that there are no statistically significant differences between the mean scores given to each one of the 15 items of the LGPI taken individually for the Coloured male and female pupils in 1995" is rejected for items 1, 2, 3, 6, 7, 11 and 12.

Table 4.3 on page 45 presents the findings that significant gender differences occur in the Coloured pupils' perceptions of the relative importance of the problems of **mass housing, unsafe substances, human health and disease, population growth, extinction of species, world hunger, and bad land use.**

The greatest gender differences occur on the items **mass housing** (males' mean score 9.9; females' mean score 9.0), **population growth** (males' mean score 5.7; females' mean score 4.7), **world hunger** (males' mean score 5.5; females' mean score 4.3) and **bad land use** (males' mean score 8.3; females' mean score 9.7).

On the item **population growth**, the ranking difference between the males and females appears to be close, ranked fourth and third respectively on the LGPI, but on the Mann-Whitney U-test there is found to exist a highly significant difference between their skewed score distributions ($p=0.01$).

In the next chapter (Chapter 5), possible reasons for the gender differences discovered for these seven items are discussed.

Hypothesis 1 (b) (i) **Correlation between North Sotho male and Xhosa male pupils' responses**

The null hypothesis that there is no significant correlation between the North Sotho male and Xhosa male pupils' mean rankings of the 15 items on the LGP1 scale as a whole" is not rejected.

Table 4.4 on page 48 presents a statistically non-signifcant correlation of **r=0.38** between the mean rank scores of the 250 North Sotho male and 76 Xhosa male pupils in 1993. Thus there is an appreciable measure of disagreement on the LGPI between the responses of the Sotho males' sampled in the Northern Province, and the responses of the Xhosa males sampled in the Western Cape Province schools.

Table 4.4

The mean priority scores, and ranks of relative importance, of global problems in science and technology rated by North Sotho male and Xhosa male pupils in 1995.

		North Sotho males n = 250		Xhosa males n = 76		p
	Global problem	Mean priority score	Rank of relative importance	Mean priority score	Rank of relative importance	value
**	Mass housing	10.2	14	1.9	1	0.00
**	Unsafe substances	9.3	9	9.2	6	0.00
**	Human health & disease	3.9	2	5.0	3	0.00
	Mineral resources	9.5	11	9.1	9	0.55
**	Fresh water supplies	1.8	1	4.4	2	0.00
**	Population growth	4.4	3	7.1	5	0.00
**	Extinction of species	10.3	15	8.8	7	0.00
**	Energy shortages	7.9	5	9.0	8	0.00
**	War technology	9.4	10	10.6	14	0.00
*	Air pollution	8.8	6	9.8	11	0.04
	World Hunger	6.1	4	5.7	4	0.17
	Bad land use	8.9	7	9.2	10	0.55
**	Nuclear power stations	9.6	12	11.5	15	0.00
	High technology	10.0	13	9.9	12	0.44
	Decision makers	9.2	8	10.1	13	0.09
		r = 0.38; p = 0.15 No significant correlation between North Sotho males and Xhosa males				

* $p < 0.05$ North Sotho males' and Xhosa males' scores are statistically significantly different for this item.

** $p < 0.01$ North Sotho males' and Xhosa males' scores are statistically highly significantly different for this item.

Hypothesis 2 (b) (i) **Differences between North Sotho male and Xhosa male pupils' responses to individual items.**

The null hypothesis "that are no statistically significant differences between the mean scores given to each one of the 15 items of the LGPI taken individually for the North Sotho male and Xhosa male pupils in 1995" is rejected for items 1,2,3,5,6,7,8,9,10 and 13.

Table 4.4 on page 48 presents the findings that significant differences occur between North Sotho male and Xhosa male pupils' perceptions of the relative importance of the problems of **mass housing**, unsafe substances, human health and disease, fresh water supplies, population growth, extinction of species, energy shortages, war technology, air pollution and nuclear power stations.

Of these ten significant differences, the largest and most obvious occurs in the male pupils' responses to the item mass housing, which is ranked only fourteenth by the North Sotho sample, but first by the Xhosa sample. Possible reasons are suggested for this important, major finding in the next chapter, when all the main results are discussed in detail.

Hypothesis 1 (b) (ii) **Correlation between Xhosa male and Coloured male pupils' responses.**

The null hypothesis "that there is no significant correlation between the Xhosa male and Coloured male pupils' mean rankings of the 15 items on the LGPI scale as a whole is not rejected.

Table 4.5 on page 51 presents a statistically non-signigficant correlation of r=0.41 between the mean rank scores of the 76 Xhosa male and 151 Coloured male pupils in 1995.

Thus, there is an appreciable measure of disagreement on the LGPI between the responses of the males in the two language groups sampled in the Western Cape Province schools.

Table 4.5

The mean priority scores, and ranks of relative importance, of global problems in science and technology rated by Xhosa male and Coloured male pupils in 1995.

		Xhosa males n = 76		Coloured males n = 151		p
	Global problem	**Mean priority score**	**Rank of relative importance**	**Mean priority score**	**Rank of relative importance**	**value**
**	Mass housing	1.9	1	9.9	11	0.00
**	Unsafe substances	7.3	6	5.9	6	0.01
	Human health & disease	5.0	3	5.4	2	0.76
**	Mineral resources	9.1	9	10.7	13	0.00
**	Fresh water supplies	4.4	2	6.1	7	0.00
**	Population growth	7.1	5	5.7	4	0.01
**	Extinction of species	8.8	7	5.8	5	0.00
*	Energy shortages	9.0	8	10.1	12	0.04
	War technology	10.6	14	9.5	10	0.10
**	Air pollution	9.8	11	5.2	1	0.00
	World Hunger	5.7	4	5.5	3	0.83
	Bad land use	9.2	10	8.3	8	0.09
**	Nuclear power stations	11.5	15	9.3	9	0.00
*	High technology	9.9	12	10.8	14	0.02
*	Decision makers	10.1	13	11.0	15	0.02
		$r = 0.41$; $p = 0.12$ No significant correlation between Xhosa males and Coloured males				

* $p < 0.05$ Xhosa males' and Coloured males' scores are **statistically** significantly different for this item.

** $p < 0.01$ Xhosa males' and Coloured males' scores are statistically highly significantly different for this item.

Hypothesis 2 (b) (ii) **Differences between Xhosa male and Coloured male pupils' responses to individual items**

The null hypothesis "that there are no statistically significant differences between the mean scores given to each one of the 15 items of the LGPI taken individually for the Xhosa male and Coloured male pupils in 1995" is rejected for items 1, 2, 4, 5, 6, 7, 8, 10, 13, 14 and 15.

Table 4.5 on page 51 presents these findings.

The most important result occurs in the pupils' responses to items 1 and 10. Whereas the Xhosa males rank **mass housing** first and **air pollution** eleventh, the Coloured males rank these the other way round, i.e. eleventh and first respectively. In the next chapter this major finding is discussed in more detail, with possible explanations being suggested.

Hypothesis 1 (b) (iii) **Correlation between North Sotho male and Coloured male pupils' responses**

The null hypothesis "that there is no significant correlation between the North Sotho male and Coloured male pupils' mean rankings of the 15 items on the LGPI scale as a whole" is rejected.

Table 4.6 on page 54 shows a statistically non-significant correlation of **r=0.47** between the mean scores of the 250 North Sotho male and 151 Coloured male pupils in 1995.

Thus there is an appreciable measure of disagreement on the LGPI between the responses of the two language groups sampled in the Northern Province (Sotho) and Western Cape Province (Coloured) schools.

Table 4.6

The mean priority scores, and ranks of relative importance, of global problems in science and technology rated by North Sotho male and Coloured male pupils in 1995.

		North Sotho males n = 250		Coloured males n = 151		p
	Global problem	**Mean priority score**	**Rank of relative importance**	**Mean priority score**	**Rank of relative importance**	**value**
	Mass housing	10.2	14	9.9	11	0.37
**	Unsafe substances	9.3	9	5.9	6	0.00
**	Human health & disease	3.9	2	5.4	2	0.00
**	Mineral resources	9.5	11	10.7	13	0.00
**	Fresh water supplies	1.8	1	6.1	7	0.00
**	Population growth	4.4	3	5.7	4	0.00
**	Extinction of species	10.3	15	5.8	5	0.00
**	Energy shortages	7.9	5	10.1	12	0.00
	War technology	9.4	10	9.5	10	0.49
**	Air pollution	8.8	6	5.2	1	0.00
	World Hunger	6.1	4	5.5	3	0.07
	Bad land use	8.9	7	8.3	8	0.15
	Nuclear power stations	9.6	12	9.3	3	0.32
	High technology	10.0	13	10.8	14	0.06
**	Decision makers	9.2	8	11.0	15	0.00
		r = 0.47; p = 0.08 No significant correlation between North Sotho males and Coloured males				

* $p < 0.05$ North Sotho males' and Coloured males' scores are statistically significantly different for this item.

** $p < 0.01$ North Sotho males' and Coloured males' scores are statistically highly significantly different for this item.

Hypothesis 2(b) (iii) **Differences between North Sotho male and Coloured male pupils' responses to individual items**

The null hypothesis "that there are no statistically significant differences between the mean scores given to each one of the 15 items of the LGPI taken individually for the North Sotho male and Coloured male pupils in 1995" is rejected for items 2,3, 4, 5, 6, 7, 8, 10 and 15.

Table 4.6 on page 54 presents these findings. The results show that item 3, **human health and disease** is ranked second by both North Sotho males and Coloured males. Nevertheless there does exist, on the Mann-Whitney U-test, a highly significant difference between their skewed score distributions (p=0.00).

Hypothesis 1 (b) (iv) **Correlation between North Sotho female and Xhosa female pupils' responses**

The null hypothesis "that there is no significant correlation between the North Sotho female and Xhosa female pupils' mean rankings of the 15 items on the LGPI scale as a whole" is rejected.

Table 4.7 on page 57 presents a statistically significant correlation of **r=0.53** between the mean rank scores of a sample of 164 North Sotho female and 113 Xhosa female pupils.

Thus there is an appreciable measure of agreement on the LGPI between responses of the female pupils sampled in the Northern Province (Sotho) and the responses of the female pupils sampled in the Western Cape Province (Xhosa) schools.

Table 4.7

The mean priority scores, and ranks of relative importance, of global problems in science and technology rated by North Sotho female and Xhosa female pupils in 1995.

		North Sotho females n = 164		Xhosa females n = 113		p
	Global problem	**Mean priority score**	**Rank of relative importance**	**Mean priority score**	**Rank of relative importance**	**value**
**	Mass housing	9.6	11	2.1	1	0.00
**	Unsafe substances	9.2	9	6.6	5	0.00
	Human health & disease	4.2	2	3.8	2	0.08
	Mineral resources	9.3	10	8.6	7	0.18
**	Fresh water supplies	1.8	1	5.0	3	0.00
**	Population growth	4.8	3	7.2	6	0.00
	Extinction of species	9.9	14	9.5	11	0.19
	Energy shortages	9.7	7	9.2	8	0.08
*	War technology	10.7	15	11.7	15	0.01
	Air pollution	9.8	13	9.3	9	0.19
	World Hunger	5.9	4	6.0	4	0.72
*	Bad land use	8.5	5	9.4	10	0.04
**	Nuclear power stations	9.7	12	11.0	14	0.00
	High technology	9.0	8	9.6	12	0.26
**	Decision makers	8.6	6	10.6	13	0.00
		r = 0.53; p = 0.04 Moderate significant correlation between North Sotho females and Xhosa females				

* $p < 0.05$ North Sotho females' and Xhosa females' scores are statistically significantly different for this item.

** $p < 0.01$ North Sotho females' and Xhosa females' scores are statistically highly significantly different for this item.

Hypothesis 2 (b) (iv) **Differences between North Sotho female and Xhosa female pupils' responses to individual items**

The null hypothesis "that there are no statistically significant differences between the mean scores given to each one of the 15 items of the LGPI taken individually for the North Sotho female and Xhosa female pupils in 1995" is rejected for items 1, 2, 5, 6, 9, 12, 13 and 15.

Table 4.7 on page 57 presents the findings. These results show that, of all the eight, the greatest difference occurs on item 1, **mass housing** with a mean score of 9.6 for North Sotho females and 2.1 for the Xhosa females, and ranked eleventh and first respectively (p=0.00).

Hypothesis 1 (b) (v) **Correlation between Xhosa female and Coloured female pupils' responses.**

The null hypotheses "that there is no statistically significant correlation between the Xhosa female and Coloured female pupils' mean rankings of the 15 items on the LGPI scale as a whole" is rejected.

Table 4.8 on page 60 presents a statistically significant correlation of **r=0.60** between the mean rank scores of the 113 Xhosa female and 192 Coloured female pupils in 1995.

Thus there is a measure of agreement on the LGPI between the responses of the females in the two language groups sampled in the Western Cape Province schools.

Table 4.8

The mean priority scores, and ranks of relative importance, of global problems in science and technology rated by Xhosa female and Coloured female pupils in 1995.

		Xhosa females n = 113		Coloured females n = 192		p
	Global problem	**Mean priority score**	**Rank of relative importance**	**Mean priority score**	**Rank of relative importance**	**value**
**	Mass housing	2.1	1	9.0	8	0.00
	Unsafe substances	6.6	5	6.5	6	0.70
	Human health & disease	3.8	2	4.4	2	0.18
**	Mineral resources	8.6	7	10.6	14	0.00
**	Fresh water supplies	5.0	3	6.4	5	0.00
**	Population growth	7.2	6	4.7	3	0.00
**	Extinction of species	9.5	11	6.8	7	0.00
**	Energy shortages	9.2	8	10.2	12	0.00
**	War technology	11.7	15	9.9	10	0.00
**	Air pollution	9.3	9	5.7	4	0.00
**	World Hunger	6.0	4	4.3	1	0.00
	Bad land use	9.4	10	9.7	9	0.42
**	Nuclear power stations	11.0	14	10.0	11	0.00
**	High technology	9.6	12	10.7	15	0.00
	Decision makers	10.6	13	10.5	13	0.65
		r = 0.60; p = 0.02 Moderate significant correlation between Xhosa females and Coloured females.				

* $p < 0.05$ Xhosa females' and Coloured females' scores are statistically significantly different for this item.

** $p < 0.01$ Xhosa females' and Coloured females' scores are statistically highly significantly different for this item.

Hypothesis 2 (b) (v) **Differences between Xhosa female and Coloured female pupils' responses to individual items**

The null hypothesis "that there are no statistically significant differences between the mean scores given to each one of the 15 items of the LGPI taken individually for the Xhosa female and Coloured female pupils in 1995" is rejected for items 1, 4, 5, 6, 8, 9, 10, 11, 13 and 14.

Table 4.8 on page 60 shows that the greatest difference between the samples occurs on item 1, **mass housing** which is ranked first by the Xhosa females and eighth by the Coloured females.

Hypothesis 1 (b) (vi) **Correlation between North Sotho female and Coloured female pupils' responses**

The null hypotheses "that there is no significant correlation between the North Sotho female and Coloured female pupils' mean rankings of the 15 items on the LGPI scale as a whole" is not rejected.

Table 4.9 on page 63 presents a statistically non-significant correlation of **r=0.36** between the mean rank scores of the 164 North Sotho female and 192 Coloured female pupils in 1995.

Thus there is no appreciable measure of agreement on the LGPI between responses of the females in the two language groups of pupils sampled in the Northern Province (Sotho) and Western Cape Province (Coloured) schools.

Table 4.9

The mean priority scores, and ranks of relative importance, of global problems in science and technology rated by North Sotho female and Coloured female pupils in 1995.

		North Sotho females n = 164		Coloured females n = 192		p
	Global problem	**Mean priority score**	**Rank of relative importance**	**Mean priority score**	**Rank of relative importance**	**value**
	Mass housing	9.6	11	9.0	8	0.13
**	Unsafe substances	9.2	9	6.5	6	0.00
	Human health & disease	4.2	2	4.4	2	0.89
**	Mineral resources	9.3	10	10.6	14	0.00
**	Fresh water supplies	1.8	1	6.4	5	0.00
	Population growth	4.8	3	4.7	3	0.30
**	Extinction of species	9.9	14	6.8	7	0.00
**	Energy shortages	8.6	6	10.5	13	0.00
	War technology	10.7	15	9.9	10	0.41
**	Air pollution	9.8	13	5.7	4	0.00
**	World Hunger	5.9	4	4.3	1	0.00
**	Bad land use	8.5	5	9.7	9	0.00
	Nuclear power stations	9.7	12	10.0	11	0.62
**	High technology	9.0	8	10.7	15	0.00
**	Decision makers	8.6	6	10.5	13	0.00
		r = 0.36; p = 0.16 No significant correlation between North Sotho females and Coloured females				

* $p < 0.05$ North Sotho females' and Coloured females' scores are statistically significantly different for this item.

* $p < 0.01$ North Sotho females' and Coloured females' scores are statistically highly significantly different for this item.

Hypothesis 2 (b) (vi) **Differences between North Sotho female and Coloured female pupils' responses to individual items**

The null hypothesis "that there are no statistically significant differences between the mean scores given to each one of the 15 items of the LGPI taken individually for the North Sotho female and Coloured female pupils in 1995" is rejected for items 2, 4, 5, 7, 8, 10, 11, 12, 14 and 15.

Table 4.9 on page 63 shows that the greatest difference in terms of mean scores and rankings occurs on item 5, **fresh water supplies.** For the North Sotho females the mean score is 1.8 and it is ranked first, but for the Coloured females the mean score is 6.4 and it is ranked fifth.

4.3 SUMMARY OF FINDINGS

4.3.1 Using the LGPI, highly significant correlations coefficients were found consistently between males and females within samples from the same region and speaking the same language, eg. North Sotho males and females (**r=0.78**), Xhosa males and females (**r=0.94**) and Coloured males and females (**r=0.92**).

4.3.2 With the gender variable held constant, most correlations across regions and languages were lower,ranging from **r=0.60 to r=0.36**, when male and female sub-samples' responses to the LGPI were correlated in pairs.

4.3.3 A plethora of significant differences occurred between the mean scores given to each one of the 15 items of the LGPI taken individually, when compared across the samples and gender sub-samples.

With the gender variable held constant, concerns for the provision of **mass housing** and **fresh water supplies** emerged as the two greatest polarising items on five and six of the nine pairs of contrasted samples, respectively, compared across regions and languages. However, the concern for items like **unsafe substances, population growth,** and the **extinction of species** also appear to be discriminating items in five of the nine hypotheses investigated.

A discussion and explanation of the emerging significant differences now occurs in the following Chapter 5.

CHAPTER 5

DISCUSSION AND IMPLICATIONS

CHAPTER 5

DISCUSSION AND IMPLICATIONS

5.1 INTRODUCTION

In the previous chapter significant differences were found to occur among the three samples' responses to the LGPI and, to a lesser extent, between genders of the same group sample. In this chapter these differences are discussed, and attempts are made to give possible explanations for the differences. The results from this study are also interpreted in terms of the principles and priorities of the Government of National Unity's current Reconstruction and Development Programme.

The preferential prioritisation of items that relate to **human survival** provide empirical evidence to support the importance of meeting basic needs of the South African population, as set out in the Government of National Unity's White Paper (1994).

The pupils' rankings of the 15 global problems in science and technology are consistent with the basic assumption of this study that both gender and cultural-geographical backgrounds may have an influence on the relative ranking of these. Each culture has unique problems, some related to gender, which may affect respondents' perceptions of global problems. This tendency resulted in the identification of several strongly polarising items when the responses of various samples were contrasted across culture and region.

Whilst it is not possible to explain individual trends emerging with every item for each contrasted pair of samples, some of the major ones are discussed below.

5.2 *INTRACULTURAL GENDER DIFFERENCES*

Only in the Coloured sample did male pupils show more concern for environmental problems than female pupils. They ranked **extinction of species** as their fifth priority whereas the females ranked it seventh, **bad land use** eighth compared to ninth by females; and **air pollution** first as against fourth by females, although in the latter case the difference was not significant.

Such a trend, however, finds little support in the other two samples. North Sotho males ranked only one item, **air pollution**, appreciably higher at sixth rank, compared to their females who ranked it thirteenth. The trend is totally absent in the Xhosa sample.

On the other hand Coloured female pupils appear to be more concerned about basic humanitarian or human problems than their male peers.

The Coloured females gave items like **world hunger** a top-ranked position whereas the males ranked it only third. **Population growth** was ranked third by females and fourth by males; and **mass housing** was ranked appreciably higher, namely eighth by females to eleventh by males.

However, as this trend emerging within the Coloured sample was not empirically supported by the responses from the other two samples, it suggests that more research needs to be done to establish whether or not the gender trend in the Coloured sample was a local effect in one limited sample only.

5.3 INTERCULTURAL GENDER DIFFERENCES

In this investigation a greater number of differences occurred when sub-samples were contrasted in pairs across language and regional/geographical boundaries with the gender variable held constant.

5.3.1 Fresh water supplies

One of the discriminating items in the LGPI that emerged from this study was the **provision of water resources**, ranked as the first priority by North Sotho males and females, second and third by the Xhosa males and females respectively but only seventh by Coloured males and fifth by the Coloured females.

5.3.1.1 Possible reasons for these differences

The availability of water is one of the most important factors limiting the development of rural areas in South Africa. Reports show that water is a very scarce commodity in most rural areas. In its Reconstruction and Development Programme policy document, the African National Congress (1994) indicates that 12 million people do not have access to clean drinking water, and these live mostly in rural areas.

The Citizen (19 November 1995:2) reports:

> "Northern Province is on the threshold of a disastrous drought, Water Affairs acting director Louis Theron said..... We have never experienced a situation as critical as at present".

The World Bank has also warned that many of the world's peoples face a future without adequate water unless water is used more efficiently, and proper investments are made for providing and protecting the resources. In its latest bulletin, **World Bank News** points out that providing clean water poses a growing economic and health challenge, especially to

developing countries, considering that water is facing pressures like population growth, pollution and the rising cost of scarce supplies. The World Bank Vice President, Ismail Serageldin warns:

> "Many of the wars of this century were about oil, but wars of the next century will be over water " (**The New Nation**, 25 August 1995:9).

Thus, news of the potential water crisis recurs in the mass media, with warnings against misusers in evidence (**The Citizen,** 7 August 1995). Yet, despite these popular warnings, the more urbanised pupils have other, higher priorities.

Nevertheless, the Government of National Unity's Reconstruction and Development Programme policy framework document (1994) declares the provision of clean water to rural areas as one of its main priorities. As Louw (1992) reports, the collection of water in many rural areas is a time-consuming task, frequently taking up to 2 - 3 hours of a housewife's time which could be used more profitably.

5.3.2 Mass housing

The **provision of mass housing** is the most discriminating item between the Xhosa samples and the North Sotho and Coloured samples. The Xhosa males and females rank it their first global priority, the North Sotho males rank it fourteenth, the North Sotho females eleventh, Coloured males rank it eleventh, and the Coloured females eighth.

5.3.2.1 Possible reasons for these differences

The provision and maintenance of suitable housing is naturally a high priority in any community. However, in many developing nations poor urban communities have often been left to their own resources to provide their own housing. Mushrooming shanty towns, and squatter camps built of any available scrap materials attest that. This is characteristic of urban life in many countries.

Such a view is consistent with the report that appeared in **The Citizen** (6 November 1995:16) headlined "Global homelessness threatens nations". The head of the United Nations Centre for Human Settlements (Habitat), Wally N'Dow, is quoted as saying:

> "Homelessness is on the increase everywhere in the developed world as well as in the underdeveloped world. No one can afford the exploding urban blight, socially, economically and politically."

From this it is clear that housing shortages and poor housing conditions are related to increasing urbanisation and expanding populations. According to the report these will double from 2.4 billion in 1995 to 5 billion by the year 2025 (**The Citizen**, 6 November 1995).

The provision of suitable housing in South Africa is a matter of sound town planning and is crucial to the successful implementation of the RDP. According to recent reports, the lack of adequate housing in urban areas has reached crisis proportions with recent figures estimated at about 1.4 million (ANC 1994 and Harber and Ludman 1995). However, the figures are subject to change every year as new families arrive. Perhaps it was against this background that the Government of National Unity's RDP policy document (1994) promised to deliver one million houses within the first five years.

Arnott (1995:20) points out there is no doubt that housing lies at the core of the Government's RDP, but warns:

> ".....the challenge would not be for affordable houses, but also for rates and taxes, especially the extent to which established cities and suburbs would be expected to subsidize the old townships areas, and we can anticipate some sort of cross-subsidy".

Thus, it is not surprising that the global concern for housing is greatest among deprived urban dwellers. Such urban pupils are very much aware of the immediate problems in their environment. However, responses to this item might also suggest that rural people have accepted the fact that they have to manage on their own at present, without the direct assistance of the Government. On the other hand, most Coloureds surveyed in this investigation live in stable suburban areas where housing problems may be less frequent.

5.3.3 Population growth

The other most discriminating item of the fifteen is the concern for **population growth** among the various samples.

5.3.3.1 Possible reasons for these differences

Reports suggest that South Africa has a runaway population growth, especially in rural areas where the conservative estimates put it at 5.1 per cent, although this is unreliable (Louw 1992). Some reports have linked this to the failure of the Government's family planning programme in the rural areas (Harber and Ludman 1995). This may explain why the more rural of the three samples ranked it appreciably higher as their third priority (both North Sotho males and females), while the urban Xhosa males and females ranked it only sixth and fifth, and the suburban Coloured males ranked it fourth and females third.

It may be pointed out at this point that, contrary to expectation, reports indicate that the world's population has risen less than expected during the past four years. This led demographic experts to lower their predictions of world growth by 330 million people, according to a study published recently in **Business Day** (7 August 1995) and **The Citizen** (7 August 1995). The world growth rate of 1.5 per cent this year, 1995, has represented a decline from the 1991 growth rate of 1.7 per cent. Berreen (1995) attributed this possibly to the scientific revolution which decreased the mortality rate, while it is difficult to reduce the high growing rate in developing countries.

The Government's RDP policy document is not clear on this issue, except to say that this is the aftermath of decades of apartheid.

5.3.4 Air pollution

The problem of **air pollution** has evoked widely different relative reactions across the samples. The North Sotho males ranked it sixth, and the females thirteenth; the Xhosa males ranked it eleventh, and the females ninth; and the Coloured males ranked it first and the females fourth.

5.3.4.1 Possible reasons for differences

Despite the apparent differences, a clear line of cultural-regional preference is not clear, thus suggesting further investigation. It may be stated at this juncture that the Eastern Transvaal (recently renamed Mpumalanga) is reported to be one of the most polluted areas in the world, with coalburning powerstations producing annual emissions of sulphur dioxide, the main ingredient of acid rain, that equal between 31 and 57 tons (Harber and Ludman 1995).

On the other hand, while most of the industrialised sections of the country are evidently more polluted than the rural countryside, Barry Commoner warns:

> "Never before in the history of this planet has its thin-life supporting suface been subject to such diverse, novel and potential agents. The cummulative effects of these pollutants, their interactions, and these can be fatal to the complex fabric of the biosphere, and because man is a dependent part of the system, continued pollution will eventually destroy the fitness of this planet for human life". (Quoted in Subbarao and Cole 1989: 151).

5.3.5 Human health and disease

The concern for **human health and disease** has been consistently ranked second by almost all the samples with the Xhosa males being the only one ranking it third. However, despite the occurrence of all these close "mean" rankings, the Mann-Whitney U-test discloses it to be a discriminating item for the recorded scores. It may be noted at this point

that the same item was ranked consistently higher in the previous studies (Bybee and Mau 1986; Ndodana et al 1994; and Le Grange and Rochford 1995).

5.3.5.1 Possible reasons for the differences

It is possible that the mass media (audio, visual and print) may have influenced the pupils' awareness of human health and disease. The problem of AIDS disease has permeated every sphere of life. Harber and Ludman (1995) reports that South Africa can expect a serious crisis of the AIDS epidemic in five to seven years' time, with up to a million seriously ill people between 500 000 and 1.3 million orphans. The report further shows that HIV infection in South Africa will most likely plateau at 20 percent of the population by the year 2020.

However, a leading expert, Peter Doyle, making a special study of alleged under-reporting to the health department, reports that it was more difficult to produce accurate numbers of fullblown AIDS cases because of a lack of reporting. His calculation of 20 000 new AIDS cases this year would bring the total of this country's AIDS cases since the start of the epidemic in 1982 to an estimated 40 000. He estimated 33 000 new AIDS cases in 1996 (**Business Day**, 7 August 1995, **The Argus**, 1 December 1995).

In another survey commissioned by Business Day (14 November 1995) the director of The National Institute of Virology, Barry Schoub, found that, while awareness of AIDS was relatively high, awareness of hepatitis B was astoundingly low. Only 38 per cent of respondents knew about the disease. The study shows that many carriers of the virus were unaware of their condition throughout their lives. About 1.4 million people are carriers of hepatitis B, and about 14 000 people die of the disease each year. The infections occurred mainly among adolescents and young

adults, although the virus was also prevalent among infants in rural areas. The report indicates that the vaccine is extremely effective and safe, and was included this year in the government's immunisation programme for all children.

Other reports indicate that South Africa has one of the highest rates of tuberculosis in the world. Harber and Ludman (1995) show that, in 1990, the Western Cape Province was the worst-hit area with 229 cases reported per 100 000 population. This report is supported by the report in the **Business Day** (2 November 1995) which says that tuberculosis kills 7 000 people a year in South Africa with 100 000 new cases reported each year.

The report shows that, on a geographical basis, the incidence increased from Gauteng towards the Western Cape.

The ANC RDP policy document (1994) states that the South African health care services were grossly damaged by decades of apartheid policies. This may account for the concerns that emerge from provinces which included former homelands. It is reported from these areas that services are in chaos ranging from:

> "Clinics without a tablet, vaccine or bandage, nurses struggle with queues" to "poor facilities, without or no proper consultation" (Strachan 1995: 14).

Many of these hospitals are currently being served by hundreds of foreign doctors as qualified South African doctors have left either for private practices or for overseas. (Harber and Ludman 1995). Perhaps the magnitude of this problem has been compounded by the recent implementation of free medical care for all children under six and pregnant women.

Within this context it should be mentioned that areas of the Northern Province have common occurrences of malaria, typhoid and diarrhoea as a result of unsafe water and inadequate sanitation, while the Western Cape is well known for its TB cases.

5.3.6 World hunger

This is the last item discussed in this study. The North Sotho males and females ranked it fourth, the Xhosa males and females also ranked it fourth, and the Coloured males and females ranked it third and first respectively. Some significant differences were disclosed by the Mann-Whitney U-test when the three samples were compared.

5.3.6.1 Possible reasons for the differences

Although reliable statistics are not available on hunger and malnutrition in South Africa, the executive director of Operation Hunger estimates that over three million rural blacks under the age of 15 are suffering from clinically diagnosable malnutrition. This situation seems to be exacerbated by the rapid population growth in rural areas, coupled with the rising unemployment rate in urban and rural areas.

Disturbing reports indicate that the food needs of some of the lesser developed parts of the world have outstripped the food supply obtainable for them. This is corroborated by the ANC (1994) report which shows that at least 17 million South African people, mostly in rural areas, live below the Minimum Living Level. This may have led the Government of National Unity to make feeding schemes one of the Presidential projects

to be implemented within 100 days of his coming into office (2 September 1995) (Government White Paper on the Reconstruction and Development Programme 1994).

5.3.7 Aims of science education in a non-western society

McKenzie (**The Sowetan**, 6 November 1995) recently reported that the Rand Afrikaans University (RAU) is offering a unique three year diploma programme in traditional health care for practising inyangas and sangomas. This is considered the first of its kind in the world where traditional doctors are to be taught botany, herbology, pharmacology, anatomy and chemistry. This is said to be aimed at equipping traditional healers to make informed decisions in their field.

This serves as a good example of how people might understand the environment in which they live, and the problems prevalent in their area, using science and technology as complementary resources. It illustrates the need for an accelerated effort to integrate science curricula to serve the needs of different South African regions with their cultural diversities.

The development of a rationale for solving global problems and the extent of accommodation of global, national and regional interests must become more balanced if world harmony is to be fostered (Tan 1988; Olorundare 1988; Ventura 1993; Amara 1987; Gallagher 1983; Bernstein 1994; and Finley 1981).

The growth of science and technology in any country depends critically on the availability of technologically and scientifically trained manpower, and it is largely the responsibility of the indigenous education system to provide this. This is a critical area for South Africa, especially in Black education which has been historically disadvantaged for generations in respect to a knowledge of western science and technology.

Thus Bajar (1981:260) comments on this by saying:

> "The introduction of science in the educational programme of any country is considered necessary and progressive. We now live in a world of science and our very existence demands an understanding of our environment, of events in nature and of technological discoveries."

This is corroborated by Za'rour (1981:382) who says:

> "A developing country should have an indigenous science and technology capacity of its own. Without it, and particularly without trained people, a developing country will not be able to know what useful technology exists elsewhere, to understand it, to select it, to adapt, to absorb, to repair, to maintain, to operate. At best only in the short term can these tasks be performed from the outside."

5.3.8 General comment on undiscussed items

It has also emerged from the current study that consistent differences occurred among the samples on the items of least concern. Both North Sotho males and females selected one least important item in common, namely **extinction of species**; the Xhosa males and females **war technology**, and **nuclear power stations**; and the Coloured males and females ranked lowest the **uses and abuses of high technology**. However, it is not feasible to discuss every small finding in a short research dissertation of this nature.

5.4 SUMMARY

In this chapter attempts have been made to explain some of the differences found between samples and genders, as reported in Chapter 4. The tendency has been to concentrate on items that revolve around human basic needs such as water, food, air, shelter, population growth and world hunger.

The conclusion and recommendations arising out of this study follow in Chapter 6.

CHAPTER 6

CONCLUSION AND RECOMMENDATIONS

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6.1 OVERVIEW

Using a selection of approximately one thousand pupils, this research set out to investigate a number of aims namely:

- to determine the significance of rank order correlation coefficients obtained using the LGPI, between the males and females of three samples of North Sotho pupils in the Northern Province and Xhosa and Coloured pupils in the Western Cape Province;

- to determine which global science-technology-society (STS) problems were consistently highly prioritised by the males and females in all three samples, irrespective of geographical area or home language;

- to determine the extent and the significant differences which occur among the three samples on each one of the fifteen items taken individually on the LGPI in 1995;

- to suggest possible explanations for similarities and differences which occur among the three samples' rankings; and

- to discuss the rankings in terms of priority policies set out in the Government White Paper on South Africa's new Reconstruction and Development Programme.

With the main objectives outlined, nine hypotheses were identified for investigation by this study. These hypotheses were in turn grouped into two sections namely:

- to determine whether there were any statistically significant correlations between the fifteen mean rankings on the LGPI as a whole, for the three samples and their sub-samples; and

- to find out whether there were any statistically significant differences between the mean rank scores given to each one of the fifteen items of the LGPI taken individually, for the three samples and their sub-samples. All hypotheses were tested, and the five main objectives of the study were achieved and interpreted.

  It was also determined, on the basis of empirical data obtained from the results, which global science-technology-society (STS) problems were consistently highly prioritised by the males and females in all three samples irrespective of geographical area or home language.

6.2 LOOKING AHEAD

This study's preliminary findings need to be replicated and expanded with larger samples in order to furnish more relevant and updated information for consideration by syllabus planners. For example, the writer feels it is important that a section of the LGPI should require respondents to identify sources of their information. Perhaps male and female pupils acquire some of their information from quite different sources of learning, and documentation of this may be educationally very useful.

The author suggests that, in some surveys, items like **human health and disease** could be expanded to include an extent of the awareness among male and female pupils of diseases such as AIDS, hepatitis A or B, or TB. Such information could be valuable in combating the spread of such diseases by means of education; and it might be helpful to establish whether gender differences in perceptions and priorities also occur on items set in these areas of concern.

Finally it has been a pleasure to pioneer a preliminary study of this nature as a team of researchers in South Africa, the first of its kind in the world extended to high school level. It suggests that more and more South Africans are acquiring skills and expertise which, if harmoniously harnessed, would enable an emerging nation to face some arduous, challenging and unfinished tasks ahead into the 21st century.

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LEGEND	
MH	Mass housing
US	Unsafe substances
HH	Human health & disease
MR	Mineral resources
FW	Fresh water supplies
PG	Population growth
EPA	Extinction of species
ES	Energy shortages
WT	War technology
AP	Air pollution
WH	World hunger
BLU	Bad land use
NP	Nuclear power stations
HT	High technology
DM	Decision makers

M	Male
F	Female
MMH	Male: Mass housing
FMH	Female: Mass housing
SAX	means Sex in North Sotho sample
S_X	means Sex in Xhosa sample
GENDER	means Sex in Coloured sample

APPENDIX A

APPENDIX A1 (i):1

1995 Cape Town High School pupils' rankings on the LGPI: Test and re-test raw scores

CODE	MH	US	HH	MR	FW	PG	EPA	ES	WT	AP	WH	BLU	NP	HT	DM
A	13	2	15	14	5	10	7	12	3	1	8	6	4	9	11
B	13	2	5	11	7	4	3	6	15	1	10	9	8	12	14
C	14	6	2	9	7	10	3	13	8	4	1	12	11	5	15
D	13	4	6	8	12	1	5	9	11	7	2	3	10	14	15
E	15	12	4	13	10	1	2	9	14	6	3	5	8	11	7
F	6	4	13	15	12	1	2	11	10	3	14	5	9	7	8
G	15	2	5	11	6	12	3	10	1	7	9	8	4	13	14
H	11	9	3	8	5	1	2	6	13	7	4	10	12	14	15
I	3	13	8	14	9	7	12	2	5	15	6	11	4	1	10
J	8	10	7	11	6	4	1	13	14	3	2	12	5	9	15
K	7	5	6	9	2	14	3	8	15	1	4	12	11	10	13
L	9	8	5	11	2	7	3	12	14	1	4	6	10	13	15
M	13	1	7	12	6	2	5	14	8	3	4	9	15	10	11
N	12	8	1	13	2	6	5	10	9	7	3	4	11	14	15
O	6	2	12	11	9	5	4	14	13	7	8	3	10	15	1
P	8	7	2	14	3	5	9	12	6	4	1	11	13	10	15
Q	9	6	5	13	11	2	4	14	8	1	3	10	12	15	7
R	8	4	5	11	10	1	6	9	13	2	3	7	12	14	15
S	13	12	1	11	4	10	2	14	15	6	3	5	7	8	9
T	8	10	2	6	15	1	11	14	5	13	3	7	12	4	9
U	8	2	6	12	3	7	1	14	15	5	9	4	13	10	11
V	3	12	2	13	6	7	8	15	9	4	1	14	10	11	5
W	7	9	4	10	8	5	2	3	15	6	1	11	12	14	13
X	4	10	3	15	2	1	8	9	12	7	5	6	11	13	14
Y	15	11	4	13	9	10	1	3	12	8	2	7	14	5	6
Z	14	11	12	9	4	3	2	8	10	1	5	7	6	13	15
AA	6	7	3	11	8	2	4	14	9	13	5	10	12	15	1
AB	9	14	7	15	10	8	11	13	6	12	5	4	3	2	1
AC	13	1	14	15	7	6	3	11	10	2	5	4	8	12	9
AD	15	11	4	12	5	2	3	8	9	7	6	13	10	14	1
AE	14	3	1	8	7	9	4	11	10	5	2	6	12	15	13
AF	6	3	4	11	7	12	8	10	15	2	1	5	13	9	14
AG	3	7	10	13	6	5	1	12	11	8	2	4	9	15	14
AH	13	2	1	5	9	3	15	8	7	6	10	12	11	14	4
AI	6	5	2	4	7	3	8	13	15	9	1	12	14	11	10
AJ	11	3	4	14	5	6	9	13	15	2	1	10	7	12	8
AK	6	5	4	11	10	1	2	13	14	9	3	15	12	8	7
AL	9	7	5	8	1	13	4	15	10	6	2	3	14	12	11
AM	13	3	2	14	11	9	6	10	12	7	1	5	4	8	15
AN	3	8	4	14	5	1	12	9	13	6	2	7	10	11	15
AO	5	6	3	7	9	4	8	12	10	13	2	15	11	14	1
AP	10	8	2	9	3	1	5	11	13	6	4	12	7	15	14
AQ	13	1	5	7	4	11	3	8	10	2	14	9	12	15	6
AR	11	9	3	13	10	5	1	2	15	6	4	8	14	12	7
AS	10	8	4	11	6	7	1	15	3	2	5	9	13	12	14
AT	15	3	1	12	4	5	6	11	8	7	2	13	9	10	14
AU	14	4	10	7	11	15	6	8	3	9	12	13	5	1	2
AV	8	7	2	15	9	10	4	11	6	3	1	12	13	5	14
AW	12	10	1	13	6	3	7	5	14	2	4	9	11	8	15
AX	10	2	7	14	3	8	4	15	6	1	5	12	11	9	13
AY	10	8	12	7	2	3	5	6	13	1	4	9	14	11	15
AZ	14	12	2	10	1	8	9	7	6	3	11	4	5	15	13
BA	3	7	8	11	9	10	12	13	6	5	4	14	2	1	15
BB	9	4	3	13	5	6	1	12	15	7	2	8	14	10	11
BC	12	8	3	7	6	2	1	14	11	9	4	5	10	15	13
BD	8	1	3	13	6	15	7	12	9	2	5	4	11	10	14
BE	11	13	2	6	3	5	4	10	15	12	1	7	8	9	14
BF	13	7	4	11	5	1	8	9	15	2	3	12	6	10	14
AVE	9.8	6.5	4.9	11	6.4	5.7	5.1	10.	10.4	5.4	4.3	8.4	9.81	10.	10.8

APPENDIX A1 (ii):2

CODE	MH	US	HH	MR	FW	PG	EPA	ES	WT	AP	WH	BLU	NP	HT	DM
A	7	2	15	14	13	5	4	8	9	1	3	10	6	11	12
B	8	4	5	12	10	3	2	11	15	1	7	6	9	13	14
C	11	6	2	10	7	8	4	12	13	3	1	14	9	5	15
D	8	4	6	13	12	1	3	11	10	5	2	9	7	15	14
E	15	12	4	5	11	1	2	13	10	6	3	14	9	7	8
F	5	7	13	12	4	1	2	14	11	3	15	6	10	8	9
G	15	3	11	10	9	14	6	7	1	8	13	12	2	4	5
H	14	10	3	7	4	1	2	8	13	9	5	6	15	12	11
I	10	14	7	15	8	5	9	2	3	13	6	12	4	1	11
J	11	8	5	7	3	4	1	9	15	2	6	12	10	14	13
K	8	9	5	6	2	7	3	12	15	1	4	10	13	11	14
L	12	8	5	13	2	7	3	10	11	1	4	6	9	15	14
M	9	1	6	11	4	5	3	10	12	2	7	8	14	15	13
N	7	9	1	8	2	5	13	11	14	6	3	4	12	10	15
O	12	2	15	8	10	11	9	13	6	7	14	3	5	4	1
P	10	8	2	14	3	4	9	11	5	6	1	13	12	7	15
Q	9	8	3	11	6	2	5	12	14	1	4	7	13	15	10
R	9	6	5	13	7	1	2	11	15	4	3	8	10	12	14
S	15	8	1	5	6	7	2	11	12	9	3	4	13	14	10
T	9	14	4	5	15	1	2	8	7	13	3	12	11	6	10
U	6	5	2	11	3	10	4	13	14	7	1	9	15	12	8
V	6	11	2	12	5	3	7	15	13	4	1	10	9	14	8
W	10	7	3	8	6	2	9	4	15	5	1	11	13	12	14
X	2	13	3	10	4	1	7	8	15	11	5	6	12	14	9
Y	10	8	7	12	4	5	1	6	3	11	2	9	15	14	13
Z	13	11	10	6	3	8	1	5	9	2	4	12	7	14	15
AA	6	7	5	11	9	2	4	14	12	8	3	10	13	15	1
AB	13	14	11	15	10	9	8	4	12	7	5	6	3	2	1
AC	8	2	5	13	6	10	3	11	12	4	1	7	14	9	15
AD	15	9	3	12	6	2	5	13	10	8	4	7	11	14	1
AE	15	3	1	9	6	7	4	13	11	10	5	8	12	14	2
AF	11	4	13	8	7	12	6	10	15	2	1	5	9	3	14
AG	15	6	2	7	5	3	1	10	12	8	4	9	11	13	14
AH	3	2	1	12	11	10	15	7	8	9	6	13	5	14	4
AI	7	5	2	8	4	3	10	9	15	6	1	11	14	12	13
AJ	7	4	3	14	6	2	11	10	15	5	1	13	9	12	8
AK	14	11	3	10	8	1	2	15	12	7	6	9	13	5	4
AL	15	14	4	11	2	8	5	12	10	3	1	6	13	7	9
AM	4	5	2	11	10	8	3	13	6	14	1	7	9	12	15
AN	10	6	2	14	5	1	11	7	12	4	3	8	9	13	15
AO	5	7	3	15	8	4	6	9	10	12	2	14	11	13	1
AP	14	6	3	7	13	1	5	10	11	4	2	9	12	15	8
AQ	15	2	8	10	7	5	4	13	12	3	9	11	14	6	1
AR	12	8	3	14	6	4	1	2	13	7	5	9	15	10	11
AS	11	6	3	14	10	7	2	12	5	4	1	8	9	15	13
AT	7	3	1	10	11	5	6	12	13	4	2	14	8	9	15
AU	13	7	1	6	5	15	8	4	12	3	9	2	11	14	10
AV	8	4	3	13	7	6	5	11	14	2	1	9	10	12	15
AW	13	5	1	9	4	2	15	10	11	3	6	7	8	12	14
AX	9	2	1	11	3	4	5	12	13	6	7	14	8	15	10
AY	8	6	11	9	5	3	2	10	12	1	4	7	14	13	15
AZ	13	5	4	3	6	8	1	7	9	2	10	11	12	14	15
BA	2	13	12	14	11	9	10	8	3	4	5	7	6	1	15
BB	6	4	2	8	7	3	1	11	15	9	5	10	14	12	13
BC	15	4	3	5	7	8	1	10	11	9	2	6	12	13	14
BD	6	1	4	13	2	14	8	15	9	3	10	5	7	11	12
BE	11	13	1	5	3	2	4	12	15	6	10	9	7	8	14
BF	13	7	4	10	6	1	5	8	15	2	3	11	9	12	14
AVE	9.9	6.8	4.7	10.2	6.5	5.2	5.0	10.0	11.1	5.5	4.4	8.9	10.3	10.8	10.7

Appendix A(iii)

The mean priority scores, and ranks of relative importance, of global problems in science and technology rated: Test-retest summary data obtained with school science pupils in 1995.

	Test N = 58		Retest N = 58	
Global problem	**Mean priority score**	**Rank of relative importance**	**Mean priority score**	**Rank of relative importance**
Mass housing	9.8	9	9.9	9
Unsafe substances	6.5	7	6.8	7
Human health & disease	4.9	2	4.7	2
Mineral resources	11.0	15	10.2	11
Fresh water supplies	6.4	6	6.5	6
Population growth	5.7	5	5.2	4
Extinction of species	5.1	3	5.0	3
Energy shortages	10.5	13	10.0	10
War technology	10.4	12	11.1	15
Air pollution	5.4	4	5.5	5
World Hunger	4.3	1	4.4	1
Bad land use	8.4	8	8.9	8
Nuclear power stations	9.81	10	10.3	12
High technology	10.0	11	10.8	14
Decision makers	10.8	14	10.7	13

$r = 0.93$; $n = 0.58$; $p = 0.01$.

APPENDIX A2 (i):4

1995 HDE(UCT) students' rankings on the LGPI:
Test raw scores

CODE		MH	US	HH	MR	FW	PG	EPA	ES	WT	AP	WH	BLU	NP	HT	DM
A		1	4	3	12	8	11	13	10	7	5	2	9	6	15	14
B		7	11	3	8	1	6	5	4	13	9	2	10	15	14	12
C		4	6	5	9	3	10	11	12	13	2	7	8	1	14	15
D		14	4	12	15	2	3	5	13	11	6	10	7	9	8	1
E		10	4	8	9	1	3	5	14	15	2	11	7	6	12	13
F		14	8	5	9	2	4	3	11	12	10	1	6	7	13	15
G		10	6	7	8	1	5	4	11	13	2	9	3	12	14	15
H		12	7	8	14	5	6	13	4	1	11	10	9	2	3	15
I		12	6	11	13	3	2	10	7	8	4	9	5	15	14	1
J		6	11	7	10	4	1	5	9	15	2	3	8	12	14	13
K		5	14	3	9	6	1	4	10	11	7	2	8	15	13	12
	AVE	8.6	7.4	6.5	10.5	3.3	4.7	7.1	9.5	10.8	5.5	6.0	7.3	9.1	12.2	11.5

A2 (ii):4

1995 HDE(UCT) students' rankings on the LGPI:
Re-test raw scores

CODE		MH	US	HH	MR	FW	PG	EPA	ES	WT	AP	WH	BLU	NP	HT	DM
A		1	4	3	10	8	15	14	9	6	7	2	12	5	11	13
B		10	9	1	8	2	7	5	11	13	6	3	4	14	12	15
C		8	7	6	14	3	15	5	9	2	4	11	12	1	10	13
D		15	9	12	13	3	5	8	6	14	4	11	7	10	2	1
E		9	10	6	5	1	3	2	12	13	4	11	14	7	8	15
F		6	13	3	10	2	9	4	8	14	7	1	5	12	11	15
G		10	6	7	8	1	2	11	9	13	4	5	3	12	14	15
H		10	8	3	9	2	4	13	11	5	15	1	12	6	7	14
I		12	9	14	11	1	5	10	6	7	3	8	2	15	13	4
J		6	10	5	11	2	1	3	4	15	8	9	7	12	13	14
K		3	15	6	4	7	1	8	9	5	11	2	10	14	13	12
	AVE	8.2	9.1	6.0	9.4	2.9	6.1	7.5	8.5	9.7	6.6	5.8	8.0	9.8	10.4	11.9

APPENDIX B

APPENDIX B1:1

1995 North Sotho pupils' rankings on the LGPI:
Raw scores

SEX	STD	MH	US	HH	MR	FW	PG	EPA	ES	WT	AP	WH	BLU	NP	HT	DM
F	E	11	7	4	13	1	9	6	8	12	15	3	2	5	10	14
F	E	13	7	6	9	1	2	12	5	15	14	10	11	4	3	8
F	E	8	13	3	2	1	7	5	12	15	14	10	11	4	6	9
F	E	13	7	6	9	1	14	12	8	15	10	4	11	5	2	3
F	E	9	14	6	7	1	13	15	5	3	12	4	2	10	8	11
F	N	10	11	5	7	1	2	13	6	14	15	3	4	9	8	12
F	N	8	5	2	14	1	13	10	9	7	12	4	15	6	3	11
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APPENDIX B1:2

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APPENDIX B1:3

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APPENDIX B1:4

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APPENDIX B1:5

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APPENDIX B1:6

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APPENDIX B1:7

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F	N	7	8	6	2	1	3	11	14	9	10	13	4	15	5	12
AVE.		10.02	9.30	4.08	9.38	1.88	4.64	10.18	8.21	9.95	9.20	6.09	8.74	9.62	9.67	9.04

APPENDIX B2:1

1995 Xhosa pupils' rankings on the LGPI: Raw scores

SEX	STAND	LANG	MH	US	HH	MR	FW	PG	EPA	ES	WT	AP	WH	BLU	NP	HT	DM
M	9	X	1	6	2	4	5	7	11	10	9	15	13	3	8	12	14
M	9	X	1	15	14	10	13	2	5	7	4	9	12	3	11	8	6
M	9	X	3	4	2	5	1	11	15	14	13	6	7	8	9	10	12
F	9	X	2	7	3	5	1	4	10	11	8	9	6	12	13	15	14
F	9	X	1	9	3	11	2	10	13	15	7	8	5	12	14	4	6
F	9	X	1	6	2	12	3	5	15	7	13	14	4	8	9	10	11
F	9	X	1	7	2	6	3	8	4	12	14	9	11	15	10	13	5
F	9	X	1	5	3	15	2	7	6	4	13	12	10	11	14	8	9
F	9	X	2	4	1	10	5	6	14	11	15	12	3	9	13	7	8
F	9	X	2	8	3	11	4	1	6	12	9	14	5	7	10	13	15
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F	9	X	3	7	2	15	4	13	6	9	14	10	8	5	12	1	11
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F	9	X	13	9	4	3	8	14	6	5	15	11	12	10	1	2	7
F	9	X	1	4	5	15	3	2	8	12	14	7	6	10	9	13	11
F	9	X	2	8	4	12	5	1	3	11	15	10	6	7	14	13	9
F	9	E	9	3	1	10	5	2	6	8	12	11	4	7	13	15	14
F	9	E	5	3	2	8	4	9	15	7	6	10	1	13	11	12	14
F	9	E	2	11	3	13	8	1	10	9	15	4	5	12	6	7	14
F	9	E	1	2	5	3	4	12	14	11	10	6	9	7	8	13	15
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M	9	E	1	2	3	10	4	6	7	14	8	5	13	9	11	12	15
F	10	X	1	8	2	10	3	6	15	11	7	5	4	12	14	13	9
F	10	X	1	6	2	8	3	7	15	10	13	4	9	12	5	11	14
F	10	X	1	6	3	7	2	4	10	9	12	11	5	8	13	14	15
M	10	E	15	10	14	8	7	13	12	5	1	9	11	4	2	6	3
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M	10	E	1	4	3	8	2	6	9	15	14	10	5	7	11	13	12
F	10	E	1	3	7	4	11	8	13	12	14	9	2	6	15	5	10
F	10	E	3	5	2	13	4	9	8	7	14	6	1	10	11	12	15
F	10	E	1	12	2	4	3	6	9	8	15	13	11	14	5	7	10
M	10	E	1	14	2	15	3	8	9	11	6	7	4	12	13	5	10
M	10	E	2	7	4	6	3	8	10	9	14	5	1	11	13	12	15
M	10	E	14	7	1	15	8	6	13	2	9	12	3	10	11	4	5
M	10	X	1	5	3	10	2	12	14	9	8	11	4	13	15	7	6
M	10	X	1	4	6	7	2	14	5	8	15	12	3	9	13	10	11
M	10	X	1	4	7	6	2	14	5	8	15	12	3	9	13	10	11
F	10	X	6	12	15	14	13	10	1	7	4	8	9	2	11	3	5
F	10	X	1	4	2	9	3	6	8	10	14	7	15	5	13	12	11
M	10	X	1	5	6	9	2	4	10	7	8	11	3	14	15	12	13
M	10	X	1	5	6	9	2	4	10	7	8	11	3	14	15	12	13
F	10	X	1	7	4	14	2	3	9	6	12	8	5	10	15	13	11

APPENDIX B2:2

F	10	X	1	10	7	15	2	5	9	6	12	13	8	4	14	11	3
M	10	X	1	8	4	15	3	5	7	6	10	14	2	13	12	9	11
M	10	X	1	8	4	9	2	5	7	6	11	13	3	12	15	10	14
M	10	E	1	6	4	8	2	15	9	13	11	10	3	14	12	7	5
M	10	E	11	14	15	12	4	6	5	1	9	2	13	8	7	10	3
M	10	E	1	15	2	13	3	4	12	11	6	5	14	7	8	9	10
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M	10	E	1	10	3	14	2	15	12	9	11	8	4	7	13	5	6
M	10	E	1	4	3	6	5	7	9	10	15	8	2	11	12	13	14
M	10	E	1	5	4	14	3	15	6	7	8	9	2	10	11	12	13
M	10	X	1	14	13	2	3	15	4	5	6	12	11	10	9	8	7
F	10	E	3	9	5	12	4	10	14	1	15	11	2	6	8	13	7
F	10	E	1	7	2	8	4	5	9	6	15	11	3	10	14	12	13
F	10	E	1	8	2	10	13	12	11	6	3	5	4	9	14	7	15
F	10	E	1	10	3	2	4	9	7	8	11	13	5	12	14	15	6
F	10	E	1	15	2	5	14	8	10	9	7	13	6	11	12	3	4
F	10	E	1	4	3	8	2	5	6	7	15	9	12	13	14	10	11
F	10	E	1	5	2	4	3	6	9	13	12	7	8	10	11	14	15
F	10	X	4	1	2	7	3	15	5	8	13	9	6	12	14	10	11
F	10	X	1	4	3	6	5	15	10	7	12	9	2	11	13	8	14
F	10	X	4	11	1	5	2	15	10	8	9	6	3	13	12	7	14
F	10	X	3	13	2	15	4	14	8	5	10	9	1	6	12	11	7
F	10	X	4	8	5	13	6	3	15	7	11	9	2	10	14	12	1
F	10	X	8	9	1	2	7	6	10	14	11	15	13	3	12	4	5
M	7	E	2	6	7	8	3	4	12	13	14	11	5	1	15	9	10
M	7	X	3	11	8	6	2	4	14	15	7	12	1	13	9	10	5
M	7	X	2	1	6	14	3	9	7	10	15	4	5	8	11	13	12
F	7	X	1	5	4	6	2	3	8	14	10	7	9	13	11	12	15
F	7	X	2	6	5	7	4	1	10	11	13	9	3	14	12	8	15
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F	7	X	1	3	2	9	4	8	10	13	14	12	11	6	7	15	5
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F	7	X	1	2	4	5	3	6	14	10	7	12	13	11	8	9	15
M	7	X	1	7	3	9	2	8	6	11	5	14	4	10	12	13	15
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F	7	X	2	1	3	9	14	8	6	13	15	12	5	4	11	7	10
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F	7	X	1	5	2	11	4	15	6	14	8	13	3	9	10	12	7
F	7	X	3	5	2	10	11	1	9	8	13	15	12	7	14	6	4
F	7	X	5	1	2	3	14	15	11	13	9	7	8	4	10	12	6
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F	7	X	3	4	5	7	6	8	10	11	12	14	1	2	13	9	15
F	7	X	1	3	2	6	14	5	8	10	7	11	9	12	13	15	4
M	7	E	1	10	4	11	2	6	8	15	13	9	3	12	14	5	7
M	7	E	3	2	1	9	8	15	4	7	14	6	13	11	12	5	10
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M	7	E	7	8	2	12	6	1	10	9	13	14	3	4	5	15	11
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M	7	E	4	5	1	14	6	3	9	7	11	12	2	10	13	8	15
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F	7	X	1	8	3	2	12	10	5	13	14	6	4	7	9	11	15
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M	7	X	2	5	7	11	6	4	13	12	14	3	1	15	9	8	10
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M	9	E	1	7	6	5	2	8	9	10	13	11	4	14	15	3	12
F	9	E	1	5	3	7	2	8	9	12	14	4	10	6	13	15	11
M	9	X	1	7	4	5	6	2	3	11	13	14	8	15	12	10	9
F	9	X	1	10	4	6	2	5	8	7	15	11	3	9	13	12	14
F	9	E	1	5	3	7	2	8	9	12	14	4	10	6	13	15	11
F	9	X	1	8	4	10	2	7	13	9	15	11	3	14	5	12	6

APPENDIX B2:3

F	9	X	1	8	4	9	5	13	6	7	12	11	2	10	14	3	15
F	9	E	2	5	4	15	3	1	13	7	8	6	12	9	14	10	11
F	9	X	1	4	3	13	2	5	12	11	15	9	6	10	14	7	8
F	9	X	1	4	5	11	3	6	14	10	13	8	9	12	7	2	15
M	9	X	1	9	2	11	3	5	7	10	15	8	4	6	12	13	14
M	9	X	1	4	2	11	3	5	12	9	6	10	7	8	14	13	15
M	9	X	4	5	9	11	13	15	7	8	10	6	1	2	12	14	3
F	9	X	1	6	2	15	3	14	10	7	8	9	4	12	11	5	13
F	9	E	1	5	2	11	8	15	12	9	14	10	3	13	4	7	6
F	9	E	3	10	8	12	14	2	9	15	7	13	5	11	6	1	4
F	9	E	1	7	9	8	11	12	3	10	15	4	2	5	6	13	14
F	9	E	3	10	13	2	11	1	12	5	15	4	8	14	6	7	9
M	9	X	1	2	5	6	7	8	11	14	10	13	12	3	15	9	4
F	9	X	1	10	4	2	3	11	15	13	14	8	9	5	12	7	6
F	9	E	1	8	2	10	4	3	11	12	13	9	5	6	14	7	15
F	9	X	1	4	2	7	3	5	15	11	6	9	12	10	14	8	13
F	9	X	1	10	12	6	2	11	7	8	5	15	9	14	13	3	4
F	9	E	1	14	5	15	4	3	12	13	10	11	2	6	9	7	8
M	9	E	1	14	3	7	2	4	8	13	15	11	5	10	9	12	6
F	9	E	2	12	1	8	3	4	9	13	11	6	14	15	5	10	7
F	9	E	1	9	11	6	2	5	4	12	7	10	3	13	8	14	15
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M	9	E	1	2	3	6	4	5	8	7	9	11	10	15	12	14	13
F	9	E	1	7	2	10	3	15	8	6	9	11	4	14	5	13	12
F	9	E	1	9	4	5	3	7	15	6	13	8	2	11	14	12	10
F	9	E	1	4	3	2	7	12	14	11	10	5	6	9	15	13	8
F	9	E	1	5	11	3	8	12	2	13	15	10	7	14	9	6	4
M	9	E	2	5	1	4	3	9	7	10	12	15	6	8	11	14	13
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M	9	E	1	14	5	4	2	6	8	7	9	13	3	15	11	12	10
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F	9	E	13	11	4	10	8	1	14	7	9	6	5	12	15	2	3
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F	9	E	1	8	6	11	5	2	14	7	9	3	4	12	10	13	15
F	9	E	1	4	3	8	2	10	15	6	13	11	5	12	9	7	14
M	9	X	1	6	3	10	2	11	14	9	15	4	5	12	13	8	7
F	6	X	1	6	2	8	3	5	9	7	13	14	4	12	11	10	15
F	6	X	1	5	2	15	6	11	14	12	4	8	3	10	7	13	9
M	6	X	1	14	6	15	2	8	10	3	9	11	4	5	12	7	13
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F	6	X	1	4	2	15	3	8	5	9	13	10	6	7	14	11	12
F	6	X	1	13	4	2	12	7	3	10	15	11	14	5	9	8	6
F	6	X	1	2	10	7	3	11	4	9	14	15	5	13	12	8	6
F	6	X	1	6	5	9	13	2	7	10	15	8	3	11	12	4	14
M	6	X	1	6	2	8	3	4	5	10	14	13	9	7	15	11	12
F	6	X	1	3	2	5	4	7	14	6	8	9	10	11	13	12	15
F	6	X	9	11	2	10	3	8	12	14	15	6	7	4	5	1	13
M	6	X	1	7	13	8	6	4	15	2	5	11	10	14	3	9	12
M	6	X	1	2	6	9	10	11	3	8	15	4	5	7	13	12	14
M	6	X	1	15	3	9	4	14	2	11	6	7	8	10	12	5	13
F	6	X	1	6	2	3	4	5	11	12	13	14	10	7	15	8	9
F	6	X	1	2	3	14	5	4	13	9	6	12	7	11	15	8	10

M	6	X	1	6	7	11	8	2	5	4	12	13	3	14	10	15	9
M	6	X	1	7	6	8	9	14	12	4	13	5	3	10	11	2	15
M	6	X	1	6	7	14	2	8	10	11	15	5	4	9	13	12	3
M	6	X	1	15	2	3	14	4	5	13	12	11	6	7	10	8	9
		AVE.	2.08	6.90	4.32	8.87	4.77	7.20	9.21	9.19	11.30	9.54	5.92	9.34	11.24	9.68	10.44

APPENDIX B3:1

1995 1995 Coloured pupils' rankings on the LGPI: Raw scores

SEX	MH	US	HH	MR	FW	PG	EPA	ES	WT	AP	WH	BLU	NP	HT	DM
M	12	3	9	15	4	5	14	13	6	1	2	8	10	11	7
M	12	11	10	9	3	2	8	7	15	1	4	5	6	14	13
M	13	9	8	10	7	6	11	12	15	1	2	5	14	4	3
M	14	6	10	11	5	1	9	12	3	4	2	13	7	8	15
M	6	2	1	12	7	8	3	9	15	4	5	10	13	11	14
M	5	9	7	11	4	1	8	10	3	6	2	13	12	14	15
M	13	6	7	9	8	2	1	3	14	4	5	11	12	10	15
M	8	10	1	13	4	2	7	6	9	5	3	11	12	14	15
M	12	5	9	13	2	1	4	10	15	3	6	11	14	7	8
M	13	15	3	6	1	2	7	10	14	8	11	5	12	4	9
M	14	5	1	8	10	4	15	7	12	2	3	6	11	9	13
M	11	3	9	13	4	2	15	12	5	1	14	7	8	10	6
M	9	5	15	14	13	7	10	8	2	4	11	12	3	6	1
M	12	2	5	14	1	3	4	10	11	6	7	8	9	13	15
M	10	3	14	15	12	11	7	9	4	8	2	13	5	6	1
M	12	10	2	4	8	5	7	3	13	6	1	11	14	15	9
M	10	4	3	12	1	8	5	11	7	6	2	13	9	14	15
M	7	3	2	11	8	1	4	15	12	6	5	9	10	13	14
M	7	2	9	12	5	11	6	13	10	4	14	3	15	8	1
M	7	14	2	15	6	1	12	10	13	3	4	5	8	11	9
M	1	3	11	12	4	8	13	15	6	7	5	9	10	14	2
M	12	8	2	7	6	15	1	9	14	5	3	4	10	13	11
M	15	4	10	11	1	13	6	12	3	5	2	7	8	14	9
M	11	8	1	7	6	2	9	5	14	3	4	15	10	13	12
M	2	4	3	9	6	11	5	13	8	7	1	12	10	14	15
M	6	7	2	13	5	8	9	11	15	4	1	3	14	12	10
M	8	6	10	11	5	4	1	12	7	15	2	3	9	13	14
M	13	2	3	8	1	6	11	7	9	5	4	12	10	14	15
M	11	3	9	13	4	2	15	12	5	1	14	7	8	10	6
M	12	7	8	15	2	1	3	13	14	4	5	6	9	10	11
M	10	9	1	7	5	8	6	14	13	11	2	3	15	12	4
M	13	7	8	3	4	9	1	10	11	5	6	2	15	14	12
M	14	4	1	7	3	2	8	10	12	5	13	11	6	9	15
M	9	14	2	10	12	4	1	6	11	5	8	3	7	13	15
M	11	2	1	4	3	8	14	13	5	6	7	12	9	10	15
M	8	4	5	13	6	3	2	12	11	10	1	7	9	15	14
M	7	8	12	15	9	4	3	13	10	6	5	2	14	11	1
M	11	5	1	13	12	4	3	14	2	15	6	7	8	10	9
M	12	1	8	11	9	7	2	10	3	4	5	14	6	13	15
M	5	3	7	14	8	4	1	13	12	9	11	2	6	10	15
M	15	1	4	8	2	9	3	6	7	10	12	14	5	11	13
M	10	1	2	12	13	5	3	6	8	7	4	15	9	11	14
M	15	1	3	5	10	2	4	9	6	7	11	8	13	14	12
M	11	15	1	2	4	14	5	3	6	7	9	8	10	12	13
M	12	2	5	6	4	7	3	11	13	1	15	8	14	9	10
M	5	8	12	13	7	2	1	14	9	3	6	10	4	11	15
M	10	6	2	11	3	5	7	9	13	4	1	8	12	15	14
M	5	3	7	14	8	4	1	13	12	9	11	2	6	10	15
M	13	4	7	15	6	14	2	9	8	1	3	5	10	12	11
M	10	8	1	13	7	6	2	14	4	11	3	9	15	12	5
M	10	7	1	12	2	3	8	9	15	4	5	6	11	13	14
M	12	1	9	11	8	15	5	14	10	4	13	6	7	2	3
M	11	4	7	10	2	3	5	9	12	1	8	6	15	13	14
M	4	1	10	12	3	11	13	15	14	6	2	7	8	9	5
M	14	9	6	8	4	3	2	7	12	1	5	11	15	13	10
M	12	4	11	5	6	10	1	7	14	8	3	2	13	15	9

APPENDIX B3:2

M	8	2	6	12	4	3	7	9	15	1	5	13	14	10	11
M	14	10	4	9	5	7	1	6	8	2	3	12	11	13	15
M	13	2	6	10	3	4	1	12	11	5	7	9	14	15	8
M	9	8	2	12	7	1	6	14	4	13	5	3	10	15	11
M	5	11	3	9	1	4	8	6	13	7	2	12	10	14	15
M	5	12	2	9	3	4	8	13	7	14	10	15	1	6	11
M	6	9	15	13	10	1	5	14	12	11	8	3	4	7	2
M	9	6	5	3	8	1	4	10	11	7	2	13	12	14	15
M	11	15	1	13	5	3	6	8	14	4	2	7	12	9	10
M	12	3	15	13	2	14	1	5	4	7	9	6	11	8	10
M	13	5	2	10	9	1	11	4	3	12	7	8	6	15	14
M	15	12	8	13	14	1	10	7	9	2	3	11	6	4	5
M	13	5	2	14	12	1	11	10	15	6	3	4	7	9	8
M	11	5	3	9	4	6	1	12	13	2	7	10	8	14	15
M	8	6	4	12	10	5	14	7	15	1	2	3	11	9	13
M	2	14	10	9	7	4	8	13	6	5	1	3	15	12	11
M	6	11	10	15	3	14	1	7	12	4	2	5	13	9	8
M	10	8	2	15	6	1	4	14	7	5	3	13	9	11	12
M	9	8	7	13	3	1	10	14	15	4	2	5	12	11	6
M	9	1	6	10	5	2	12	4	15	13	3	8	7	11	14
M	15	2	1	10	3	5	11	4	12	6	7	9	13	8	14
M	12	1	4	11	13	15	3	10	6	5	7	8	2	9	14
M	13	4	10	14	6	7	2	15	1	3	11	5	9	12	8
M	15	8	9	10	3	11	2	12	13	1	14	4	5	6	7
M	15	8	7	13	5	3	2	9	4	1	12	10	6	11	14
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APPENDIX B3:3

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APPENDIX B3:4

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APPENDIX B3:5

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F	4	6	1	8	7	2	11	12	9	13	3	5	10	14	15
F	2	9	5	14	6	4	13	7	15	8	1	12	10	11	3
F	9	5	2	11	6	4	7	10	14	3	1	8	12	13	15
F	6	9	8	11	12	4	7	10	2	1	5	13	3	14	15
F	13	3	8	9	6	7	10	11	2	1	4	12	5	15	14
F	8	11	5	15	6	10	4	14	3	9	12	13	2	7	1
F	11	4	2	12	5	7	6	10	15	3	1	13	14	8	9
F	3	11	5	2	15	6	10	13	1	4	7	14	9	12	8
F	10	3	5	11	9	6	7	14	15	2	4	8	13	12	1
F	15	13	10	9	14	4	3	7	8	1	2	5	6	11	12
F	15	2	6	3	7	1	4	9	11	5	10	13	12	8	14
F	10	1	8	14	9	4	12	15	13	5	3	11	2	6	7
F	8	10	1	11	2	3	12	13	4	5	7	9	6	14	15
F	10	14	4	12	6	5	11	7	1	8	3	9	2	13	15
F	5	8	4	6	9	7	3	10	2	11	12	13	14	1	15

F	14	3	4	8	7	15	13	11	2	6	10	12	1	5	9
F	11	15	9	8	7	3	2	6	1	5	4	10	12	13	14
AVE.	9.45	6.31	4.88	10.74	6.27	5.22	6.44	10.16	9.77	5.55	4.89	9.15	9.64	10.79	10.76

APPENDIX C

APPENDIX C1:1

Summary statistics for 250 North Sotho male pupils

Variable:	MH select sax='MUS	select sax='MHH	select sax=
Sample size	250	250	250
Average	10.284	9.344	3.956
Median	11	9.5	3
Mode	14	13	2
Geometric mean	9.47082	8.3943	3.08172
Variance	11.8026	13.8973	9.02215
Standard deviation	3.43548	3.7279	3.00369
Standard error	0.217279	0.235773	0.18997
Minimum	1	1	1
Maximum	15	15	15
Range	14	14	14
Lower quartile	8	6	2
Upper quartile	13	13	5
Interquartile range	5	7	3
Skewness	-0.587348	-0.219688	1.50818
Standardized skewness	-3.79131	-1.41808	9.73528
Kurtosis	-0.364721	-1.06513	1.8289
Standardized kurtosis	-1.17713	-3.43769	5.90274
Coeff. of variation	33.4061	39.8962	75.9274
Sum	2571	2336	989

Variable:	MR select sax='MFW	select sax='MPG	select sax='
Sample size	250	250	250
Average	9.472	1.88	4.492
Median	10	1	3
Mode	7	1	3
Geometric mean	8.65252	1.49771	3.5065
Variance	12.7884	2.66024	10.4758
Standard deviation	3.57608	1.63102	3.23664
Standard error	0.226171	0.103155	0.204703
Minimum	1	1	1
Maximum	15	11	15
Range	14	10	14
Lower quartile	7	1	2
Upper quartile	13	2	6
Interquartile range	6	1	4
Skewness	-0.127588	2.52942	1.24858
Standardized skewness	-0.823576	16.3273	8.05956
Kurtosis	-1.068	7.16352	0.968777
Standardized kurtosis	-3.44696	23.1202	3.12672
Coeff. of variation	37.7543	86.7566	72.0534
Sum	2368	470	1123

APPENDIX C1:2

Variable:	EPA select sax=	ES select sax=	MW1 select sax=
Sample size	250	250	250
Average	10.332	7.928	9.46
Median	11	7	9
Mode	15	7	9
Geometric mean	9.65982	7.14774	8.73206
Variance	11.1946	10.9667	11.157
Standard deviation	3.34583	3.3116	3.34021
Standard error	0.211609	0.209444	0.211254
Minimum	1	1	2
Maximum	15	15	15
Range	14	14	13
Lower quartile	8	5	7
Upper quartile	13	10	12
Interquartile range	5	5	5
Skewness	-0.324529	0.268423	-0.175891
Standardized skewness	-2.09483	1.73266	-1.13537
Kurtosis	-0.811111	-0.744187	-0.629407
Standardized kurtosis	-2.61785	-2.40185	-2.0314
Coeff. of variation	32.3831	41.7709	35.3088
Sum	2583	1982	2365

APPENDIX C1:3

Variable:	AP select sax='MWH	select sax='MBLU	select sax=
Sample size	250	250	250
Average	8.812	6.16	8.896
Median	9	5	9
Mode	10	4	5
Geometric mean	7.67294	5.00014	7.85157
Variance	15.4143	14.649	15.3626
Standard deviation	3.92611	3.8274	3.91952
Standard error	0.248309	0.242066	0.247892
Minimum	1	1	1
Maximum	15	15	15
Range	14	14	14
Lower quartile	6	4	5
Upper quartile	12	9	13
Interquartile range	6	5	8
Skewness	-0.11149	0.755868	-0.0755865
Standardized skewness	-0.719668	4.87911	-0.487909
Kurtosis	-0.977974	-0.590199	-1.28288
Standardized kurtosis	-3.1564	-1.90486	-4.14047
Coeff. of variation	44.5541	62.1331	44.0593
Sum	2203	1540	2224

Variable:	NP select sax='MHT	select sax='MDM	select sax=
Sample size	250	250	250
Average	9.588	10.08	9.316
Median	10	11	9
Mode	13	15	15
Geometric mean	8.52916	9.11094	8.32274
Variance	15.3758	14.7888	14.8756
Standard deviation	3.92119	3.84562	3.8569
Standard error	0.247998	0.243218	0.243932
Minimum	1	2	1
Maximum	15	15	15
Range	14	13	14
Lower quartile	6	7	6
Upper quartile	13	14	13
Interquartile range	7	7	7
Skewness	-0.357994	-0.404042	-0.110241
Standardized skewness	-2.31084	-2.60808	-0.711604
Kurtosis	-1.08195	-0.970954	-1.08501
Standardized kurtosis	-3.49198	-3.13374	-3.50186
Coeff. of variation	40.8969	38.1509	41.4008
Sum	2397	2520	2329

APPENDIX C2:1

Summary statistics for 164 North Sotho female pupils

Variable:	MH select sax='FUS select sax='FHH select sax='F		
Sample size	164	164	164
Average	9.60976	9.23171	4.2622
Median	10	9	4
Mode	13	9	2
Geometric mean	8.72555	8.44208	3.53974
Variance	12.7548	11.1607	7.21304
Standard deviation	3.57138	3.34076	2.68571
Standard error	0.278878	0.26087	0.209719
Minimum	1	1	1
Maximum	15	15	12
Range	14	14	11
Lower quartile	7	7	2
Upper quartile	13	12	6
Interquartile range	6	5	4
Skewness	-0.397887	-0.290603	1.21675
Standardized skewness	-2.0802	-1.51931	6.36134
Kurtosis	-0.749781	-0.655853	0.952876
Standardized kurtosis	-1.95998	-1.71444	2.49088
Coeff. of variation	37.1641	36.1879	63.0124
Sum	1576	1514	699

Variable:	MR select sax='FFW select sax='FPG select sax='F		
Sample size	164	164	164
Average	9.25	1.87195	4.85976
Median	9	1	4
Mode	7	1	3
Geometric mean	8.09291	1.44859	3.80767
Variance	15.2316	2.97123	11.9495
Standard deviation	3.90277	1.72373	3.45681
Standard error	0.304755	0.1346	0.269932
Minimum	1	1	1
Maximum	15	8	15
Range	14	7	14
Lower quartile	7	1	2.5
Upper quartile	13	2	7
Interquartile range	6	1	4.5
Skewness	-0.297095	2.14323	1.27183
Standardized skewness	-1.55325	11.2051	6.64932
Kurtosis	-0.888716	3.70145	1.04879
Standardized kurtosis	-2.32316	9.67584	2.7416
Coeff. of variation	42.1921	92.0818	71.1313
Sum	1517	307	797

08/24/95 04:14:22 PM

Variable:	EPA select sax='ES select sax='FWT select sax='F		
Sample size	164	164	164
Average	9.95122	8.63415	10.7012
Median	10.5	9	11
Mode	10	5	15
Geometric mean	8.97662	7.97176	9.88371
Variance	13.8504	9.55858	11.904

APPENDIX C2:2

Variance	14.6392	10.7803	18.5951
Standard deviation	3.82612	3.28334	4.31221
Standard error	0.311365	0.267194	0.350923
Minimum	1	2	1
Maximum	15	15	15
Range	14	13	14
Lower quartile	3	8	6
Upper quartile	8	13	14
Interquartile range	5	5	8
Skewness	0.671165	-0.454973	-0.337271
Standardized skewness	3.36699	-2.28243	-1.69197
Kurtosis	-0.391096	-0.576311	-1.18248
Standardized kurtosis	-0.980994	-1.44557	-2.96604
Coeff. of variation	64.697	32.5745	45.1243
Sum	893	1522	1443

Variable:	AP select sax='FWH select sax='FBLU select sax=		
Sample size	164	164	164
Average	9.79268	5.9939	8.5122
Median	10	4	8
Mode	15	4	15
Geometric mean	8.79984	4.80073	7.43286
Variance	15.2696	15.957	16.2023
Standard deviation	3.90764	3.99462	4.02521
Standard error	0.305135	0.311928	0.314316
Minimum	1	1	2
Maximum	15	15	15
Range	14	14	13
Lower quartile	7	3	5
Upper quartile	13	8	11.5
Interquartile range	6	5	6.5
Skewness	-0.277552	0.931727	0.19083
Standardized skewness	-1.45108	4.87119	0.997686
Kurtosis	-1.14777	-0.334051	-1.11471
Standardized kurtosis	-3.00034	-0.873231	-2.91392
Coeff. of variation	39.9037	66.6448	47.2876
Sum	1606	983	1396

Variable:	NP select sax='FHT select sax='FDM select sax='F		
Sample size	164	164	164
Average	9.67073	9.03659	8.62195
Median	10	9	9
Mode	14	14	3
Geometric mean	8.60996	7.83209	7.5019
Variance	15.2897	15.741	15.7949
Standard deviation	3.9102	3.96749	3.97427
Standard error	0.305336	0.309809	0.310339
Minimum	1	1	2
Maximum	15	15	15
Range	14	14	13
Lower quartile	7	6	5.5
Upper quartile	13	12	12
Interquartile range	6	6	6.5
Skewness	-0.302747	-0.26847	-0.0618577
Standardized skewness	-1.5828	-1.4036	-0.3234
Kurtosis	-1.03684	-0.987273	-1.18309
Standardized kurtosis	-2.71036	-2.5808	-3.09268
Coeff. of variation	40.4334	43.9048	46.0948
Sum	1586	1482	1414

APPENDIX C3:1

Summary statistics for 76 Xhosa male pupils

Variable:	MH select S_X='MUS	select S_X='MHH	select S_X='M
Sample size	76	76	76
Average	1.98684	7.30263	5.02632
Median	1	6.5	4
Mode	1	5	3
Geometric mean	1.40548	6.28764	4.13875
Variance	7.02649	14.6939	10.2926
Standard deviation	2.65075	3.83326	3.20821
Standard error	0.304062	0.439705	0.368007
Minimum	1	1	1
Maximum	15	15	15
Range	14	14	14
Lower quartile	1	5	3
Upper quartile	2	9	6
Interquartile range	1	4	3
Skewness	3.66709	0.695404	1.30673
Standardized skewness	13.0513	2.47496	4.6507
Kurtosis	13.8881	-0.428618	1.65271
Standardized kurtosis	24.714	-0.762732	2.94101
Coeff. of variation	133.415	52.4914	63.8283
Sum	151	555	382

Variable:	MR select S_X='MFW	select S_X='MPG	select S_X='M
Sample size	76	76	76
Average	9.19737	4.40789	7.18421
Median	9	3	6
Mode	9	2	4
Geometric mean	8.50259	3.60622	5.89436
Variance	11.3072	8.8314	17.4323
Standard deviation	3.36262	2.97177	4.1752
Standard error	0.385719	0.340885	0.478928
Minimum	2	1	1
Maximum	15	14	15
Range	13	13	14
Lower quartile	6	2	4
Upper quartile	11	6	10.5
Interquartile range	5	4	6.5
Skewness	0.0404406	1.34685	0.549568
Standardized skewness	0.143929	4.79348	1.95593
Kurtosis	-0.801544	1.46974	-0.823735
Standardized kurtosis	-1.42636	2.61542	-1.46585
Coeff. of variation	36.5606	67.4192	58.1163
Sum	699	335	546

08/22/95 01:49:23 PM

Variable:	EPA select S_X='ES	select S_X='MWT	select S_X='M
Sample size	76	76	76
Average	8.82895	9.09211	10.6053
Median	9	9	11
Mode	7	10	15
Geometric mean	8.03161	8.19971	9.54416
Variance	12.3837	12.0047	14.3221

APPENDIX C3:2

Standard deviation	3.51905	3.46479	3.78446
Standard error	0.403662	0.397438	0.434107
Minimum	2	1	1
Maximum	15	15	15
Range	13	14	14
Lower quartile	6	7	8
Upper quartile	11.5	11.5	14
Interquartile range	5.5	4.5	6
Skewness	0.060957	-0.283081	-0.693079
Standardized skewness	0.216948	-1.00749	-2.46669
Kurtosis	-0.922081	-0.498712	-0.297576
Standardized kurtosis	-1.64086	-0.887464	-0.529541
Coeff. of variation	39.858	38.1076	35.6847
Sum	671	691	806

APPENDIX C3:3

Variable:	AP select S_X='MWH select S_X='MBLU select S_X='		
Sample size	76	76	76
Average	9.85526	5.73684	9.23684
Median	11	4	10
Mode	11	3	10
Geometric mean	8.97779	4.4966	8.30054
Variance	13.5921	15.6632	12.9032
Standard deviation	3.68675	3.95767	3.5921
Standard error	0.422899	0.453976	0.412042
Minimum	2	1	1
Maximum	15	14	15
Range	13	13	14
Lower quartile	6.5	3	7
Upper quartile	13	8.5	12
Interquartile range	6.5	5.5	5
Skewness	-0.362391	0.847563	-0.323989
Standardized skewness	-1.28976	3.0165	-1.15308
Kurtosis	-0.944004	-0.672161	-0.719595
Standardized kurtosis	-1.67987	-1.19612	-1.28053
Coeff. of variation	37.4089	68.9869	38.8888
Sum	749	436	702

Variable:	NP select S_X='MHT select S_X='MDM select S_X='M		
Sample size	76	76	76
Average	11.5	9.85526	10.1842
Median	12	10	10.5
Mode	13	12	10
Geometric mean	11.0142	9.09277	9.37844
Variance	7.74667	11.4321	13.0589
Standard deviation	2.78328	3.38114	3.61372
Standard error	0.319265	0.387843	0.414522
Minimum	2	2	3
Maximum	15	15	15
Range	13	13	12
Lower quartile	10	8	7
Upper quartile	13	13	13
Interquartile range	3	5	6
Skewness	-1.09556	-0.496851	-0.442148
Standardized skewness	-3.89914	-1.76831	-1.57362
Kurtosis	1.53057	-0.608078	-0.933791
Standardized kurtosis	2.72366	-1.08208	-1.66169
Coeff. of variation	24.2025	34.308	35.4835
Sum	874	749	774

APPENDIX C4:1

Summary statistics for 113 Xhosa female pupils

Variable:	MH select S_X='FUS	select S_X='FHH	select S_X='F
Sample size	113	113	113
Average	2.14159	6.63717	3.84956
Median	1	6	3
Mode	1	4	2
Geometric mean	1.54439	5.76912	3.15095
Variance	6.03334	10.0547	7.62895
Standard deviation	2.45629	3.17091	2.76206
Standard error	0.231068	0.298294	0.259832
Minimum	1	1	1
Maximum	14	15	15
Range	13	14	14
Lower quartile	1	4	2
Upper quartile	2	9	5
Interquartile range	1	5	3
Skewness	3.16031	0.373522	1.90101
Standardized skewness	13.7149	1.62099	8.2499
Kurtosis	10.8565	-0.49106	3.70748
Standardized kurtosis	23.5572	-1.06554	8.04475
Coeff. of variation	114.694	47.7751	71.7499
Sum	242	750	435

Variable:	MR select S_X='FFW	select S_X='FPG	select S_X='F
Sample size	113	113	113
Average	8.64602	5.0177	7.20354
Median	8	4	6
Mode	7	2	5
Geometric mean	7.61063	4.0881	5.81453
Variance	14.6771	12.6961	17.235
Standard deviation	3.83108	3.56316	4.1515
Standard error	0.360397	0.335194	0.390541
Minimum	2	1	1
Maximum	15	14	15
Range	13	13	14
Lower quartile	6	3	4
Upper quartile	11	6	10
Interquartile range	5	3	6
Skewness	0.0350269	1.42585	0.443776
Standardized skewness	0.152007	6.18784	1.92587
Kurtosis	-0.873103	0.920409	-0.786892
Standardized kurtosis	-1.89452	1.99717	-1.70745
Coeff. of variation	44.3103	71.0118	57.6314
Sum	977	567	814

08/22/95 01:46:25 PM

Variable:	EPA select S_X='ES	select S_X='FWT	select S_X='F
Sample size	113	113	113
Average	9.46018	9.25664	11.7611
Median	10	9	13
Mode	10	7	15
Geometric mean	8.55843	8.72164	11.2427
Variance	13.0899	8.24605	9.52276

APPENDIX C4:2

Standard deviation	3.518	2.87159	3.0697
Standard error	0.340353	0.270137	0.290297
Minimum	1	1	3
Maximum	15	15	15
Range	14	14	12
Lower quartile	7	7	9
Upper quartile	12	12	14
Interquartile range	5	5	5
Skewness	-0.210152	-0.0944162	-0.844088
Standardized skewness	-0.912005	-0.409742	-3.66312
Kurtosis	-0.700176	-0.576524	-0.24296
Standardized kurtosis	-1.51929	-1.25098	-0.527191
Coeff. of variation	38.2445	31.022	26.2382
Sum	1069	1046	1329

Variable:	AP select S_X='FWH	select S_X='FBLU	select S_X='
Sample size	113	113	113
Average	9.33628	6.0354	9.41593
Median	9	5	10
Mode	9	3	12
Geometric mean	8.71714	4.87205	8.63193
Variance	9.79662	13.5166	11.4594
Standard deviation	3.12995	3.67649	3.38517
Standard error	0.294441	0.345855	0.31845
Minimum	2	1	1
Maximum	15	15	15
Range	13	14	14
Lower quartile	7	3	7
Upper quartile	11	9	12
Interquartile range	4	6	5
Skewness	-0.145615	0.608948	-0.283191
Standardized skewness	-0.631932	2.64268	-1.22898
Kurtosis	-0.622303	-0.690739	-0.802764
Standardized kurtosis	-1.35032	-1.49881	-1.74189
Coeff. of variation	33.5246	60.9155	35.9515
Sum	1055	682	1064

Variable:	NP select S_X='FHT	select S_X='FDM	select S_X='F
Sample size	113	113	113
Average	11.0708	9.55752	10.6106
Median	12	10	11
Mode	14	13	15
Geometric mean	10.4236	8.29349	9.68106
Variance	9.78066	15.4275	14.847
Standard deviation	3.1274	3.92778	3.85318
Standard error	0.294201	0.369495	0.362477
Minimum	1	1	1
Maximum	15	15	15
Range	14	14	14
Lower quartile	9	7	8
Upper quartile	14	13	14
Interquartile range	5	6	6
Skewness	-0.967155	-0.553891	-0.476152
Standardized skewness	-4.1972	-2.40374	-2.06637
Kurtosis	0.281424	-0.67852	-0.981745
Standardized kurtosis	0.610654	-1.4723	-2.13026
Coeff. of variation	28.2491	41.0962	36.3144
Sum	1251	1080	1199

APPENDIX C5:1

Summary statistics for 151 Coloured male pupils

Variable:	MH select gender	US select gender	HH select gender
Sample size	151	151	151
Average	9.98675	5.97351	5.42384
Median	11	5	5
Mode	13	2	1
Geometric mean	9.16498	4.68461	3.99626
Variance	11.6265	14.746	14.5792
Standard deviation	3.40976	3.84005	3.81827
Standard error	0.277483	0.312499	0.310726
Minimum	1	1	1
Maximum	15	15	15
Range	14	14	14
Lower quartile	8	3	2
Upper quartile	13	8	8
Interquartile range	5	5	6
Skewness	-0.597961	0.675527	0.691287
Standardized skewness	-2.99976	3.38888	3.46794
Kurtosis	-0.4112	-0.433854	-0.341116
Standardized kurtosis	-1.03142	-1.08824	-0.855627
Coeff. of variation	34.1429	64.2846	70.3978
Sum	1508	902	819

Variable:	MR select gender	FW select gender	PG select gender
Sample size	151	151	151
Average	10.7881	6.06623	5.87417
Median	11	6	5
Mode	13	6	1
Geometric mean	10.198	5.00517	4.31806
Variance	9.48812	11.2223	17.7507
Standard deviation	3.08028	3.34996	4.21316
Standard error	0.25067	0.272616	0.342862
Minimum	2	1	1
Maximum	15	15	15
Range	13	14	14
Lower quartile	9	3	2
Upper quartile	13	8	8
Interquartile range	4	5	6
Skewness	-0.742452	0.462495	0.73684
Standardized skewness	-3.72462	2.32017	3.69646
Kurtosis	0.0165279	-0.503054	-0.524031
Standardized kurtosis	0.0414573	-1.26182	-1.31444
Coeff. of variation	28.5526	55.2232	71.7235
Sum	1629	916	887

07/10/95 12:29:39 PM

Variable:	EPA select gende	ES select gender	WT select gender
Sample size	151	151	151
Average	5.91391	10.0795	9.55629
Median	5	10	10
Mode	4	10	15
Geometric mean	4.58855	9.39094	8.16736

APPENDIX C5:2

Variance	14.6392	10.7803	18.5951
Standard deviation	3.82612	3.28334	4.31221
Standard error	0.311365	0.267194	0.350923
Minimum	1	2	1
Maximum	15	15	15
Range	14	13	14
Lower quartile	3	8	6
Upper quartile	8	13	14
Interquartile range	5	5	8
Skewness	0.671165	-0.454973	-0.337271
Standardized skewness	3.36699	-2.28243	-1.69197
Kurtosis	-0.391096	-0.576311	-1.18248
Standardized kurtosis	-0.980994	-1.44557	-2.96604
Coeff. of variation	64.697	32.5745	45.1243
Sum	893	1522	1443

Variable:	AP select genderWH select genderBLD select gende		
Sample size	151	151	151
Average	5.24503	5.54305	8.37086
Median	5	5	9
Mode	1	5	12
Geometric mean	4.00771	4.26194	7.46339
Variance	12.8662	14.1565	12.5815
Standard deviation	3.58695	3.76251	3.54705
Standard error	0.291902	0.306189	0.288655
Minimum	1	1	2
Maximum	15	15	15
Range	14	14	13
Lower quartile	2	2	5
Upper quartile	7	8	12
Interquartile range	5	6	7
Skewness	0.951572	0.770241	-0.093469
Standardized skewness	4.77369	3.86402	-0.4689
Kurtosis	0.486492	-0.411718	-1.09035
Standardized kurtosis	1.22028	-1.03272	-2.73495
Coeff. of variation	68.3876	67.878	42.3737
Sum	792	837	1264

Variable:	NP select genderHT select genderDM select gender		
Sample size	151	151	151
Average	9.2649	10.8742	11.0397
Median	10	11	13
Mode	10	14	15
Geometric mean	8.18447	9.96704	9.44835
Variance	13.6227	11.5641	18.4651
Standard deviation	3.69089	3.4006	4.2971
Standard error	0.300361	0.276737	0.349693
Minimum	1	1	1
Maximum	15	15	15
Range	14	14	14
Lower quartile	7	9	9
Upper quartile	12	14	15
Interquartile range	5	5	6
Skewness	-0.372839	-1.0205	-1.03865
Standardized skewness	-1.8704	-5.11949	-5.21051
Kurtosis	-0.61366	0.696029	-0.0388183
Standardized kurtosis	-1.53926	1.74586	-0.0973688
Coeff. of variation	39.8374	31.2722	38.924
Sum	1399	1642	1667

APPENDIX C6:1

Summary statistics for 192 Coloured female pupils

Sample size	192	192	192
Average	9.02083	6.57292	4.45313
Median	9	6	4
Mode	10	5	1
Geometric mean	8.02577	5.58873	3.40419
Variance	13.4655	11.7015	9.93496
Standard deviation	3.66954	3.42074	3.15198
Standard error	0.264826	0.246871	0.227474
Minimum	1	1	1
Maximum	15	15	13
Range	14	14	12
Lower quartile	6	4	2
Upper quartile	12	9	6
Interquartile range	6	5	4
Skewness	-0.206302	0.559969	0.934243
Standardized skewness	-1.16702	3.16766	5.28488
Kurtosis	-0.890155	-0.308127	-0.0139428
Standardized kurtosis	-2.51774	-0.871516	-0.0394362
Coeff. of variation	40.6785	52.043	70.7813
Sum	1732	1262	855

Variable:	MR select genderFW select genderPG select gender		
Sample size	192	192	192
Average	10.6979	6.43229	4.70313
Median	11	6	4
Mode	12	6	2
Geometric mean	10.2353	5.4125	3.46036
Variance	8.06534	12.2362	13.1732
Standard deviation	2.83995	3.49803	3.62949
Standard error	0.204956	0.252449	0.261936
Minimum	2	1	1
Maximum	15	15	15
Range	13	14	14
Lower quartile	8.5	4	2
Upper quartile	13	8.5	6.5
Interquartile range	4.5	4.5	4.5
Skewness	-0.4866	0.608954	1.11928
Standardized skewness	-2.75263	3.44476	6.33162
Kurtosis	-0.296643	-0.248776	0.504521
Standardized kurtosis	-0.839034	-0.703646	1.427
Coeff. of variation	26.5468	54.3824	77.1718
Sum	2054	1235	903

07/10/95 12:35:16 PM

Variable:	EPA select gendeES select genderWT select gender		
Sample size	192	192	192
Average	6.85938	10.2188	9.93229
Median	6	10	11
Mode	5	14	15
Geometric mean	5.46037	9.57245	8.2992

APPENDIX C6:2

Variance	15.556	9.89954	20.4823
Standard deviation	3.94411	3.14635	4.52574
Standard error	0.284642	0.227069	0.326617
Minimum	1	2	1
Maximum	15	15	15
Range	14	13	14
Lower quartile	4	8	6
Upper quartile	10	13	14
Interquartile range	6	5	8
Skewness	0.309658	-0.557626	-0.531728
Standardized skewness	1.75169	-3.15441	-3.00791
Kurtosis	-0.864521	-0.255026	-1.01309
Standardized kurtosis	-2.44523	-0.721322	-2.86544
Coeff. of variation	57.4996	30.79	45.5659
Sum	1317	1962	1907

APPENDIX C6:3

Variable:	AP select genderWH select genderBLU select gende		
Sample size	192	192	192
Average	5.78646	4.36979	9.75521
Median	5	3	10
Mode	5	2	11
Geometric mean	4.64704	3.31994	8.9933
Variance	11.5301	10.4227	10.8351
Standard deviation	3.3956	3.22843	3.29166
Standard error	0.245056	0.232992	0.237555
Minimum	1	1	1
Maximum	14	15	15
Range	13	14	14
Lower quartile	3	2	7
Upper quartile	8	6	12
Interquartile range	5	4	5
Skewness	0.478063	1.15484	-0.391685
Standardized skewness	2.70433	6.53276	-2.21571
Kurtosis	-0.614802	0.721859	-0.412458
Standardized kurtosis	-1.73892	2.04172	-1.16661
Coeff. of variation	58.6818	73.8806	33.7426
Sum	1111	839	1873

Variable:	NP select genderHT select genderDM select gender		
Sample size	192	192	192
Average	9.9375	10.7188	10.5417
Median	11	12	13
Mode	11	13	15
Geometric mean	8.99714	9.59282	8.60017
Variance	12.3207	14.7582	21.6527
Standard deviation	3.51008	3.84164	4.65325
Standard error	0.253318	0.277246	0.335819
Minimum	1	1	1
Maximum	15	15	15
Range	14	14	14
Lower quartile	8	8	7
Upper quartile	13	14	14
Interquartile range	5	6	7
Skewness	-0.732894	-0.856598	-0.842424
Standardized skewness	-4.14587	-4.84565	-4.76547
Kurtosis	-0.189276	-0.293717	-0.606481
Standardized kurtosis	-0.535352	-0.830756	-1.71539
Coeff. of variation	35.3216	35.8404	44.1415
Sum	1908	2058	2024

APPENDIX D

APPENDIX D1:1

Mann-Whitney U-test statistics for North Sotho male and female pupils

Comparison of Two Samples

Sample NORTH SOTHO.MH SELECT SAX='M'

Sample NORTH SOTHO.MH SELECT SAX='F'

Test: Unpaired

Average rank of first group = 216.46 based on 250 values.
Average rank of second group = 193.841 based on 164 values.
Large sample test statistic Z = -1.8883
Two-tailed probability of equaling or exceeding Z = 0.0589859

NOTE: 414 total observations.

Comparison of Two Samples

Sample NORTH SOTHO.US SELECT SAX='M'

Sample NORTH SOTHO.US SELECT SAX='F'

Test: Unpaired

Average rank of first group = 209.614 based on 250 values.
Average rank of second group = 204.277 based on 164 values.
Large sample test statistic Z = -0.444947
Two-tailed probability of equaling or exceeding Z = 0.656355

NOTE: 414 total observations.

Comparison of Two Samples

Sample NORTH SOTHO.HH SELECT SAX='M'

Sample NORTH SOTHO.HH SELECT SAX='F'

Test: Unpaired

Average rank of first group = 197.398 based on 250 values.
Average rank of second group = 222.899 based on 164 values.
Large sample test statistic Z = 2.15335
Two-tailed probability of equaling or exceeding Z = 0.031291

NOTE: 414 total observations.

APPENDIX D1:2

Comparison of Two Samples

Sample NORTH SOTHO.MR SELECT SAX='M'

Sample NORTH SOTHO.MR SELECT SAX='F'

Test: Unpaired

Average rank of first group = 208.86 based on 250 values.
Average rank of second group = 205.427 based on 164 values.
Large sample test statistic Z = -0.286252
Two-tailed probability of equaling or exceeding Z = 0.774681

NOTE: 414 total observations.

Comparison of Two Samples

Sample NORTH SOTHO.FW SELECT SAX='M'

Sample NORTH SOTHO.FW SELECT SAX='F'

Test: Unpaired

Average rank of first group = 211.534 based on 250 values.
Average rank of second group = 201.351 based on 164 values.
Large sample test statistic Z = -1.00693
Two-tailed probability of equaling or exceeding Z = 0.313967

NOTE: 414 total observations.

Comparison of Two Samples

Sample NORTH SOTHO.PG SELECT SAX='M'

Sample NORTH SOTHO.PG SELECT SAX='F'

Test: Unpaired

Average rank of first group = 201.618 based on 250 values.
Average rank of second group = 216.466 based on 164 values.
Large sample test statistic Z = 1.24764
Two-tailed probability of equaling or exceeding Z = 0.212162

NOTE: 414 total observations.

Comparison of Two Samples

Sample NORTH SOTHO.AP SELECT SAX='M'

Sample NORTH SOTHO.AP SELECT SAX='F'

Test: Unpaired

Average rank of first group = 195.874 based on 250 values.
Average rank of second group = 225.223 based on 164 values.
Large sample test statistic Z = 2.44837
Two-tailed probability of equaling or exceeding Z = 0.0143505

NOTE: 414 total observations.

Comparison of Two Samples

Sample NORTH SOTHO.WH SELECT SAX='M'

Sample NORTH SOTHO.WH SELECT SAX='F'

Test: Unpaired

Average rank of first group = 210.88 based on 250 values.
Average rank of second group = 202.348 based on 164 values.
Large sample test statistic Z = -0.714433
Two-tailed probability of equaling or exceeding Z = 0.474957

NOTE: 414 total observations.

Comparison of Two Samples

Sample NORTH SOTHO.BLU SELECT SAX='M'

Sample NORTH SOTHO.BLU SELECT SAX='F'

Test: Unpaired

Average rank of first group = 211.672 based on 250 values.
Average rank of second group = 201.14 based on 164 values.
Large sample test statistic Z = -0.878132
Two-tailed probability of equaling or exceeding Z = 0.37987

NOTE: 414 total observations.

Comparison of Two Samples

Sample NORTH SOTHO.EPA SELECT SAX='M'

Sample NORTH SOTHO.EPA SELECT SAX='F'

Test: Unpaired

Average rank of first group = 211.346 based on 250 values.
Average rank of second group = 201.637 based on 164 values.
Large sample test statistic Z = -0.810554
Two-tailed probability of equaling or exceeding Z = 0.41762

NOTE: 414 total observations.

Comparison of Two Samples

Sampl NORTH SOTHO.ES SELECT SAX='M'

Sample NORTH SOTHO.ES SELECT SAX='F'

Test: Unpaired

Average rank of first group = 196.728 based on 250 values.
Average rank of second group = 223.921 based on 164 values.
Large sample test statistic Z = 2.27052
Two-tailed probability of equaling or exceeding Z = 0.023176

NOTE: 414 total observations.

Comparison of Two Samples

SampleNORTH SOTHO.WT SELECT SAX='M'

Sample NORTH SOTHO.WT SELECT SAX='F'

Test: Unpaired

Average rank of first group = 189.296 based on 250 values.
Average rank of second group = 235.25 based on 164 values.
Large sample test statistic Z = 3.83787
Two-tailed probability of equaling or exceeding Z = 1.24151E-4

NOTE: 414 total observations.

Comparison of Two Samples

Sample NORTH SOTHO.NP SELECT SAX='M'

Sample NORTH SOTHO.NP SELECT SAX='F'

Test: Unpaired

Average rank of first group = 206.186 based on 250 values.
Average rank of second group = 209.503 based on 164 values.
Large sample test statistic Z = 0.276396
Two-tailed probability of equaling or exceeding Z = 0.78224

NOTE: 414 total observations.

Comparison of Two Samples

Sample NORTH SOTHO.HT SELECT SAX='M'

Sample NORTH SOTHO.HT SELECT SAX='F'

Test: Unpaired

Average rank of first group = 219.994 based on 250 values.
Average rank of second group = 188.454 based on 164 values.
Large sample test statistic Z = -2.63236
Two-tailed probability of equaling or exceeding Z = 8.47934E-3

NOTE: 414 total observations.

Comparison of Two Samples

Sample NORTH SOTHO.DM SELECT SAX='M'

Sample NORTH SOTHO.DM SELECT SAX='F'

Test: Unpaired

Average rank of first group = 215.588 based on 250 values.
Average rank of second group = 195.171 based on 164 values.
Large sample test statistic Z = -1.70278
Two-tailed probability of equaling or exceeding Z = 0.0886097

NOTE: 414 total observations.

APPENDIX D2:1

Mann-Whitney U-test statistics for Xhosa male and female pupils

Comparison of Two Samples

Sample XHOSA.MH SELECT S_X='M'

Sample XHOSA.MH SELECT S_X='F'

Test: Unpaired

Average rank of first group = 90.5855 based on 76 values.
Average rank of second group = 97.969 based on 113 values.
Large sample test statistic Z = 1.11369
Two-tailed probability of equaling or exceeding Z = 0.265412

NOTE: 189 total observations.

Comparison of Two Samples

Sample XHOSA.US SELECT S_X='M'

Sample XHOSA.US SELECT S_X='F'

Test: Unpaired

Average rank of first group = 99.0658 based on 76 values.
Average rank of second group = 92.2655 based on 113 values.
Large sample test statistic Z = -0.840716
Two-tailed probability of equaling or exceeding Z = 0.400505

NOTE: 189 total observations.

Comparison of Two Samples

Sample XHOSA.HH SELECT S_X='M'

Sample XHOSA.HH SELECT S_X='F'

Test: Unpaired

Average rank of first group = 109.789 based on 76 values.
Average rank of second group = 85.0531 based on 113 values.
Large sample test statistic Z = -3.091
Two-tailed probability of equaling or exceeding Z = 1.99499E-3

NOTE: 189 total observations.

Comparison of Two Samples

Sample XHOSA.MR SELECT S_X='M'

Sample XHOSA.MR SELECT S_X='F'

Test: Unpaired

Average rank of first group = 99.5855 based on 76 values.
Average rank of second group = 91.9159 based on 113 values.
Large sample test statistic Z = -0.947104
Two-tailed probability of equaling or exceeding Z = 0.343584

NOTE: 189 total observations.

Comparison of Two Samples

Sample XHOSA.FW SELECT S_X='M'

Sample XHOSA.FW SELECT S_X='F'

Test: Unpaired

Average rank of first group = 89.2039 based on 76 values.
Average rank of second group = 98.8982 based on 113 values.
Large sample test statistic Z = 1.21216
Two-tailed probability of equaling or exceeding Z = 0.225449

NOTE: 189 total observations.

Comparison of Two Samples

Sample XHOSA.PG SELECT S_X='M'

Sample XHOSA.PG SELECT S_X='F'

Test: Unpaired

Average rank of first group = 94.1579 based on 76 values.
Average rank of second group = 95.5664 based on 113 values.
Large sample test statistic Z = 0.172851
Two-tailed probability of equaling or exceeding Z = 0.862764

NOTE: 189 total observations.

Comparison of Two Samples

Sample XHOSA.EPA SELECT S_X='M'

Sample XHOSA.EPA SELECT S_X='F'

Test: Unpaired

Average rank of first group = 88.9737 based on 76 values.
Average rank of second group = 99.0531 based on 113 values.
Large sample test statistic Z = 1.24513
Two-tailed probability of equaling or exceeding Z = 0.213082

NOTE: 189 total observations.

Comparison of Two Samples

Sample XHOSA.ES SELECT S_X='M'

Sample XHOSA.ES SELECT S_X='F'

Test: Unpaired

Average rank of first group = 94.6776 based on 76 values.
Average rank of second group = 95.2168 based on 113 values.
Large sample test statistic Z = 0.0653757
Two-tailed probability of equaling or exceeding Z = 0.947869

NOTE: 189 total observations.

Comparison of Two Samples

Sample XHOSA.WT SELECT S_X='M'

Sample XHOSA.WT SELECT S_X='F'

Test: Unpaired

Average rank of first group = 85.5987 based on 76 values.
Average rank of second group = 101.323 based on 113 values.
Large sample test statistic Z = 1.95207
Two-tailed probability of equaling or exceeding Z = 0.0509296

NOTE: 189 total observations.

Comparison of Two Samples

Sample XHOSA.AP SELECT S_X='M'

Sample XHOSA.AP SELECT S_X='F'

Test: Unpaired

Average rank of first group = 101.039 based on 76 values.
Average rank of second group = 90.9381 based on 113 values.
Large sample test statistic Z = -1.24852
Two-tailed probability of equaling or exceeding Z = 0.211841

NOTE: 189 total observations.

Comparison of Two Samples

Sampl XHOSA.WH SELECT S_X='M'

Sample XHOSA.WH SELECT S_X='F'

Test: Unpaired

Average rank of first group = 90.9803 based on 76 values.
Average rank of second group = 97.7035 based on 113 values.
Large sample test statistic Z = 0.832401
Two-tailed probability of equaling or exceeding Z = 0.405181

NOTE: 189 total observations.

Comparison of Two Samples

Sample XHOSA.BLU SELECT S_X='M'

Sample XHOSA.BLU SELECT S_X='F'

Test: Unpaired

Average rank of first group = 93.75 based on 76 values.
Average rank of second group = 95.8407 based on 113 values.
Large sample test statistic Z = 0.257286
Two-tailed probability of equaling or exceeding Z = 0.796954

NOTE: 189 total observations.

Comparison of Two Samples

Sample XHOSA.NP SELECT S_X='M'

Sample XHOSA.NP SELECT S_X='F'

Test: Unpaired

Average rank of first group = 98.0526 based on 76 values.
Average rank of second group = 92.9469 based on 113 values.
Large sample test statistic Z = -0.632705
Two-tailed probability of equaling or exceeding Z = 0.526924

NOTE: 189 total observations.

Comparison of Two Samples

Sample XHOSA.HT SELECT S_X='M'

Sample XHOSA.HT SELECT S_X='F'

Test: Unpaired

Average rank of first group = 96.2303 based on 76 values.
Average rank of second group = 94.1726 based on 113 values.
Large sample test statistic Z = -0.253515
Two-tailed probability of equaling or exceeding Z = 0.799866

NOTE: 189 total observations.

Comparison of Two Samples

Sample XHOSA.DM SELECT S_X='M'

Sample XHOSA.DM SELECT S_X='F'

Test: Unpaired

Average rank of first group = 89.9605 based on 76 values.
Average rank of second group = 98.3894 based on 113 values.
Large sample test statistic Z = 1.04297
Two-tailed probability of equaling or exceeding Z = 0.296961

NOTE: 189 total observations.

APPENDIX D3:1

Mann-Whitney U-test statistics for Coloured male and female pupils

Comparison of Two Samples

Sample COLOURED.MH SELECT GENDER ='M'

Sample COLOURED.MH SELECT GENDER ='F'

Test: Unpaired

Average rank of first group = 186.924 based on 151 values.
Average rank of second group = 160.263 based on 192 values.
Large sample test statistic Z = -2.4803
Two-tailed probability of equaling or exceeding Z = 0.0131272

NOTE: 343 total observations.

Comparison of Two Samples

Sample COLOURED.US SELECT GENDER ='M'

Sample COLOURED.US SELECT GENDER ='F'

Test: Unpaired

Average rank of first group = 160.033 based on 151 values.
Average rank of second group = 181.411 based on 192 values.
Large sample test statistic Z = 1.98909
Two-tailed probability of equaling or exceeding Z = 0.0466912

NOTE: 343 total observations.

Comparison of Two Samples

Sample COLOURED.HH SELECT GENDER ='M'

Sample COLOURED.HH SELECT GENDER ='F'

Test: Unpaired

Average rank of first group = 184.262 based on 151 values.
Average rank of second group = 162.357 based on 192 values.
Large sample test statistic Z = -2.04428
Two-tailed probability of equaling or exceeding Z = 0.0409256

NOTE: 343 total observations.

Comparison of Two Samples

Sampl COLOURED.MR SELECT GENDER ='M'

Sample COLOURED.MR SELECT GENDER ='F'

Test: Unpaired

Average rank of first group = 175.768 based on 151 values.
Average rank of second group = 169.036 based on 192 values.
Large sample test statistic Z = -0.627296
Two-tailed probability of equaling or exceeding Z = 0.530463

NOTE: 343 total observations.

Comparison of Two Samples

Sample COLOURED.FW SELECT GENDER ='M'

Sample COLOURED.FW SELECT GENDER ='F'

Test: Unpaired

Average rank of first group = 166.907 based on 151 values.
Average rank of second group = 176.005 based on 192 values.
Large sample test statistic Z = 0.846559
Two-tailed probability of equaling or exceeding Z = 0.397239

NOTE: 343 total observations.

Comparison of Two Samples

Sample COLOURED.PG SELECT GENDER ='M'

Sample COLOURED.PG SELECT GENDER ='F'

Test: Unpaired

Average rank of first group = 187.315 based on 151 values.
Average rank of second group = 159.956 based on 192 values.
Large sample test statistic Z = -2.55204
Two-tailed probability of equaling or exceeding Z = 0.0107094

NOTE: 343 total observations.

Comparison of Two Samples

Sample COLOURED.EPA SELECT GENDER ='M'

Sample COLOURED.EPA SELECT GENDER ='F'

Test: Unpaired

Average rank of first group = 158.185 based on 151 values.
Average rank of second group = 182.865 based on 192 values.
Large sample test statistic Z = 2.29496
Two-tailed probability of equaling or exceeding Z = 0.0217352

NOTE: 343 total observations.

Comparison of Two Samples

Sample COLOURED.ES SELECT GENDER ='M'

Sample COLOURED.ES SELECT GENDER ='F'

Test: Unpaired

Average rank of first group = 169.954 based on 151 values.
Average rank of second group = 173.609 based on 192 values.
Large sample test statistic Z = 0.340034
Two-tailed probability of equaling or exceeding Z = 0.733827

NOTE: 343 total observations.

Comparison of Two Samples

Sample COLOURED.WT SELECT GENDER ='M'

Sample COLOURED.WT SELECT GENDER ='F'

Test: Unpaired

Average rank of first group = 165.937 based on 151 values.
Average rank of second group = 176.768 based on 192 values.
Large sample test statistic Z = 1.00861
Two-tailed probability of equaling or exceeding Z = 0.313159

NOTE: 343 total observations.

Comparison of Two Samples

Sample COLOURED.AP SELECT GENDER ='M'

Sample COLOURED.AP SELECT GENDER ='F'

Test: Unpaired

Average rank of first group = 161.311 based on 151 values.
Average rank of second group = 180.406 based on 192 values.
Large sample test statistic Z = 1.7782
Two-tailed probability of equaling or exceeding Z = 0.0753707

NOTE: 343 total observations.

Comparison of Two Samples

Sample COLOURED.WH SELECT GENDER ='M'

Sample COLOURED.WH SELECT GENDER ='F'

Test: Unpaired

Average rank of first group = 190.086 based on 151 values.
Average rank of second group = 157.776 based on 192 values.
Large sample test statistic Z = -3.01606
Two-tailed probability of equaling or exceeding Z = 2.56099E-3

NOTE: 343 total observations.

Comparison of Two Samples

Sample COLOURED.BLU SELECT GENDER ='M'

Sample COLOURED.BLU SELECT GENDER ='F'

Test: Unpaired

Average rank of first group = 150.911 based on 151 values.
Average rank of second group = 188.586 based on 192 values.
Large sample test statistic Z = 3.50509
Two-tailed probability of equaling or exceeding Z = 4.56532E-4

NOTE: 343 total observations.

Comparison of Two Samples

Sample COLOURED.NP SELECT GENDER ='M'

Sample COLOURED.NP SELECT GENDER ='F'

Test: Unpaired

Average rank of first group = 161.003 based on 151 values.
Average rank of second group = 180.648 based on 192 values.
Large sample test statistic Z = 1.82809
Two-tailed probability of equaling or exceeding Z = 0.0675364

NOTE: 343 total observations.

Comparison of Two Samples

Sample COLOURED.HT SELECT GENDER ='M'

Sample COLOURED.HT SELECT GENDER ='F'

Test: Unpaired

Average rank of first group = 170.808 based on 151 values.
Average rank of second group = 172.938 based on 192 values.
Large sample test statistic Z = 0.198065
Two-tailed probability of equaling or exceeding Z = 0.84299

NOTE: 343 total observations.

Comparison of Two Samples

Sample COLOURED.DM SELECT GENDER ='M'

Sample COLOURED.DM SELECT GENDER ='F'

Test: Unpaired

Average rank of first group = 177 based on 151 values.
Average rank of second group = 168.068 based on 192 values.
Large sample test statistic Z = -0.83718
Two-tailed probability of equaling or exceeding Z = 0.402489

NOTE: 343 total observations.

APPENDIX E

Mann-Whitney U-test statistics for North Sotho male and Xhosa male pupils

Comparison of Two Samples

Sample NORTH SOTHO.MH SELECT SAX='M'

Sample XHOSA .MH SELECT S_X='M'

Test: Unpaired

Average rank of first group = 198.082 based on 250 values.
Average rank of second group = 49.7434 based on 76 values.
Large sample test statistic Z = -12.0749
Two-tailed probability of equaling or exceeding Z = 0

NOTE: 326 total observations.

Comparison of Two Samples

Sample NORTH SOTHO.US SELECT SAX='M'

Sample XHOSA .US SELECT S_X='M'

Test: Unpaired

Average rank of first group = 174.992 based on 250 values.
Average rank of second group = 125.697 based on 76 values.
Large sample test statistic Z = -4.00434
Two-tailed probability of equaling or exceeding Z = 6.22206E-5

NOTE: 326 total observations.

The formula for the Mann-Whitney U-test is:-

$$Z = \frac{U - U_E}{\sigma_U}$$

Where Z = Z score
U = U-statistic
U_E = expected value of U
σ_U = standard deviation of U

Comparison of Two Samples

Sample NORTH SOTHO.HH SELECT SAX='M'

Sample : XHOSA .HH SELECT S_X='M'

Test: Unpaired

Average rank of first group = 154.032 based on 250 values.
Average rank of second group = 194.645 based on 76 values.
Large sample test statistic Z = 3.33451
Two-tailed probability of equaling or exceeding Z = 8.54605E-4

NOTE: 326 total observations.

Comparison of Two Samples

Sample NORTH SOTHO.MR SELECT SAX='M'

Sample XHOSA .MR SELECT S_X='M'

Test: Unpaired

Average rank of first group = 165.21 based on 250 values.
Average rank of second group = 157.875 based on 76 values.
Large sample test statistic Z = -0.595775
Two-tailed probability of equaling or exceeding Z = 0.551323

NOTE: 326 total observations.

Comparison of Two Samples

Sample **NORTH SOTHO**.FW SELECT SAX='M'

Sample **XHOSA** .FW SELECT S_X='M'

Test: Unpaired

Average rank of first group = 138.006 based on 250 values.
Average rank of second group = 247.362 based on 76 values.
Large sample test statistic Z = 9.50643
Two-tailed probability of equaling or exceeding Z = 0

NOTE: 326 total observations.

Comparison of Two Samples

Sample **NORTH SOTHO**.PG SELECT SAX='M'

Sample **XHOSA** .PG SELECT S_X='M'

Test: Unpaired

Average rank of first group = 147.896 based on 250 values.
Average rank of second group = 214.829 based on 76 values.
Large sample test statistic Z = 5.46274
Two-tailed probability of equaling or exceeding Z = 4.69975E-8

NOTE: 326 total observations.

Comparison of Two Samples

Sample NORTH SOTHO.EPA SELECT SAX='M'

Sample XHOSA .EPA SELECT S_X='M'

Test: Unpaired

Average rank of first group = 172.888 based on 250 values.
Average rank of second group = 132.618 based on 76 values.
Large sample test statistic Z = -3.27435
Two-tailed probability of equaling or exceeding Z = 1.05917E-3

NOTE: 326 total observations.

Comparison of Two Samples

Sample NORTH SOTHO.ES SELECT SAX='M'

Sample XHOSA .ES SELECT S_X='M'

Test: Unpaired

Average rank of first group = 155.452 based on 250 values.
Average rank of second group = 189.974 based on 76 values.
Large sample test statistic Z = 2.80647
Two-tailed probability of equaling or exceeding Z = 5.00889E-3

NOTE: 326 total observations.

Comparison of Two Samples

Sample NORTH SOTHO.WT SELECT SAX='M'

Sample XHOSA .WT SELECT S_X='M'

Test: Unpaired

Average rank of first group = 155.61 based on 250 values.
Average rank of second group = 189.454 based on 76 values.
Large sample test statistic Z = 2.75238
Two-tailed probability of equaling or exceeding Z = 5.91655E-3

NOTE: 326 total observations.

Comparison of Two Samples

Sample **NORTH SOTHO.**AP SELECT SAX='M'

Sample **XHOSA** .AP SELECT S_X='M'

Test: Unpaired

Average rank of first group = 157.606 based on 250 values.
Average rank of second group = 182.888 based on 76 values.
Large sample test statistic Z = 2.05372
Two-tailed probability of equaling or exceeding Z = 0.0400029

NOTE: 326 total observations.

Comparison of Two Samples

Sample **NORTH SOTHO.**WH SELECT SAX='M'

Sample **XHOSA** .WH SELECT S_X='M'

Test: Unpaired

Average rank of first group = 167.362 based on 250 values.
Average rank of second group = 150.796 based on 76 values.
Large sample test statistic Z = -1.35003
Two-tailed probability of equaling or exceeding Z = 0.177005

NOTE: 326 total observations.

Comparison of Two Samples

Sample **NORTH SOTHO.**BLU SELECT SAX='M'

Sample **XHOSA** .BLU SELECT S_X='M'

Test: Unpaired

Average rank of first group = 161.79 based on 250 values.
Average rank of second group = 169.125 based on 76 values.
Large sample test statistic Z = 0.595208
Two-tailed probability of equaling or exceeding Z = 0.551702

NOTE: 326 total observations.

Comparison of Two Samples

Sample NORTH SOTHO.NP SELECT SAX='M'

Sample XHOSA .NP SELECT S_X='M'

Test: Unpaired

Average rank of first group = 153.374 based on 250 values.
Average rank of second group = 196.809 based on 76 values.
Large sample test statistic Z = 3.53269
Two-tailed probability of equaling or exceeding Z = 4.11442E-4

NOTE: 326 total observations.

Comparison of Two Samples

Sample NORTH SOTHO.HT SELECT SAX='M'

Sample XHOSA .HT SELECT S_X='M'

Test: Unpaired

Average rank of first group = 165.696 based on 250 values.
Average rank of second group = 156.276 based on 76 values.
Large sample test statistic Z = -0.765207
Two-tailed probability of equaling or exceeding Z = 0.444146

NOTE: 326 total observations.

Comparison of Two Samples

Sample NORTH SOTHO.DM SELECT SAX='M'

Sample XHOSA .DM SELECT S_X='M'

Test: Unpaired

Average rank of first group = 158.686 based on 250 values.
Average rank of second group = 179.336 based on 76 values.
Large sample test statistic Z = 1.67744
Two-tailed probability of equaling or exceeding Z = 0.0934557

NOTE: 326 total observations.

APPENDIX E2:1

Mann-Whitney U-test statistics for Xhosa male and Coloured male pupils

Comparison of Two Samples

Sample XHOSA.MH SELECT S_X='M'

Sample COLOURED.MH SELECT GENDER ='M'

Test: Unpaired

Average rank of first group = 45.5789 based on 76 values.
Average rank of second group = 148.437 based on 151 values.
Large sample test statistic Z = 11.2422
Two-tailed probability of equaling or exceeding Z = 0

NOTE: 227 total observations.

Comparison of Two Samples

Sample XHOSA.US SELECT S_X='M'

Sample COLOURED.US SELECT GENDER ='M'

Test: Unpaired

Average rank of first group = 129.717 based on 76 values.
Average rank of second group = 106.089 based on 151 values.
Large sample test statistic Z = -2.56706
Two-tailed probability of equaling or exceeding Z = 0.0102566

NOTE: 227 total observations.

Comparison of Two Samples

Sample XHOSA.HH SELECT S_X='M'

Sample COLOURED.HH SELECT GENDER ='M'

Test: Unpaired

Average rank of first group = 112.151 based on 76 values.
Average rank of second group = 114.93 based on 151 values.
Large sample test statistic Z = 0.301487
Two-tailed probability of equaling or exceeding Z = 0.763039

NOTE: 227 total observations.

Comparison of Two Samples

Sample XHOSA.MR SELECT S_X='M'

Sample COLOURED.MR SELECT GENDER ='M'

Test: Unpaired

Average rank of first group = 92.5658 based on 76 values.
Average rank of second group = 124.788 based on 151 values.
Large sample test statistic Z = 3.50448
Two-tailed probability of equaling or exceeding Z = 4.57595E-4

NOTE: 227 total observations.

Comparison of Two Samples

Sample XHOSA.FW SELECT S_X='M'

Sample COLOURED.FW SELECT GENDER ='M'

Test: Unpaired

Average rank of first group = 90.5987 based on 76 values.
Average rank of second group = 125.778 based on 151 values.
Large sample test statistic Z = 3.82871
Two-tailed probability of equaling or exceeding Z = 1.28863E-4

NOTE: 227 total observations.

Comparison of Two Samples

Sample XHOSA.PG SELECT S_X='M'

Sample COLOURED.PG SELECT GENDER ='M'

Test: Unpaired

Average rank of first group = 129.204 based on 76 values.
Average rank of second group = 106.348 based on 151 values.
Large sample test statistic Z = -2.48302
Two-tailed probability of equaling or exceeding Z = 0.0130275

NOTE: 227 total observations.

Comparison of Two Samples

Sample XHOSA.EPA SELECT S_X='M'

Sample COLOURED.EPA SELECT GENDER ='M'

Test: Unpaired

Average rank of first group = 146.928 based on 76 values.
Average rank of second group = 97.4272 based on 151 values.
Large sample test statistic Z = -5.37396
Two-tailed probability of equaling or exceeding Z = 7.7196E-8

NOTE: 227 total observations.

Comparison of Two Samples

Sample XHOSA.ES SELECT S_X='M'

Sample COLOURED.ES SELECT GENDER ='M'

Test: Unpaired

Average rank of first group = 101.592 based on 76 values.
Average rank of second group = 120.245 based on 151 values.
Large sample test statistic Z = 2.02672
Two-tailed probability of equaling or exceeding Z = 0.0426906

NOTE: 227 total observations.

Comparison of Two Samples

Sample XHOSA.WT SELECT S_X='M'

Sample COLOURED.WT SELECT GENDER ='M'

Test: Unpaired

Average rank of first group = 124.158 based on 76 values.
Average rank of second group = 108.887 based on 151 values.
Large sample test statistic Z = -1.65946
Two-tailed probability of equaling or exceeding Z = 0.0970219

NOTE: 227 total observations.

Comparison of Two Samples

Sample XHOSA.AP SELECT S_X='M'

Sample COLOURED.AP SELECT GENDER ='M'

Test: Unpaired

Average rank of first group = 160.704 based on 76 values.
Average rank of second group = 90.4934 based on 151 values.
Large sample test statistic Z = -7.62423
Two-tailed probability of equaling or exceeding Z = 2.4647E-14

NOTE: 227 total observations.

Comparison of Two Samples

Sample XHOSA.WH SELECT S_X='M'

Sample COLOURED.WH SELECT GENDER ='M'

Test: Unpaired

Average rank of first group = 115.25 based on 76 values.
Average rank of second group = 113.371 based on 151 values.
Large sample test statistic Z = -0.203521
Two-tailed probability of equaling or exceeding Z = 0.838723

NOTE: 227 total observations.

Comparison of Two Samples

Sample XHOSA.BLU SELECT S_X='M'

Sample COLOURED.BLU SELECT GENDER ='M'

Test: Unpaired

Average rank of first group = 124.428 based on 76 values.
Average rank of second group = 108.752 based on 151 values.
Large sample test statistic Z = -1.70187
Two-tailed probability of equaling or exceeding Z = 0.0887801

NOTE: 227 total observations.

Comparison of Two Samples

Sample XHOSA.NP SELECT S_X='M'

Sample COLOURED.NP SELECT GENDER ='M'

Test: Unpaired

Average rank of first group = 141.559 based on 76 values.
Average rank of second group = 100.129 based on 151 values.
Large sample test statistic Z = -4.50243
Two-tailed probability of equaling or exceeding Z = 6.7242E-6

NOTE: 227 total observations.

Comparison of Two Samples

Sample XHOSA.HT SELECT S_X='M'

Sample COLOURED.HT SELECT GENDER ='M'

Test: Unpaired

Average rank of first group = 99.3487 based on 76 values.
Average rank of second group = 121.374 based on 151 values.
Large sample test statistic Z = 2.39575
Two-tailed probability of equaling or exceeding Z = 0.0165862

NOTE: 227 total observations.

Comparison of Two Samples

Sample XHOSA.DM SELECT S_X='M'

Sample COLOURED.DM SELECT GENDER ='M'

Test: Unpaired

Average rank of first group = 99.4211 based on 76 values.
Average rank of second group = 121.338 based on 151 values.
Large sample test statistic Z = 2.39048
Two-tailed probability of equaling or exceeding Z = 0.0168261

NOTE: 227 total observations.

APPENDIX E3:1

Mann-Whitney U-test statistics for North Sotho male and Coloured male pupils

Comparison of Two Samples

Sample NORTH SOTHO.MH SELECT SAX='M'

Sample COLOURED.MH SELECT GENDER ='M'

Test: Unpaired

Average rank of first group = 204.962 based on 250 values.
Average rank of second group = 194.44 based on 151 values.
Large sample test statistic Z = -0.884116
Two-tailed probability of equaling or exceeding Z = 0.376632

NOTE: 401 total observations.

Comparison of Two Samples

Sample NORTH SOTHO.US SELECT SAX='M'

Sample COLOURED.US SELECT GENDER ='M'

Test: Unpaired

Average rank of first group = 236.682 based on 250 values.
Average rank of second group = 141.924 based on 151 values.
Large sample test statistic Z = -7.95169
Two-tailed probability of equaling or exceeding Z = 1.77636E-15

NOTE: 401 total observations.

Comparison of Two Samples

Sample NORTH SOTHO.HH SELECT SAX='M'

Sample COLOURED.HH SELECT GENDER ='M'

Test: Unpaired

Average rank of first group = 185.614 based on 250 values.
Average rank of second group = 226.474 based on 151 values.
Large sample test statistic Z = 3.45575
Two-tailed probability of equaling or exceeding Z = 5.48855E-4

NOTE: 401 total observations.

APPENDIX E3:2

Comparison of Two Samples

Sample **NORTH SOTHO**.MR SELECT SAX='M'

Sample **COLOURED**.MR SELECT GENDER ='M'

Test: Unpaired

Average rank of first group = 184.946 based on 250 values.
Average rank of second group = 227.579 based on 151 values.
Large sample test statistic Z = 3.58459
Two-tailed probability of equaling or exceeding Z = 3.37678E-4

NOTE: 401 total observations.

Comparison of Two Samples

Sample **NORTH SOTHO**.FW SELECT SAX='M'

Sample **COLOURED**.FW SELECT GENDER ='M'

Test: Unpaired

Average rank of first group = 143.008 based on 250 values.
Average rank of second group = 297.013 based on 151 values.
Large sample test statistic Z = 13.4413
Two-tailed probability of equaling or exceeding Z = 0

NOTE: 401 total observations.

Comparison of Two Samples

Sample **NORTH SOTHO**.PG SELECT SAX='M'

Sample **COLOURED**.PG SELECT GENDER ='M'

Test: Unpaired

Average rank of first group = 187.932 based on 250 values.
Average rank of second group = 222.636 based on 151 values.
Large sample test statistic Z = 2.92714
Two-tailed probability of equaling or exceeding Z = 3.42112E-3

NOTE: 401 total observations.

Comparison of Two Samples

Sample NORTH SOTHO.EPA SELECT SAX='M'

Sample COLOURED.EPA SELECT GENDER ='M'

Test: Unpaired

Average rank of first group = 246.64 based on 250 values.
Average rank of second group = 125.437 based on 151 values.
Large sample test statistic Z = -10.1734
Two-tailed probability of equaling or exceeding Z = 0

NOTE: 401 total observations.

Comparison of Two Samples

Sample NORTH SOTHO.ES SELECT SAX='M'

Sample COLOURED.ES SELECT GENDER ='M'

Test: Unpaired

Average rank of first group = 173.726 based on 250 values.
Average rank of second group = 246.156 based on 151 values.
Large sample test statistic Z = 6.08479
Two-tailed probability of equaling or exceeding Z = 1.17088E-9

NOTE: 401 total observations.

Comparison of Two Samples

Sample NORTH SOTHO.WT SELECT SAX='M'

Sample COLOURED.WT SELECT GENDER ='M'

Test: Unpaired

Average rank of first group = 197.942 based on 250 values.
Average rank of second group = 206.063 based on 151 values.
Large sample test statistic Z = 0.68173
Two-tailed probability of equaling or exceeding Z = 0.495407

NOTE: 401 total observations.

Comparison of Two Samples

Sample **NORTH SOTHO**.AP SELECT SAX='M'

Sample **COLOURED**.AP SELECT GENDER ='M'

Test: Unpaired

Average rank of first group = 238.854 based on 250 values.
Average rank of second group = 138.328 based on 151 values.
Large sample test statistic Z = -8.43657
Two-tailed probability of equaling or exceeding Z = 0

NOTE: 401 total observations.

Comparison of Two Samples

Sample **NORTH SOTHO**.WH SELECT SAX='M'

Sample **COLOURED**.WH SELECT GENDER ='M'

Test: Unpaired

Average rank of first group = 208.854 based on 250 values.
Average rank of second group = 187.997 based on 151 values.
Large sample test statistic Z = -1.75569
Two-tailed probability of equaling or exceeding Z = 0.0791414

NOTE: 401 total observations.

Comparison of Two Samples

Sample **NORTH SOTHO**.BLU SELECT SAX='M'

Sample **COLOURED**.BLU SELECT GENDER ='M'

Test: Unpaired

Average rank of first group = 207.382 based on 250 values.
Average rank of second group = 190.434 based on 151 values.
Large sample test statistic Z = -1.42259
Two-tailed probability of equaling or exceeding Z = 0.154853

NOTE: 401 total observations.

Comparison of Two Samples

Sample NORTH SOTHO.NP SELECT SAX='M'

Sample COLOURED.NP SELECT GENDER ='M'

Test: Unpaired

Average rank of first group = 205.416 based on 250 values.
Average rank of second group = 193.689 based on 151 values.
Large sample test statistic Z = -0.984365
Two-tailed probability of equaling or exceeding Z = 0.324935

NOTE: 401 total observations.

Comparison of Two Samples

Sample NORTH SOTHO.HT SELECT SAX='M'

Sample COLOURED.HT SELECT GENDER ='M'

Test: Unpaired

Average rank of first group = 192.784 based on 250 values.
Average rank of second group = 214.603 based on 151 values.
Large sample test statistic Z = 1.83491
Two-tailed probability of equaling or exceeding Z = 0.0665179

NOTE: 401 total observations.

Comparison of Two Samples

Sample NORTH SOTHO.DM SELECT SAX='M'

Sample COLOURED.DM SELECT GENDER ='M'

Test: Unpaired

Average rank of first group = 179.832 based on 250 values.
Average rank of second group = 236.046 based on 151 values.
Large sample test statistic Z = 4.72755
Two-tailed probability of equaling or exceeding Z = 2.27517E-6

NOTE: 401 total observations.

APPENDIX E4:1

Mann-Whitney U-test statistics for North Sotho female and Xhosa female pupils

Comparison of Two Samples

Sample NORTH SOTHO.MH SELECT SAX='F'

Sample XHOSA.MH SELECT S_X='F'

Test: Unpaired

Average rank of first group = 189.799 based on 164 values.
Average rank of second group = 65.2743 based on 113 values.
Large sample test statistic Z = -12.8647
Two-tailed probability of equaling or exceeding Z = 0

NOTE: 277 total observations.

Comparison of Two Samples

Sample NORTH SOTHO.US SELECT SAX='F'

Sample XHOSA.US SELECT S_X='F'

Test: Unpaired

Average rank of first group = 163.287 based on 164 values.
Average rank of second group = 103.752 based on 113 values.
Large sample test statistic Z = -6.09881
Two-tailed probability of equaling or exceeding Z = 1.07268E-9

NOTE: 277 total observations.

Comparison of Two Samples

Sample NORTH SOTHO.HH SELECT SAX='F'

Sample XHOSA.HH SELECT S_X='F'

Test: Unpaired

Average rank of first group = 145.759 based on 164 values.
Average rank of second group = 129.19 based on 113 values.
Large sample test statistic Z = -1.72097
Two-tailed probability of equaling or exceeding Z = 0.0852558

NOTE: 277 total observations.

Comparison of Two Samples

Sample NORTH SOTHO.MR SELECT SAX='F'

Sample XHOSA.MR SELECT S_X='F'

Test: Unpaired

Average rank of first group = 144.25 based on 164 values.
Average rank of second group = 131.381 based on 113 values.
Large sample test statistic Z = -1.3174
Two-tailed probability of equaling or exceeding Z = 0.187704

NOTE: 277 total observations.

Comparison of Two Samples

Sample NORTH SOTHO.FW SELECT SAX='F'

Sample XHOSA.FW SELECT S_X='F'

Test: Unpaired

Average rank of first group = 97.4695 based on 164 values.
Average rank of second group = 199.274 based on 113 values.
Large sample test statistic Z = 10.8377
Two-tailed probability of equaling or exceeding Z = 0

NOTE: 277 total observations.

Comparison of Two Samples

Sample NORTH SOTHO.PG SELECT SAX='F'

Sample XHOSA.PG SELECT S_X='F'

Test: Unpaired

Average rank of first group = 118.936 based on 164 values.
Average rank of second group = 168.119 based on 113 values.
Large sample test statistic Z = 5.046
Two-tailed probability of equaling or exceeding Z = 4.51897E-7

NOTE: 277 total observations.

Comparison of Two Samples

Sample NORTH SOTHO.EPA SELECT SAX='F'

Sample XHOSA.EPA SELECT S_X='F'

Test: Unpaired

Average rank of first group = 144.116 based on 164 values.
Average rank of second group = 131.575 based on 113 values.
Large sample test statistic Z = -1.28504
Two-tailed probability of equaling or exceeding Z = 0.198778

NOTE: 277 total observations.

Comparison of Two Samples

Sample NORTH SOTHO.ES SELECT SAX='F'

Sample XHOSA.ES SELECT S_X='F'

Test: Unpaired

Average rank of first group = 132.235 based on 164 values.
Average rank of second group = 148.819 based on 113 values.
Large sample test statistic Z = 1.70068
Two-tailed probability of equaling or exceeding Z = 0.0890027

NOTE: 277 total observations.

Comparison of Two Samples

Sample NORTH SOTHO.WT SELECT SAX='F'

Sample XHOSA.WT SELECT S_X='F'

Test: Unpaired

Average rank of first group = 128.881 based on 164 values.
Average rank of second group = 153.686 based on 113 values.
Large sample test statistic Z = 2.54943
Two-tailed probability of equaling or exceeding Z = 0.01079

NOTE: 277 total observations.

Comparison of Two Samples

Sample NORTH SOTHO.AP SELECT SAX='F'

Sample XHOSA.AP SELECT S_X='F'

Test: Unpaired

Average rank of first group = 144.119 based on 164 values.
Average rank of second group = 131.571 based on 113 values.
Large sample test statistic Z = -1.28488
Two-tailed probability of equaling or exceeding Z = 0.198833

NOTE: 277 total observations.

Comparison of Two Samples

Sample NORTH SOTHO.WH SELECT SAX='F'

Sample XHOSA.WH SELECT S_X='F'

Test: Unpaired

Average rank of first group = 137.622 based on 164 values.
Average rank of second group = 141 based on 113 values.
Large sample test statistic Z = 0.346131
Two-tailed probability of equaling or exceeding Z = 0.72924

NOTE: 277 total observations.

Comparison of Two Samples

Sample NORTH SOTHO.BLU SELECT SAX='F'

Sample XHOSA.BLU SELECT S_X='F'

Test: Unpaired

Average rank of first group = 130.848 based on 164 values.
Average rank of second group = 150.832 based on 113 values.
Large sample test statistic Z = 2.04609
Two-tailed probability of equaling or exceeding Z = 0.0407476

NOTE: 277 total observations.

Comparison of Two Samples

Sample NORTH SOTHO.NF SELECT SAX='F'

Sample XHOSA.NF SELECT S_X='F'

Test: Unpaired

Average rank of first group = 128.183 based on 164 values.
Average rank of second group = 154.699 based on 113 values.
Large sample test statistic Z = 2.72094
Two-tailed probability of equaling or exceeding Z = 6.50974E-3

NOTE: 277 total observations.

Comparison of Two Samples

Sample NORTH SOTHO.HT SELECT SAX='F'

Sample XHOSA.HT SELECT S_X='F'

Test: Unpaired

Average rank of first group = 134.546 based on 164 values.
Average rank of second group = 145.465 based on 113 values.
Large sample test statistic Z = 1.11756
Two-tailed probability of equaling or exceeding Z = 0.263753

NOTE: 277 total observations.

Comparison of Two Samples

Sample NORTH SOTHO.DM SELECT SAX='F'

Sample XHOSA.DM SELECT S_X='F'

Test: Unpaired

Average rank of first group = 122.482 based on 164 values.
Average rank of second group = 162.973 based on 113 values.
Large sample test statistic Z = 4.1484
Two-tailed probability of equaling or exceeding Z = 3.35006E-5

NOTE: 277 total observations.

APPENDIX E5:1

Mann-Whitney U-test statistics for Xhosa female and Coloured female pupils

Comparison of Two Samples

Sample XHOSA.MH SELECT S_X='F'

Sample COLOURED.MH SELECT GENDER ='F'

Test: Unpaired

Average rank of first group = 68.9204 based on 113 values.
Average rank of second group = 202.484 based on 192 values.
Large sample test statistic Z = 12.9001
Two-tailed probability of equaling or exceeding Z = 0

NOTE: 305 total observations.

Comparison of Two Samples

Sample XHOSA.US SELECT S_X='F'

Sample COLOURED.US SELECT GENDER ='F'

Test: Unpaired

Average rank of first group = 155.504 based on 113 values.
Average rank of second group = 151.526 based on 192 values.
Large sample test statistic Z = -0.38152
Two-tailed probability of equaling or exceeding Z = 0.702814

NOTE: 305 total observations.

Comparison of Two Samples

Sample XHOSA.HH SELECT S_X='F'

Sample COLOURED.HH SELECT GENDER ='F'

Test: Unpaired

Average rank of first group = 144.31 based on 113 values.
Average rank of second group = 158.115 based on 192 values.
Large sample test statistic Z = 1.33392
Two-tailed probability of equaling or exceeding Z = 0.182229

NOTE: 305 total observations.

APPENDIX E5:2

Comparison of Two Samples

Sample XHOSA.MR SELECT S_X='F'

Sample COLOURED.MR SELECT GENDER ='F'

Test: Unpaired

Average rank of first group = 121.898 based on 113 values.
Average rank of second group = 171.305 based on 192 values.
Large sample test statistic Z = 4.74412
Two-tailed probability of equaling or exceeding Z = 2.0967E-6

NOTE: 305 total observations.

Comparison of Two Samples

Sample XHOSA.FW SELECT S_X='F'

Sample COLOURED.FW SELECT GENDER ='F'

Test: Unpaired

Average rank of first group = 125.482 based on 113 values.
Average rank of second group = 169.195 based on 192 values.
Large sample test statistic Z = 4.20464
Two-tailed probability of equaling or exceeding Z = 2.61662E-5

NOTE: 305 total observations.

Comparison of Two Samples

Sample XHOSA.PG SELECT S_X='F'

Sample COLOURED.PG SELECT GENDER ='F'

Test: Unpaired

Average rank of first group = 188.504 based on 113 values.
Average rank of second group = 132.104 based on 192 values.
Large sample test statistic Z = -5.41971
Two-tailed probability of equaling or exceeding Z = 5.98342E-8

NOTE: 305 total observations.

Comparison of Two Samples

Sample 1 XHOSA.EPA SELECT S_X='F'

Sample COLOURED.EPA SELECT GENDER ='F'

Test: Unpaired

Average rank of first group = 188.925 based on 113 values.
Average rank of second group = 131.857 based on 192 values.
Large sample test statistic Z = -5.47112
Two-tailed probability of equaling or exceeding Z = 4.48287E-8

NOTE: 305 total observations.

Comparison of Two Samples

Sample XHOSA.ES SELECT S_X='F'

Sample COLOURED.ES SELECT GENDER ='F'

Test: Unpaired

Average rank of first group = 133.597 based on 113 values.
Average rank of second group = 164.419 based on 192 values.
Large sample test statistic Z = 2.96056
Two-tailed probability of equaling or exceeding Z = 3.07095E-3

NOTE: 305 total observations.

Comparison of Two Samples

Sample XHOSA.WT SELECT S_X='F'

Sample COLOURED.WT SELECT GENDER ='F'

Test: Unpaired

Average rank of first group = 172.004 based on 113 values.
Average rank of second group = 141.815 based on 192 values.
Large sample test statistic Z = -2.90835
Two-tailed probability of equaling or exceeding Z = 3.63359E-3

NOTE: 305 total observations.

Comparison of Two Samples

Sample XHOSA.AP SELECT S_X='F'

Sample COLOURED.AP SELECT GENDER ='F'

Test: Unpaired

Average rank of first group = 205.991 based on 113 values.
Average rank of second group = 121.813 based on 192 values.
Large sample test statistic Z = -8.07451
Two-tailed probability of equaling or exceeding Z = 6.66134E-16

NOTE: 305 total observations.

Comparison of Two Samples

Sample XHOSA.WH SELECT S_X='F'

Sample COLOURED.WH SELECT GENDER ='F'

Test: Unpaired

Average rank of first group = 180.398 based on 113 values.
Average rank of second group = 136.875 based on 192 values.
Large sample test statistic Z = -4.18928
Two-tailed probability of equaling or exceeding Z = 2.80016E-5

NOTE: 305 total observations.

Comparison of Two Samples

Sample XHOSA.BLU SELECT S_X='F'

Sample COLOURED.BLU SELECT GENDER ='F'

Test: Unpaired

Average rank of first group = 147.779 based on 113 values.
Average rank of second group = 156.073 based on 192 values.
Large sample test statistic Z = 0.795723
Two-tailed probability of equaling or exceeding Z = 0.426191

NOTE: 305 total observations.

APPENDIX E5:5

Comparison of Two Samples

Sample XHOSA.NP SELECT S_X='F'

Sample COLOURED.NP SELECT GENDER ='F'

Test: Unpaired

Average rank of first group = 172.097 based on 113 values.
Average rank of second group = 141.76 based on 192 values.
Large sample test statistic Z = -2.91623
Two-tailed probability of equaling or exceeding Z = 3.54298E-3

NOTE: 305 total observations.

Comparison of Two Samples

Sample XHOSA.HT SELECT S_X='F'

Sample COLOURED.HT SELECT GENDER ='F'

Test: Unpaired

Average rank of first group = 134.774 based on 113 values.
Average rank of second group = 163.727 based on 192 values.
Large sample test statistic Z = 2.78251
Two-tailed probability of equaling or exceeding Z = 5.39404E-3

NOTE: 305 total observations.

Comparison of Two Samples

Sample XHOSA.DM SELECT S_X='F'

Sample COLOURED.DM SELECT GENDER ='F'

Test: Unpaired

Average rank of first group = 150.088 based on 113 values.
Average rank of second group = 154.714 based on 192 values.
Large sample test statistic Z = 0.445784
Two-tailed probability of equaling or exceeding Z = 0.65575

NOTE: 305 total observations.

APPENDIX E6:1

Mann-Whitney U-test statistics for North Sotho female and Coloured female pupils

Comparison of Two Samples

Sample NORTH SOTHO.MH SELECT SAX='F'

Sample COLOURED.MH SELECT GENDER ='F'

Test: Unpaired

Average rank of first group = 187.369 based on 164 values.
Average rank of second group = 170.924 based on 192 values.
Large sample test statistic Z = -1.50735
Two-tailed probability of equaling or exceeding Z = 0.131721

NOTE: 356 total observations.

Comparison of Two Samples

Sample NORTH SOTHO.US SELECT SAX='F'

Sample COLOURED.US SELECT GENDER ='F'

Test: Unpaired

Average rank of first group = 219.884 based on 164 values.
Average rank of second group = 143.151 based on 192 values.
Large sample test statistic Z = -7.03444
Two-tailed probability of equaling or exceeding Z = 2.01394E-12

NOTE: 356 total observations.

Comparison of Two Samples

Sample NORTH SOTHO.HH SELECT SAX='F'

Sample COLOURED.HH SELECT GENDER ='F'

Test: Unpaired

Average rank of first group = 179.287 based on 164 values.
Average rank of second group = 177.828 based on 192 values.
Large sample test statistic Z = -0.134059
Two-tailed probability of equaling or exceeding Z = 0.89335

NOTE: 356 total observations.

Comparison of Two Samples

Sample NORTH SOTHO.MR SELECT SAX='F'

Sample COLOURED.MR SELECT GENDER ='F'

Test: Unpaired

Average rank of first group = 159.201 based on 164 values.
Average rank of second group = 194.984 based on 192 values.
Large sample test statistic Z = 3.28402
Two-tailed probability of equaling or exceeding Z = 1.02349E-3

NOTE: 356 total observations.

Comparison of Two Samples

Sample NORTH SOTHO.FW SELECT SAX='F'

Sample COLOURED.FW SELECT GENDER ='F'

Test: Unpaired

Average rank of first group = 100.68 based on 164 values.
Average rank of second group = 244.971 based on 192 values.
Large sample test statistic Z = 13.4779
Two-tailed probability of equaling or exceeding Z = 0

NOTE: 356 total observations.

Comparison of Two Samples

Sample NORTH SOTHO.PG SELECT SAX='F'

Sample COLOURED.PG SELECT GENDER ='F'

Test: Unpaired

Average rank of first group = 184.463 based on 164 values.
Average rank of second group = 173.406 based on 192 values.
Large sample test statistic Z = -1.0178
Two-tailed probability of equaling or exceeding Z = 0.308772

NOTE: 356 total observations.

Comparison of Two Samples

Sample NORTH SOTHO.EPA SELECT SAX='F'

Sample COLOURED.EPA SELECT GENDER ='F'

Test: Unpaired

Average rank of first group = 219.982 based on 164 values.
Average rank of second group = 143.068 based on 192 values.
Large sample test statistic Z = -7.04728
Two-tailed probability of equaling or exceeding Z = 1.83653E-12

NOTE: 356 total observations.

Comparison of Two Samples

Sample NORTH SOTHO.ES SELECT SAX='F'

Sample COLOURED.ES SELECT GENDER ='F'

Test: Unpaired

Average rank of first group = 150.613 based on 164 values.
Average rank of second group = 202.32 based on 192 values.
Large sample test statistic Z = 4.74541
Two-tailed probability of equaling or exceeding Z = 2.08333E-6

NOTE: 356 total observations.

Comparison of Two Samples

Sample NORTH SOTH .WT SELECT SAX='F'

Sample COLOURED.WT SELECT GENDER ='F'

Test: Unpaired

Average rank of first group = 183.302 based on 164 values.
Average rank of second group = 174.398 based on 192 values.
Large sample test statistic Z = -0.817657
Two-tailed probability of equaling or exceeding Z = 0.413551

NOTE: 356 total observations.

Comparison of Two Samples

Sample NORTH SOTHO.AP SELECT SAX='F'

Sample COLOURED.AP SELECT GENDER ='F'

Test: Unpaired

Average rank of first group = 230.835 based on 164 values.
Average rank of second group = 133.797 based on 192 values.
Large sample test statistic Z = -8.89268
Two-tailed probability of equaling or exceeding Z = 0

NOTE: 356 total observations.

Comparison of Two Samples

Sample NORTH SOTHO.WH SELECT SAX='F'

Sample COLOURED.WH SELECT GENDER ='F'

Test: Unpaired

Average rank of first group = 203.576 based on 164 values.
Average rank of second group = 157.081 based on 192 values.
Large sample test statistic Z = -4.27969
Two-tailed probability of equaling or exceeding Z = 1.87284E-5

NOTE: 356 total observations.

Comparison of Two Samples

Sample NORTH SOTHO.BLU SELECT SAX='F'

Sample COLOURED.BLU SELECT GENDER ='F'

Test: Unpaired

Average rank of first group = 159.799 based on 164 values.
Average rank of second group = 194.474 based on 192 values.
Large sample test statistic Z = 3.1784
Two-tailed probability of equaling or exceeding Z = 1.48104E-3

NOTE: 356 total observations.

Comparison of Two Samples

Sample NORTH SOTHO.NP SELECT SAX='F'

Sample COLOURED.NP SELECT GENDER ='F'

Test: Unpaired

Average rank of first group = 175.652 based on 164 values.
Average rank of second group = 180.932 based on 192 values.
Large sample test statistic Z = 0.483882
Two-tailed probability of equaling or exceeding Z = 0.628466

NOTE: 356 total observations.

Comparison of Two Samples

Sample NORTH SOTHO.HT SELECT SAX='F'

Sample COLOURED.HT SELECT GENDER ='F'

Test: Unpaired

Average rank of first group = 154.006 based on 164 values.
Average rank of second group = 199.422 based on 192 values.
Large sample test statistic Z = 4.1664
Two-tailed probability of equaling or exceeding Z = 3.09627E-5

NOTE: 356 total observations.

Comparison of Two Samples

Sample NORTH SOTHO.DM SELECT SAX='F'

Sample COLOURED.DM SELECT GENDER ='F'

Test: Unpaired

Average rank of first group = 150.479 based on 164 values.
Average rank of second group = 202.435 based on 192 values.
Large sample test statistic Z = 4.76958
Two-tailed probability of equaling or exceeding Z = 1.84843E-6

NOTE: 356 total observations.

APPENDIX F

XHOSA TRANSLATION OF THE LGPI

Xhosa translation of the LGPI

Qaphela: Zinike elinye igama (codename) xa ungafuni ukusebenzisa elakho.

UKUBEKWA EZINGENI KWEZENZULULWAZI KWANEZOBUNGCALI-IINGXAKI ZELIZW EZICHAPHAZELEKAYO

Ziziphi ezona ngxaki uzibona njengezona zibalulekileyo ehlabathini ngokuphathelele ekusetyenzisweni kwezengcali nezenzululwazi entlalweni yabantu? Linganisela ezi zilandelayo ukususela ku 1-15 (ubonise okuthatha njengokona kubalulekileyo kuwe). Fakela amanani akho kwizivalelo (brackets) ezifanelekileyo.

IINGXAKI ZELIZWE

( ) UKWAKHIWA KWEZINDLU EZININZI ZOKUHLALISA ABANTU (amakhaya alungele wonke umntu, kwanokuthuthwa kwenkunkuma nococeko lwangasese, iindawo zokufihla intloko, ukhuseleko, izibane ezitalatweni, iinkonzo zentlalontle ezinjengomkhosi wamapolisa noonoposi).

( ) IZINTO EZINOBUNGOZI (iindawo zokulahla inkunkuma, iikhemikhali ezinobungozi, iilead paints, ielectro-magnetic wave radiation umz: iultraviolet radiation evela elangeni ne microwave oven radiation).

( ) IMPILO NEZIFO (izifo ezibulalayo nezingabulaliyo ezifana ne gawulayo; umthambo; izigulo zengqondo; ukudinwa, ingxolo ukutya nesondlo).

( ) IZIMBIWA (EZIVUTHAYO NEZINGAVUTHIYO,ezisisinyithi nezi ngesiso sinyithi, ezemigodi, ezengcali, ezikwinqanaba eli phantsi, irecycling, imigqomo).

APPENDIX F1:2

( ) AMANZI ACOCEKILEYO (inkunkuma, umlambo, ukusetyenziswa kwamanzi, ukungcoliseka kwamanzi asemhlabeni, ukungcolisa kwezichumisi, ukuphathwa kwamanzi angasese, uqaphelo nolawulo lwezantyala tyala zemvula kwanembalela)

( ) UKWANDA KOLUNTU (Ehlabathini, uthutho/imfuduko, indawo yokuhlala, ucwangwiso lwedolophu).

( ) UKUTSHITSHA KWEZITYALO NEZILWANYANA (ukusala kwentlobo zezilwanyana ezimbalwa, ukuloba okubaxwayo, ukungcoliseka nokucutheka kwezilwanyana nezityalo zaselwandle, ukukhuseleka kobomi basendle (izityalo nezilwanyana).

( ) UKUNQONGOPHALA KWAMANDLA (amandla enziwe ngabantu, amandla elanga, amandla embiwayo/amalahle, ukunqongophala kwemithombo ugcino lwamahlathi, imveliso ye-oli.)

( ) UBUNGCALI BEZEMFAZWE (i-nerve gas, ukwakhiwa kweze-nuclear, ilifu lezixhobo ze-nuclear elothusayo).

( ) UNGCOLISEKO LOMOYA (imvula ye-acid, CO_2, ukucutheka kwe-Ozone, umsi ongcolisayo, i-global warming).

( ) INDLALA NOKUFUMANEKA KOKUTYA (imveliso yokutya, izityalo nendlela zolimo).

( ) UKUSETYENZISWA OKUNGEKUKO KOMHLABA (ukhukuliseko lomhaba, ukuncipha komhlaba, ukwanda nokukhula kwedolophu, ukuswela kwendle indawo zokuhlala, ukususwa kwamahlathi, ukukhula

kwentlambo, ukwanda kwetyuwa emhlabeni).

( ) IZITISHI ZE-NUCLEAR (ulawulo lolahlo lwenkunkuma ye-nuclear, uxabiso lokwakhiwa, ukhuseleko, izenzo zobhukuqo).

( ) UKUSETYENZISWA OKULUNGILEYO NOKUNGALUNGANGA KWEZOBUNGCALI OBUKWINQANABA ELIPHEZULU (i-electronic information explosion imfundo nokusasazwa kolwazi, i-genetic engineering, unxibelelwano lomhlaba ngokubanzi, ukwakhiwa kwemisebenzi, imfundiso zomabonakude, ukwahlulelana okukhawulezileyo ngenkcukacha ezingaginyisi mathe/ezixhalabisayo nge-satelite

( ) ABAQULUNQI MTHETHO ABANGACHUBEKANGA (inkokheli zasekuhlaleni ezingenalwazi ngenzululwazi nezengcali; inzululwazi nezoluntu njengezithethe ezahlukeneyo).

Valela ibe nye kwezi zilandelayo ngesangqa:-

Indoda	Ibhinqa

Std. 6	Std. 7	Std. 8	Std. 9	Std.10