# THE ROLE OF CULTURAL CAPITAL IN THE ACHIEVEMENT IN THE TIMSS GRADE 8 SCIENCE IN RESPECT OF RURAL SECONDARY SCHOOLS (1995-2003): A META-ANALYSIS

**by**

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# ABSTRACT

The conditions under which Science learners in poor rural socio-economic contexts learn Science is not necessary the same as their counterparts in well-resourced urban areas. At the centre of this, is the growing concern that their performance in the gateway subjects is comparatively lower than their equals in metropolitan areas. From the foregoing a study was undertaken to explore the role that cultural capital plays in the difference in achievement in the TIMSS Grade 8 Science test amongst the rural secondary schools of Mthwalume Circuit, Kwazulu-Natal. This exploratory study was guided by the following two critical research questions:

1. What is the achievement in the TIMSS Grade 8 Science test amongst rural secondary schools?
2. How do researchers and policy makers explain the relationship between learners' achievements in the TIMSS Grade 8 Science test and their socio-cultural-economic background?

The study combined both qualitative and quantitative methods to collect data. The study employed semi-structured interviews, a probe and TIMSS 1995, 1999 and 2003 secondary sources to generate qualitative data of the study. Statistical analysis of secondary documents from TIMSS studies as presented by the Human Science Research Council (HSRC) were used to generate quantitative data of the study. Pierre Bourdieu's (1977) theory of cultural reproduction and social reproduction framed the theoretical lens adopted, while meta-analysis strengthened the study in responding to critical questions.

The findings from the study revealed that the challenges faced by Science learners in poor, rural socio-economic contexts as compared to their counterparts in well-resourced urban schools are not only attributed to resources, but to other deep seated factors. The initial critical research question one yielded insufficient findings owing to inaccessibility of the quantitative data due to confidentiality and other ethical related issues. However, the revised critical one research question: *how did South African Grade 8 learners perform in the TIMSS Science tests from 1995-2003* revealed that out of the 41 countries that participated in TIMSS 1995, South Africa came last. This was the case for TIMSS 1999 and 2003, in which 38 and 50 countries participated respectively. Throughout 1995 to 2003 South Africa's Grade 8 learners' performance fell below the international mean score of 474 points, with scores of 244, 243 and 244. When the TIMSS results were analysed according to the nine provinces, it was significant to note amongst the top

performing provinces were the historically advantaged provinces such as the Western Cape and Gauteng, whilst the poorer provinces like KwaZulu-Natal, Eastern Cape and Limpopo, performed the lowest. Findings from critical research question two indicated that there is a relationship between performances of Science learners and their socio-economic-cultural factors. The study, through the themes like home environment, language of instruction, among others, as they were used to generate data all confirmed to affect learner performance. Data also revealed that the poorly resourced schools are attended by learners from poor rural homes and townships which themselves (poor rural homes) lack the social or cultural capital necessary to access the present curriculum offered at schools.

From the foregoing the study strongly indicates that it is not only that the learners from poor socio-economic backgrounds do not have social or cultural capital, the fact is, as the study argues, their social or cultural capital does not match or is not required by the present curriculum of the school system. Both inequality and poverty, according the study explain properly the difference in learner achievements. Heterogeneity, which is the difference of income between the richest and the poorest, has according to findings, benefited only the minority rich both in economic and educational achievements. Challenges in poor environments are not only faced by learners alone, but by teachers themselves. It was also revealed that the school system is there to function well and provide quality learning equally across all levels of the society. According to its underlying policy, it manifests itself as a one-size-fits-all. But from the perspective of the study there is a dichotomy between what the school system advocates and what it normally does.

# DECLARATION

I hereby declare that the study "***the role of cultural capital in the achievement in the TIMSS Grade 8 science in respect of rural secondary schools (1995-2003): a meta-analysis***", is my own work and has never been submitted before to this or any other academic institution. All the resources I have used or quoted have been indicated and acknowledged by means of complete references.

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# ETHICAL CLEARANCE

# DEDICATION

This work is dedicated to my siblings and mother, maZwane, Mangethe for their unconditional love.

To my late brothers Mduduzi, Te Michael and father Thomas Madala Nxumalo I’d like to say thank you Nxumalo for teaching me Mathematics!

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# CHAPTER 1

# CONTEXTUAL BACKGROUND OF THE STUDY

This chapter conceptualizes and contextualizes the research by providing a contextual background and changes to the South African education system. It describes and explains the purpose of the research and highlights its critical questions. In addition, it presents the researcher's background, explains the significance of the study and lastly, furnishes an outline of the study in question.

## 1.1 CONTEXTUAL BACKGROUND TO EDUCATION IN SOUTH AFRICA

The South African education system has, for the past decades, experienced radical and intensive changes prior and partially after the democratic political dispensation of 1994. These educational changes, when tracked briefly from missionary education, through apartheid education and to the current outcomes based education system reflect a precise picture and nature of how past political regimes coerced and steered the education system. Msila (2007, p.146), when viewing the South African education system from apartheid education to the Revised National Curriculum Statement, concurs that "the legislators or others who formulate education policies always have certain goals in mind which can be political, social or cultural in nature".

However, studies have long been informing us that traces of socially created inequalities of the past based on prestige and wealth (Haralambos & Holborn, 1995, p.19) still impact negatively not only in eco-socio and cultural sectors, but also in vital sectors such as the country's education system (Lareau, 2001). In relation to this context, the South African education system has constantly received international criticism owing to its poor performance associated with socially created inequalities such as discrimination, class, ethnic divisions, indoctrination, and sexism, among others. This criticism was further exacerbated by the poor performance of Mathematics and Science learners in TIMSS 1995, 1999 and 2003 Science test results, where South African learners achieved the lowest scores in all the three international test rounds respectively.

These socially created inequalities of the past political regimes seem to prevail even in the 21st century and thus impede educational innovations of the new democratic era. Some scholars' publications concur that the consequences of the separate and unequal education policies of the past apartheid era in South Africa continue into the present, and if not properly addressed will again persist into the future (Kahn, 2004; Howie, 1997; Reddy, 2006 and Howie; Scherman & Venter, 2004).

With reference to the education system under the missionaries since 1910, education for Africans in was located in the reserves whereby schools were built in isolated places wherever missionaries happened to find themselves (Nelson Mandela Foundation, 2005, p.36). The curriculum within those institutions was mainly about the development of a better set of values among Africans (Christie, 1988). Included among those values were belief in God, hard menial work, rational thinking and planning. Other schools focused on training teachers and religious ministers with greater emphasis on biblical understanding. Another sector provided people with practical skills for use within the then developing modern capitalist economy (Kallaway, 1986 and Ashley, 1989). Little is said about the presence of vigorous mathematical sciences in those missionary institutions. In the early fifties, missionary schools endured scarcity of resources and attacks by the Afrikaner National Government, which ultimately closed them all in the1960's.

Regarding the apartheid education system under the National Party Government, education was entrenched in a centralized curriculum policy that was racist, Euro centric, dictatorial, prescriptive, context blind and largely based on inequality (Jansen, 1999; Msila, 2007). Central to the controversial curriculum of Bantu Education, was the insensitive marginalization of African learners from learning Mathematics, as indicated in the Bantu Education Act of 1956, which was both discriminatory and flawed. According to the statement of Dr. H. F Verwoerd, then Minister of Education in the National Party in 1953, "teaching the Bantu Mathematics when he cannot use it in practice, is an absurd idea" (RSA, 1953, vol.83, column 3585; Samuel & Naidoo, 1992; Seepe, 1994; Malcom & Alant, 2004; Reddy, 2006).

What followed as a result of that apartheid education policy was, as Reddy (2006) proclaims, a racially-differentiated access to gateway subjects like Mathematics and Science. This was because the apartheid education system with its 17 Departments was so divided children of each race group attended different school that were separated

on the basis of culture and racial group. Schools for white children that were well located and resourced, received more funding than others, had better amenities, properly equipped and with better qualified teachers (Alexander, Baden horst, & Gibbs, 2005), cited in Howie et, al (2006).

Such appalling conditions of the apartheid education systems are also revealed in the report by the Nelson Mandela Foundation (2005, p.84) where 71% of teachers in South Africa considered lack of physical and human resources as their biggest problem in teaching and learning. The unfair education policies of the apartheid era, and others that were also oppressive to Africans were, among others, mainly concerned with white minority group supremacy right from school level, tertiary institutions to the workplace. It is in this vein that Naicker (2000, p.1) asserts that education policy and curriculum development in apartheid South Africa was used as an ideological state apparatus to promote the interests of the ruling minority government.

Bourdieu (1973) reminds us that the existence of dominant groups in society that have power and wealth tends to define the type of knowledge that is taught in educational systems. Naidoo (2004); Viljoen and Pienaar (1971), cited in Malcolm and Alant (2004, p.2) reveal that oppressive laws and restrictions of the apartheid era abused black communities; deprived learners of educational resources and indoctrinated teachers and learners both in schools and teacher education through Christian National Education(CNE) and Fundamental Pedagogics.

Such revelation is, however contrary to scholars' perception that Mathematics and Science are key areas of competence for the development of an individual as well as social and economic growth of a whole country. Reddy (2006, p.392) argues that achievement in these subjects guarantee a healthy educational system and economy, and have been a contributor of inequality of access and income. The report from the study of the state of Maths and Science in 1990 before the first democracy in SA conducted by Kahn (1993) disclosed that participation and performance in these subjects among racial groups indicated that African learner' results were poorest within a wide margin. This poor performance and low achievement of African learners continues, both at school level and in tertiary institutions, particularly in Science related faculties. Reddy (2006, p.76) in her monograph reports on South Africa's performance in Mathematics and Science in TIMSS 2003, concurs that African schools bear crippling backlogs in terms

of basic infrastructure, learning materials, and qualified teachers, all of which affect Science and Mathematics participation and achievements.

With the advent of Outcome Based Education (OBE) in South Africa at the beginning of the post-apartheid era, studies reported that an American Educationist, William Spady (Gultig; Lubisi; Parker & Wedekind, 1998) originated OBE in the USA. From the foregoing, the meaning of OBE is primarily about focusing and organizing an education system around what is crucial for all students to be able to succeed at the end of their learning experiences (Spady, 1995; DoE, 2003).

OBE was fundamentally introduced in the USA because the American society had moved from industrial to an information age; on this account an appropriate education was a necessity (Spady, 1995) cited in Gultig et, al. (1998). In relation to the South African context, OBE was brought in to replace the segregated education of the apartheid era by shifting from Bantu Education to a type of education that would liberate and decolonize learners' minds. At the centre of this change, a content driven curriculum whose success was based on examination results had to be replaced by lifelong learning (DoE, 1997, Laugksch; Aldridge & Fraser, 2007. p.2).

The lifelong learning as manifested in a National Curriculum document of 1996 was the first major curriculum statement of the democratic South Africa (DoE, 1996). It was explained primarily by principles drawn from the White Paper on Education and Training (DoE, 1995a), South African Qualification Act No. 58 of 1995, (DoE,1995), and the National Education Act No. 27 of 1996, (DoE, 1996). The White Paper envisaged robust changes in the South African education system, and a need to shift from a traditional aims and objectives approach to an outcomes based approach. This change, which in academic language, is referred to as a paradigm shift was merely a move to a new mind-set, a new attitude and a new way of thinking.

Within the parameters of OBE, a new legal policy framework to address the legacy of a racially and culturally segregated education system had to be established by the government (Country Report-SA, 2005; DoE, 1996 and 2000). This policy framework had to align with the vision of: 'A prosperous, truly united, democratic, internationally competitive country, with a literate, creative, and critical citizens leading productive, self-fulfilled lives in a country free of violence, discrimination and prejudice'(DoE, 2002, p.8 ). Outcomes Based Education was introduced and implemented into our school systems through Curriculum 2005 (Chisholm, 2003, p.3).

Although it meant different things to different people in theory and in practice (Hargreaves & Moore, 2000, Harley et al, 2000) cited in Chisholm (2003), it was regarded as the pedagogical route out of apartheid education.

Curriculum 2005 as a structure or form of OBE was the first major curriculum statement of a democratic South Africa meant to eradicate the legacy of apartheid education and take South Africa into the 21st century. When the new curriculum was announced in 1995 its timeframes indicated that it should have been implemented in all school grades (gr 1-12) by the year 2000. Owing to various complexities the implementation timetable had to be amended to 2005, and the new curriculum was aptly named curriculum 2005. The Department of Education (1997a) on the other hand, defines Curriculum 2005 as an OBE curriculum derived from nationally agreed critical cross-field outcomes that sketch our vision of a transformed society and the role education has to play in creating it.

According to Chisholm, it is probably the most significant curriculum reform in the South African education of the last century. It restricted any reproduction of limited interest and domination of any one particular grouping at the expense of another; hence, it could not shape and be shaped by narrow visions, concerns and identities. Both OBE and Curriculum 2005 provided a wide-ranging structure for the development of an alternative to apartheid education that was open, non-prescriptive and dependent on teachers creating their own learning programs and learning support materials (DoE, 1997a, b & d.), cited in Chisholm (2003).

Just like democracy in the post-apartheid era, Curriculum 2005 was not implemented on a blank slate as Chisholm indicates, “but in a context of immensely complex social inequalities and realities and diverse educational politics”. At the centre of these complexities were the financial constraints, educator readiness, infrastructure and mostly resources, among others, particularly in historically disadvantaged rural schools where the introduction of the outcomes based curriculum was the salt on the long bleeding wound in terms of resource inadequacies and inequalities. Practically speaking, the introduction of OBE with curriculum 2005 made the rural teaching community understand the notion of negligence much better than before.

## 1.2 RATIONALE

This study is driven by personal concerns emanating from my 20 years' experience as a Science teacher in the rural secondary schools of KZN. Responding to the South African matric results of 2003, Asmal (2003, p.2) highlighted that rural schools still lagged behind in achievement in Maths and Science. According to Asmal these low achievements in Science could be, among other things, attributed to poor socio economic background and lack of substantial resources. Furthermore, the TIMMS results of 1995, 1999 and 2003 showed that achievements in both Mathematics and Science in our schools, particularly in rural schools, was below that expected. It is in this vein that scholars such as Howie (2002, p.26) argue that for the African child getting into scientific careers is like climbing Mount Everest.

Admittedly, learners in rural schools learn Science under conditions that are not necessarily the same as those in urban areas. The socio economic backgrounds of most rural learners are poor to the extent that for many families the main source of income is in the form of grants, be it the grandmother's pension or the child grant in the instance of unemployed parents. As Arnold, Newman, Gaddy and Dean (2005, p.2) remind us, rural schools face many pressures which range from diverse students' backgrounds, learning styles, needs, state accountability requirements and availability of education funding. Such pressures are further exacerbated by the geographic isolation of these schools. Although some of the rural schools in some areas have successfully met these challenges, a large number still struggle.

My point of departure from the scenario reflected above is to acknowledge the link between socio-economic status and achievement in Science and Mathematics in school. Bourdieu (1977, p.501) proclaims that the education system, instead of pursuing the fair gospel of pedagogy in policy and practice, promotes a system that fails the pupils of the working class in tests and examinations because they lack the dominant culture. Bourdieu argues that this subsequently prevents learners from the working class to enter into institutions of higher education.

In this regard, the educational performance of social groups is therefore directly related to and ultimately determined, by the amount of 'cultural capital' they possess

## 1.3 SIGNIFICANCE OF THE STUDY

The study seeks to explore the nature of the relationship between educational performance in Science of rural schools and the cultural capital that these schools possess. It aims to identify the cultural variables that are associated with successful achievement in Science in rural socio-economic contexts as perceived by the different researchers and policymakers participating in the study.

The findings from this research may be useful to a variety of stakeholders, including, Mathematics and Science teachers; Science advisors and examiners; policy makers and researchers, amongst others.

## 1.4 OBJECTIVES OF THE STUDY

The study is intended to determine the difference in achievement amongst the KZN schools in the TIMSS Grade 8 Science, with particular reference to rural secondary schools.

Secondly the researchers and policymakers' views on how they explain/ make sense of the relationship between learners' achievements in the TIMSS Grade 8 test and their socio-cultural economic background.

## 1.5 CRITICAL RESEARCH QUESTIONS

1. What is the difference in achievement amongst KZN schools in the TIMSS Grade 8 Science, with particular reference to rural secondary schools?
2. How do researchers and policy makers explain/make sense of the relationship between learners' achievements in the TIMSS Grade 8 Science test and their socio- cultural economic background?

## 1.6 THEORETICAL AND CONCEPTUAL FRAMEWORK

In order to explore Pierre Bourdieu's theory of cultural capital as a framework of the study, we turn to his theories of cultural reproduction and social reproduction. Bourdieu (1977, p.488) argues that the major role of the education system is the preservation (reproduction) of the culture of dominant classes from one generation to the next, and this he calls *cultural reproduction*. However, social reproduction, he

argues, means the conservation or maintenance of unequal social structures, privilege and power relations in successive generations, whose fundamental cause is centred on the education system that legitimates cultural heritage of the dominant class (Bourdieu, 1973), cited in Jenkins (1992, p.110-118); Bourdieu and Parsseron (1977) cited in Haralambos and Holborn (2004, p.745). I therefore selected Bourdieu's theory due to the fact that it accommodates social issues, economical stance and educational related variables which have a precise link to my research focus.

## 1.7 RESEARCH METHODOLOGY

The methodology that was employed in this study is meta-analysis. According to Glass (1976, p.3 & 2000, p.2), the only originator of meta-analysis in educational research towards the late seventies, meta-analysis is the statistical analysis of a large collection of analysis results from individual studies for the purpose of integrating the findings. In that regard, researchers and policymakers' perception about the nature of the relationship between socio-economic background and performance of Science learners in rural secondary schools of KZN was explored as a focus of the study through the use of meta-analysis.

This exploration was done by using statistical analysis of the TIMSS 1995, 1999 and 2003 grade 8 Science test results as a body of primary research studies to find the relationship between socio-economic background (independent variable) and performance of Science (dependent variable) learners in rural secondary school of KZN.

I employed the following methods as a strategic means to collect data:

- Document analysis of TIMSS Grade 8 released items
- Using Probe
- Semi-structured Interviews

A combination of qualitative and quantitative methods was used. Using the probe and semi structured interviews yielded qualitative data while document analysis was a source of quantitative information (statistical data).

## 1.8 OVERVIEW OF THE STUDY

The study comprises of the following seven chapters:

***Chapter 1***, presents the research background of the study, the rationale, purpose, objectives, critical research questions, research methodology, theoretical framework and the limitations encountered in the study.

***Chapter 2***, explores different opinions and findings of scholars both locally and internationally about the impact of poor socio economic backgrounds, resources, inequality on the performance of learners from rural areas. The theoretical framework that guided the study is also discussed in chapter two.

***Chapter 3***, addresses the research design and methodology used to answer critical research questions that were the basic guide of the study in chapter three.

***Chapter 4***, addresses the findings of the first research question.

***Chapter 5***, addresses the first part of research question 2.

***Chapter 6,*** addresses the second part of research question 2.

***Chapter 7***, provides the discussions and recommendations of the findings.

# CHAPTER 2
# A REVIEW OF THE LITERATURE

The purpose of this chapter is to discuss the literature review that informed and guided this research study, which aims to explore the role that cultural capital plays in the difference in achievements in the TIMSS grade 8 Science tests amongst rural secondary schools of Mthwalume Ward. The following themes derived from critical research questions will guide the literature review.

- Challenges facing rural communities and how these challenges impact on the education of the rural learners, especially, Science learning.
    - How do learners from poor rural socio-economic context learn Science?
    - How do learners from rural settings achieve in Science?
- Student achievement in Science globally – what does the literature say about the achievement of learners in different contexts?
- Science achievement in the South-African context
    - Out of school issues
    - In school issues
- Theoretical Framework: Bourdieu' *cultural capital"* as a theoretical framework for the study.

## 2.1 CHALLENGES FACED BY RURAL COMMUNITIES AND HOW IT IMPACTS ON THE EDUCATION OF RURAL LEARNERS, ESPECIALLY SCIENCE LEARNING

The rhetoric that social challenges in rural areas far exceed those in urban areas is unquestionable. Scholars in the field of rural research reveal that lower standards of living in rural communities do not prevail in Third World countries alone, but also in the most developed countries across the globe (Carter, 1999; Duncan, 1999; Gibbs, Swaim & Teixeira, 1998; Howley & Bickel, 2000; Wallace & Boylan, 2006). The lack of wealth, power, infrastructure, substantially under-resourced schools and lack of employment opportunities are, from our South African context, and in most other foreign countries, the unquestionable challenges associated with rural societies (Cross & Chisholm, 1990; Hartshorne, 1992; Murphy, 1992; Mandela, 1994; Kallaway, 1999; Ash, 1997; Hugo, 1998;

Abdi, 2001). There is also a growing concern that communities in rural settings will continue to suffer the debilitating effects of poverty and inequality for as long as these problems remain unchallenged and unaddressed (IRIN Report, 2007).

In acknowledging the aforementioned concerns, research studies conducted in the USA found that infrastructure deficiencies continue to agonize American rural societies even in the 21st century (Lacy, 2001). A comparative study based on rural challenges between China and South Africa established that geographical poverty, insufficient resources, high illiteracy rates, low economic developmental level and, poor lifestyles and social supports are some of the difficulties faced by rural communities in these two developing countries (Gordon & Qiang, 2000).

Scholars (Cross & Chisholm, 1990; Hugo, 1998; Abdi, 2001), concur that poverty-stricken backgrounds and unequal distribution patterns in terms of social resources have long been perceived as accelerating significantly poor living conditions within rural socio economic contexts. In the same way, histories of inequality and outside control of resources, as US Department of Agriculture (1997) asserts, have left many rural persistent poor (RPP) countries with deep social stratification, low performing education systems and low expectations for students from poor families.

However, some other studies conclude that unemployment rate is the supreme challenge, amongst others, that distresses rural communities lying outside urban and suburban areas, where the source of income is in the form of pensions, social grants, if not modicums from farm works and migrant labour (Smith, 1992; Smith & De Young, 1992). What is distressing therefore, is the fact that school-going learners from these poor rural environments, particularly those studying Mathematical sciences, have to endure these challenges, not only in their home backgrounds, but also in their teaching and learning contexts.

## 2.2 HOW DO LEARNERS FROM POOR RURAL SOCIO-ECONOMIC CONTEXTS LEARN SCIENCE?

Educational problems in rural areas are not new but, are as old as rural areas themselves. Literature reveals that South Africa, even in the post-apartheid era has a 40 % poor population and another 20% ultra-poor population (Eckstein, 1994, p. 49; Mayibuye, February 1996, p 11; Malcolm & Keane, 2003; Malcolm & Alant, 2004 and Department of

Education, 2005). This means that 60% of the population in our country lives below the poverty line where they struggle for shelter, employment, nutritious food, infrastructure and resources, not to mention diseases like HIV/AIDS which strikes poor people especially in the 25-40 age group (Badcock –Walters, 2001; Malcolm, 2002).

What is problematic is the fact that school-going learners from these socio-economic backgrounds, besides enduring appalling conditions at home, further experience another challenge in their teaching and learning contexts where schools are poorly built, overcrowded, with unqualified or under qualified teachers, no textbooks, electricity, Science laboratories, amongst others. Teaching relies mainly on the availability of textbooks and rote learning, whether the textbooks are relevant or perhaps up to date, that's another case.

Scientific concepts in such contexts are therefore learnt through cramming and memorization (Yager & Penick, 1990; Savage, 1995; Kyle, 1995a; Russell, 1993, p.212). This situation is congruent with the view of Hodgkinson (1994) who states that the "invisible" rural poor face particular challenges. If truth be told, learners in rural settings study Science under conditions that are not necessarily the same as their counter parts in urban areas; they are so poor to an extent that buying Science textbooks is difficult if not impossible.

The study conducted by TIMMS in 1994 and 1995 on Science achievement in the middle school years concurs that there is a strong positive relationship between Science achievement and having study aids in the home or at school, including a dictionary, computer, and a study desk/table for the students' own use (Beaton, Martin, Mullis, Gonzalez, Smith & Kelly, 1996). , Recent studies inform us that, out of nine provinces in South Africa, four have been identified as having rife poverty .These provinces are KwaZulu Natal, Eastern Cape, Mpumalanga and Limpopo (Nelson Mandela Foundation, 2005). KwaZulu Natal follows Eastern Cape and Limpopo in terms of poverty and rurality (HSRC, 2005). It has also been yet observed that matric pass rates in these provinces is comparatively lower compared to other provinces particularly in Maths and Science subjects.

Another body of research has disclosed that as late as 1986, the South African state spent nine times more on each white learner than it spent on learners in the worst off Bantustans, which were largely rural areas of the country (Department of Education, 2005). This evidence indicates that the policy of apartheid discriminated against certain racial

groups and this resulted in unequal education provision in terms of race and region. A precise depiction of these historically advantaged education centres is the fact that apart from being well established through discriminatory funding, their location also serves as a hallmark that deceptively shows the world where and how donations, subsidies; and other funds from outside donors and parastatals are fairly utilized, but only in those schools located in metropolitan settings.

Similarly, the comparative perspective on Education conducted in rural areas of China and South Africa revealed that resources are generally not fairly allocated between rural and urban areas, and most government expenditure gets invested in construction in urban areas which results in much better lifestyles and social support in urban areas than in rural areas (Gordon & Qiang, 2000; Ben Barka, 2005). Recently, the goals set by the latest government's Accelerated and Shared Growth Initiative (ASGISA) program of capacitating both public and private sectors have been intensely perceived to be at risk of being shattered by the smallest number of learners achieving well in Mathematics and Science subjects (Mail and Guardian, December 12, 2006).From my own perspective, the stigma of a few learners perceived as performing well in scarce subjects is exacerbated by the mere fact that a big percentage of potential Science achievers are rejected and marginalized learners from rural socio economic contexts .

When the then Minister of Education Naledi Pandor released her educational viewpoint, she admitted that rural families are very poor and schools are still poorly resourced in provinces that inherited large rural homelands, and their learners achieved worse by far (Department of Education, 2005). The Minister of Education then concluded her viewpoint by asserting that:

> *Learners scored best in town schools and (in descending order) less well in township, farm schools, rural and remote rural schools. In some tasks remote rural learners scored almost three times worse than urban learners.*
> *In fact the social and economic conditions at home have the strongest correlation with how well children learn. On average children from very poor families scored a third as well in language and mathematics and half as well in science as did children from very well off families. (*ANC TODAY, January 13-19 2006)

It is thus painfully clear that learning successfully is very unequally spread across the country, particularly in the historically disadvantaged and marginalized rural contexts.

## 2.3 ACHIEVEMENT OF LEARNERS IN SCIENCE IN RURAL CONTEXTS

Scholars in the field of research conducted in rural settings reveal that most of the studies conducted in Africa and abroad pertaining to the relationship between 'rurality' and performance of learners in Science were done across continents, involving both comparatively developed and undeveloped countries (Jegede, 1996). These research studies perceived poor performance in Science as linked to the economical position of a country. However, local contexts were less considered because most of the studies concentrated on large scale surveys.

## 2.4 STUDENT CHIEVEMENT IN SCIENCE GLOBALLY

The study done by Keeves and Dryden (1984) indicates that Science learners' achievement differs across societies. For instance, Japan and Thailand Science learners achieve best results owing to their insistence on practical work, enquiry-based methods of teaching and investigation of scientific problems, which is based on their societies. TIMMS (1999) results on assessment of Maths and Science performance of U.S. students found that eighty percent of grade 8 learners perform higher in Maths and Science owing to their access to computers and internet compared to their peers in other nations. TIMMS study (1999) further showed that countries like Japan, Singapore and Chinese Taipei are on top of the list in Science and Maths achievements with Chinese Taipei the leading country compared to less industrialised countries. South Africa out of 46 countries assessed by TIMMS came last.

Thomas, Sammons, Mortimore and Mees (1995) reminds us that socio-economic status has long been offered as a primary factor that contributes to differences in student academic achievement. Similarly, the study conducted by the Council of Educational Ministers in Canada agrees with Thomas, et al. (1995) who specifies that gaps in Science achievement is more pronounced in learners from low socio-economic status. This Canadian study reflects what Bourdieu refers to as legitimated educational failure of the underprivileged group. Wide spread socio-economic gap as Ishda, Muller and Ridge (1995) emphasise, exists not only in industrialised countries, but also in developing countries where it impacts negatively on learner's achievement.

The study conducted in Philippines analysing the outcomes in Maths and Science of 13 year olds showed that educational background of parents is an indicator of

students' achievement in Maths and Science. Students whose parents have college degrees have higher achievement in Science and Maths than those whose parents are illiterate. Akbuiro and Joshua (2004), after investigating self-concept, attitude and achievement of students in Maths and Science as their study in Nigeria, concluded that attitudes of learners in Science is linked to their underperformance. They continue arguing that society must play a role in developing a positive attitude of learners to Science subjects in order to enhance their level of achievement.

Another study conducted by Cuttance (1992) reveals that achievement in Science is significantly greater for students from more affluent home background when compared with students from poorer homes. The study also highlights the notion that power and wealth are prerequisites and contributors to learners' achievements. Learners from middle class backgrounds have a higher success rate than those from underprivileged backgrounds.

The United Nations Economic Commission for Africa (2003) argues that Science and Technology are the readiest means of empowering the poor that live below the threshold in Sub- Saharan Africa which is still growing in the 21'st century. The commission again raises the level of achievements in Science and Technology which is by far the most unacceptable compared to other developing countries.

The speech by Asmal (2003) on the South African matric results denoted that rural schools still lag behind in achievement in Maths and Science. According to Asmal this low achievement in Science is among other things attributed to poor socio-economic backgrounds and lack of substantial resources. The TIMMS studies conducted in South Africa in 1995, 1999 and 2003 show that there is a slight improvement in achievement of Maths and Science amongst South African schools. Such studies indicate that Science and Maths results need great attention.

## 2.5 SCIENCE ACHIEVEMENT IN THE SOUTH AFRICAN CONTEXT

The percentage of learners passing Science in our South African schools is scantily fluctuating if not merely declining. Current research studies specify that this problem is not spectacular in South Africa alone, but is a striking scourge prevailing amongst many other countries both locally and abroad, where it has also been observed that learners' interest in Science is dwindling with increasing rates of dropouts (Teppo

& Rannikmae, 2004) cited in Stears (2005). Secondly, South African pupils performed worst in Science in an international study conducted amongst standard 5 and 6 classes in 41 countries (Human Science Research Council (HSRC), 1996), Beaton, Martin, Mullis, Gonzalez, Smith and Kelly, 1996). This shocking performance was attributed, amongst others, to inadequate problem solving skills and Science curricula that was not in line with other participating countries since it covered only about 18% of the questions asked (HSRC, 1996).

Why did our South African Science curriculum deprive pupils of achieving in the TIMSS (1996) study? In responding to this question Linkson (1999) argues that the South African Science curriculum is based on Western culture and thus impacts negatively on student indigenous beliefs, and consequently affects levels of achievements. Relevant Science curriculum, as curricula scholars accentuate, must be fundamentally multicultural and produce scientifically literate people (Wallace & Louden, 1998; Davison & Miller, 1998; Zarry, 2002).

The study carried out by South African Institute of Race Relations (SAIRC) on the achievement of South African learners in Science and Mathematics disclosed that a drop from 19% to 17% in the Science pass rate was noticed in 1998 (Fast Facts, SAIRR, No 3, 1999), with the majority of those failing being overwhelmingly black (Abdi, 2001, p.237). This drop in Science is, according to McRae (1994), cited in Abdi (2001), the “brilliantly harvested” Verwoerdian apartheid end result which insisted that Mathematical sciences were to remain forever exclusive domains of achievement and subsequent advancement for white South Africans. The rate of performance in Science of learners in South Africa Science and Mathematics is at an alarming state.

## 2.6 OUT-OF-SCHOOL ISSUES

It is painfully clear that learning successfully is very unequally spread across the country. On some assessment tasks learners scored half as well on average in some provinces than in others. Families are very poor and schools are still poorly resourced in provinces that inherited large rural homelands, and their learners fared worse by far. Learners scored best in town schools and (in descending order) less well in township, farm schools, rural and remote rural schools. In some tasks remote rural learners scored almost three times worse than urban learners. Learners’ home circumstances seem to have strongly

influenced their performance in all three learning areas. In fact, the social and economic conditions at home have the strongest correlation with how well children learn. On average children from very poor families scored a third as well in Language and Mathematics and half as well in Science as did children from very well off families.

Poor households are unable to afford books, radios and television, and children who have access to these media of information and stimulation at home generally performed better on their assessment tasks. A relatively large proportion of parents in the sample reported that their children stayed home from time to time when they were unable to pay school fees, and such children scored significantly lower on the three assessment tasks. By contrast learners performed better whose parents or guardians were able to pay school fees, were themselves educated, took an interest in their children's schoolwork and participated in school activities.

## 2.7 IN-SCHOOL ISSUES

Literature reveals that South Africa even in the post-apartheid era has a 40 % poor population and another 20% of ultra-poor (Malcolm & Keane, 2003). Such statistics locate South Africa on the list of poor countries in Africa and abroad. Educational systems in such poor countries always suffers the consequences since its functionality and prosperity lies entirely on the economic stance of a country. It is again a common trend that a poor economic position of a country impacts negatively on the academic achievement of school going learners and subsequently blemishes the entire educational system of that country.

Poor countries with poor educational systems lack wealth and power and they are usually dominated by other countries who are dominantly rich and powerful, who in turn transmit their cultural beliefs onto the poor and less privileged and decide what knowledge should be taught in their educational systems. Such cases have been witnessed throughout the African continent where in some countries indigenous people lost their culture and language to practice Muslim culture and speak Arabic languages instead of Swahili, accepted western civilization and Christianity instead of burning incense and slaughter animals to communicate with God via ancestral spirits and snakes(serpents ).

Malcolm and Alant (2004) reminds us that the South African population is basically poor and rural, living in villages where learners travel long distances to schools which are under resourced and have either unqualified or under qualified teachers. I have personally witnessed these appalling conditions since I started teaching in deep rural areas of KwaZulu-Natal at Mthwalume circuit for the past 14 years. The Province of KwaZulu-Natal follows Eastern Cape and Limpopo in terms of poverty and rurality (HSRC, 2005). Matric pass rates in these provinces is comparatively lower compared to other provinces particularly in Maths and Science subjects.

Although some rural schools in KwaZulu Natal perform well in Science, a large percentage still achieve poorly in Science compared to their counterparts in urban areas. Considering Mthwalume circuit which is located in the rural area of Kwazulu Natal near the town of Port Shepstone, this circuit stretches from the coastal belt of Hibberdene to the undulating sugar cane valleys of Highflats. Learners in this circuit study Science under conditions where there is no electricity, laboratories and well facilitated classrooms, not to mention computers and audio-visual materials to enhance their learning. Their socio-economic background is so poor to the extent that affording to buy a Science text book is difficult if not impossible.

The poor socio-economic background of Science learners is, among other things attributed to the high unemployment rate and low level of literacy. Malcolm (2003) perceives South Africa as the most unequal country in the world owing to its failure to provide citizens with democratic freedom, material well-being, affordable and accessible education and well established schools-based curricula that will enable learners to achieve successfully both at school and tertiary levels .

It is therefore this inequality in cultural capital coupled with poor socio-economic background of Science learners that I propose is linked to the difference in achievement in the TIMMS Grade 8 Science test amongst rural secondary schools of Umthwalume circuit.

## 2.8 THEORETICAL FRAMEWORK: BOURDIEU'S CULTURAL CAPITAL THEORY

Lack of wealth, power, infrastructure, under-resourced schools, employment opportunities are, from our South African context, and in most other foreign countries, the unquestionable challenges associated with rural societies since the apartheid era (Cross & Chisholm, 1990; Hartshorne, 1992; Murphy, 1992; Mandela, 1994; Kallaway, 1999; Ash, 1997; Hugo, 1998; Abdi, 2001). These challenges do not only symbolize rural contexts but, are also some of the perceived dominant features noticed amongst the multiple definitions of 'rurality' (Arnold, Newman, Gaddy & Dean, 2005; NCRECL, 2000; HSRC, 2002; U.S. Department of Health and Human Services, 2004). Furthermore, they serve as a dividing line between rural and urban societies, and between working class and middle class, even in the post-apartheid era of equity and non-racism. These challenges have surprisingly became the reference norms and an acceptable criteria fitting enough to identify rural inhabitants amid other social classes.

Bourdieu (1977) perceives ownership of wealth, power and high cultural status as "cultural capital" which is possessed by middle class groups in society which in turn distinguishes them from working class that faces many social challenges. Bourdieu (1977) reminds us that the major role of educational systems is the reproduction of power relationships and privilege between social classes where social inequality is reproduced and legitimated.

Pierre Bourdieu's (1977) theory of cultural reproduction and social reproduction is used to frame the study. Bourdieu (1977) introduces the notion of habitus and symbolic violence. Bourdieu (1977) sees habitus as the key reproduction mechanism because it is what actually generates the regular practises that make up social life. Symbolic violence means that people come to experience systems of meaning (culture) as legitimate. In other words, working class children see dominant culture as legitimate and that their middle class peers have more success in the educational systems based on their objective performance.

Bourdieu proclaims that the major role of educational systems is the reproduction of power relationships and privilege between social classes. Social inequality is reproduced and legitimated. Underprivileged positions of the lower classes is legitimated by educational failure while privileged positions of the dominant classes are justified by educational success. The educational system maintains the power of the dominant classes

through its presentation as a neutral body attached to equal opportunity for all policy and lastly Bourdieu admittedly confesses that education practically is concerned with reproduction of the established order.

The origin of Bourdieu's socio-cultural theory, which focuses on 'cultural capital', dates back to the mid 1960's in France (Paris). It was fundamentally derived from a Marxist perspective of social economies and ideologies. Bourdieu's cultural capital emanates from the existence of a dominant group in society who have power, wealth and high cultural status. This dominant group in society has the power to define what knowledge should be taught in educational systems. In a school where classroom knowledge is largely based upon knowledge of the dominant group, teaching and learning will obviously favour the children of the dominant group and discriminate against those from the lower social strata. The dominant group has the ability to establish their culture as the basis of knowledge in an educational system and its culture should be sought and possessed.

The result of this unequal cultural status at school is only, according to Bourdieu (1977), the transmission of culture of the high privileged group instead of reproduction of the culture of the whole society. It is therefore this dominant culture or the culture of privilege that Bourdieu calls 'cultural capital'. Bourdieu sees cultural capital as standing supreme amongst the other types of capitals, such as human, social and financial.

Echoing, Bourdieu's idea is Wong (1998), who argues that schools are not socially neutral institutions. Their apparently neutral academic standards, argues Wong, are burdened or laden with specific cultural resources. Wong (1998) in his study of families in Czechoslovakia sees family capital as being constituted by the following four aspects: social, financial, human and cultural capital. He argues that family lifestyle and consumption patterns are cultural sources for children's cultural formation, which in turn, provides valuable educational resources that foster children's motivation to learn and enhance their academic performance.

I therefore selected Bourdieu's theory due to the fact that it accommodates social issues, economical stance and educational related variables which have a precise link to my research focus.

## 2.9 CONCLUSION

This chapter looked at the challenges faced by poor rural communities and how these challenges affect school-going learners from these environments. The chapter further explored some literature that attempts to explain how Science learners from these backgrounds are affected by poor conditions of the rural context. It then explored how those rural Science learners achieve in Science tests in comparison to their counterparts min well-resourced urban schools. Science learners' achievements in the same tests internationally and locally was then explored with the aim of identifying differences in levels of achievement.
Out of school and in school issues in the South African context were also investigated in order to have a clearer picture of how these issues affect Science performance.

The chapter concluded by proposing Bourdieus' idea of *cultural capital* as a theoretical framework guiding the study. This chapter looked at the challenges faced by poor rural communities and how these challenges affect school-going learners from these environments. The chapter further explored some literature that attempts to explain how Science learners from these backgrounds are affected by poor conditions of the rural context. It then explored how those rural Science learners achieve in Science tests in comparison to their counterparts in well-resourced urban schools. Science learners' achievements in the same tests internationally and locally was then explored with the aim of identifying differences in levels of achievement.
Out of school and in school issues in the South African context were also investigated in order to have a clearer picture of how these issues affect Science performance.

The chapter concluded by proposing Bourdieus' idea of *cultural capital* as a theoretical framework guiding the study.

# CHAPTER 3
# RESEARCH METHODOLOGY

This chapter provides an overview of the research process. It describes and justifies the research methodology to denote its appropriateness. It addresses the critical research questions for the study, as well as the selection of the data collection instruments efficient enough to yield both suitable qualitative and quantitative data for the study. The research design, procedures for gaining access and acceptance, type of samples used, data analysis and concerns for validity, are the focal areas of discussion.

## 3.1 PUPOSE OF THE STUDY

This exploratory study addresses the following critical research questions:

1. What is the difference in achievement amongst KZN schools in the TIMSS Grade 8 Science test, with particular reference to rural secondary schools?
2. How do researchers and policy makers explain/make sense of the relationship between learners' achievements in the TIMSS Grade 8 Science test and their socio-cultural economic background?

## 3.2 METHODOLOGICAL APPROACH

An exploration of the plethora of literature based on research methodology was undertaken in line with the focus of the study and critical research questions, to find an appropriate methodology for pursuing the study. After gleaning through the literature, I realized that the direction and epistemological stance of my critical research questions locate and confine the study to meta-analysis as a methodology to guide this exploratory study, derived from the scholarships of Glass (1976, p.3) and Glass (2000, p.2), Fitz-Gibbon (1985), Catts (1992), Wilson (1999), Lipsey and Wilson (2001); Berman and Carter (2002; De Coster (2004); Leandro (2005) and Neill ( 2006).

According to Glass (1976, p.3 and 2000, p.2), the only originator of meta-analysis in educational research was towards the late seventies. Meta-analysis is the statistical analysis of a large collection of analysis results from individual studies for the purpose of integrating the findings. However, some scholars in the field of educational

research, when supplementing to the understanding of meta-analysis, comprehend it as a method of synthesising, summarizing and reviewing previous research results (Fitz-Gibbon, 1985; Catts, 1992; Berman & Carter, 2002; DeCoster, 2005; Leandro, 2005 & Neill, 2006).

Owing to meta-analysis's defining role in statistical analysing, synthesizing and summarizing previous research results, it then opens a space for this study to explore, through semi structured interviews, a probe and secondary sources the role that cultural capital plays in the difference in achievements in TIMMS Grade 8 science test amongst the rural secondary schools of KwaZulu- Natal.

The study aims basically to identify the cultural variables that are associated with successful achievement in Science in rural socio economic contexts as perceived by different stakeholders in KwaZulu-Natal.

The study combines both qualitative and quantitative methods to collect data. Through probe and semi structured interviews as qualitative data collection sources of the study, I intended to acknowledge the link that is often alluded to between socio economic status and achievement in rural secondary schools. In other words I wanted to enquire through the use of semi structured interviews and probing how poor socioeconomic backgrounds of rural science learners relate to the low achievements in Science subjects.

I also intended to unveil the history of the schools in KwaZulu-Natal reflecting activities pertinent to their cultural and socio economic contexts; performance in Science subjects; challenges facing rural schools and how they have been neglected since the apartheid era. Labuschagne (2003, p.2) asserts that qualitative data present profundity and detail through direct quotations and careful description of situations, proceedings, interactions and observed behaviours.

Secondary sources that comprise statistical analysis of TIMMS Grade 8 Science results collected in 1995, 1999 and 2003 by the Human Science Research Council (HSRC) statistically denoting and informing how schools, particularly those in rural socio economic contexts, have achieved in Science subjects, and was utilized as quantitative data. Secondary data is, according to Kumar (2005) the data that has already been collected by someone else and only the required information is extracted for the purpose of pursuing one's study. Merriam (1998, p.22) reminds us that the

reason for combining both qualitative and quantitative methods is in fact a form of triangulation that enhances the validity of one's study.

The textual facts procured through semi structured interviews and probe from the researchers and policymakers to yield qualitative data, therefore assists in reflecting the events, challenges and forces that have affected and at the same time shaped the rural society, in terms of socio economical and educational status, culture and power of social groups. Hence the profile of the conditions under which rural learners, compared to their urban counterparts, perform and learn Science at schools, particularly those situated in rural socio economic contexts is explicitly depicted.

Reddy (2006, p.117) discloses, from the findings of the TIMSS 2003 study, that low performance standards in Science and Mathematics of South African learners is attributed to a combination of several factors acting together within particular social, economic, historical and cultural contexts. Testifying with Reddy's findings is the theory of social reproduction of Bourdieu (1973), who reminds us that maintenance of unequal social structures, privilege and power relations are centred on or promoted by our educational systems which legitimates cultural heritage of the dominant class in society.

Pope; Ziebland and Mays (2000, p.114-116), when supplementing to the crucial role of the study instruments, argue that transcribed recordings of semi structured interviews or focus groups or verbatim notes which provide a descriptive record of the research can produce vast amounts of required data in the qualitative research domain. The same goes with probe which, according to Wikipedia encyclopaedia, is comprehended as an exploratory action or expedition that is specially designed to investigate and obtain information on a remote and unknown region.

My 16 years' experience teaching Science and Mathematics at rural schools has taught me that the magnitude of challenges in our South African rural school's context is explicitly visible and defined when one dissects the problems facing school learners in rural areas like, unemployed parents, low income jobs, lack of Science resources, no laboratory, long distances from schools, to mention but a few. Testifying to this assertion is the scholarship of Malcolm and Alant (2004) when alerting us that the South African population is basically poor and rural, living in villages where learners travel long distances to schools which are under-resourced and have either unqualified or under qualified teachers.

I have also observed that most research carried out in rural areas have studied rural problems merely through an economic lens which in certain instances are blurred by politically motivated issues such as malfunctioning of a certain political party whose stronghold is in rural areas. Hence problems faced by historically disadvantaged rural communities at large and school going Science learners in particular end up partially addressed if not completely rejected. This scourge subsequently diverts the meaning of rurality by defining it only in terms of poverty and rejection, where rural inhabitants had to suffer the worst and rural school learners had to climb the steepest gradient to pass the matriculation gate that doesn't consider whether the learner is from the disadvantaged rural area or advantaged well-resourced urban school.

Given the above scenario, Bourdieu (1973) argues that the major role of the educational system is the reproduction of the power relationship and privilege between social classes, wherein social inequality is reproduced and legitimated. The underprivileged position of the lower classes Bourdieu argues, is legitimated by educational failure while privileged positions of the dominant classes are justified by educational success. The latter argument is again congruent with the perception of Howie, Scherman and Venter (2006, p.4) when asserting that the South African education system is marked by underachievement of pupils at each level of the system where poor communities, particularly those of rural Africans, feel the atrocities of the past inequalities that are continuously revealed in yearly matric results.

Hence the focus of this study seeks to explore the nature of the relationship between socio economic background and performance of Science learners in rural secondary schools of KwaZulu-Natal. The first meta-analysis was performed by Karl Pearson in 1904, when trying to overcome the problem of reduced statistical power in studies with small sample sizes (Sutton, Jones, Abrams, Sheldons & Song, 2000). From that attempt, and many others that produced positive, null and negative results (Lipsey & Wilson, 2001), meta- analysis was popularly used in epidemiology and evidence – based medicine ever since. In that scholarly journey Sutton, *et al* (2000), reveal that meta-analysis was subsequently introduced for the first time in educational research by Gene V Glass in the late seventies.

However, some other studies disclose that Gene V Glass first used the term "meta- analysis" in 1976 to refer to a philosophy, not a statistical technique. In that sense Glass argued that literature review should be as organized as a primary research

and should interpret the results of individual studies with an aim of distributing findings, partly determined by study characteristics and to some extent random (Bangert-Browns & Rudner, 1991).

Wilson (1999. p6), from his version of practical meta-analysis, pronounces that comparison of abilities between boys and girls, association between variables, experimentally created groups like comparisons of outcomes between treatment and comparisons groups are, among others the forms of research findings suitable to meta-analysis. On the other hand, Lipsey and Wilson (2001, p.1) understand meta-analysis as a form of survey research in which research reports, rather than people, are surveyed. They proclaim that a survey protocol is developed where a population of research is assembled, and each research study is interviewed by a coder who reads it carefully and codes the appropriate information about its characteristics and quantitative findings. The resulting data is then analysed using special adaptations of conventional statistical techniques to investigate and describe the pattern of findings in the selected set of studies (Glass, McGraw & Smith, 1981, p.21 and Lipsey & Wilson, 2001, p.2).

In addition, meta–analysis is considered as one of many ways to summarize, integrate and interpret selected sets of scholarly works in various disciplines, but with limited area of applicability. In that regard Lipsey and Wilson (2001, p.2-3) declare meta-analysis as only applicable to empirical research studies; to research studies that produce quantitative findings and encode and scrutinize the statistics that summarize research findings as they are normally presented in research reports. Because meta-analysis focuses on the aggregation and comparison of the findings of different research studies, it is, according to Lipsey and Wilson (2001) recommended that findings are meaningfully comparable. This means that the findings must be conceptually equivalent i.e. deal with the same constructs and relationships and be configured in similar statistical forms. When referring to contemporary quantitative research publications, scholars in educational research inform us that meta-analysis was fundamentally brought in as a method for combining research results by examining the effects of variables in terms of the “Effect Size”, i.e. in terms of how much difference they make, rather than only in terms on whether or not the effects are statistically significant at some (frequently arbitrary) level such as 0, 05 (Fitz-Gibbon, 1985, p.4 and Neill, 2006).

The rationale for such undertaking was, according to Rudner, Glass, Evartt and Emery (2002), the exponential rate at which research literature was growing; hence it

was difficult to understand what the research results tell and how to acquire knowledge from that flood of information. Arguing the same line with Rudner, *et.al* (2002), is the scholarship of De Coster (2004, p.2) who asserts that, traditionally, when reviewers wanted to make deductions about the results of a set of studies, they had to use vaguely defined, qualitative methods such as narrative reviews, which were flawed and inexact. These methods were unable to deal with large numbers of studies in a topic; conclusions of previous reviews were often cited without examining them critically and reviewers were unable to give full weight to evidence that is dissimilar to their own positions (Glass, Evartt & Emery, 2002).

Since its introduction almost 30 years ago (Glass, 1976), meta-analysis has strongly influenced research in many fields of Social Sciences. It has become the accepted standard for summarizing research in many fields because of its emphasis on objective observation, and its openness to critical evaluation. Moreover, it provides the means to investigate new research question types such as how the strength of an effect relates to the setting in which it was investigated (De Coster, 2004, p.3). As knowledge of the meta- analytic techniques has become widespread, argues DeCoster (2004, p.4), it is more common to see researchers using simple meta-analytic summaries within primary research papers. In this regard, meta-analysis sustains specific theoretical statements, mostly about the whole vigour or consistency of a relationship within the studies being conducted.

De Coster (2004), acknowledges that meta-analysis is by far most commonly used in quantitative research and, a number of research studies have grown to be accurately synthesized by a human without the aid of statistical inferences. Tobin and Kincheloe (2006, p.315), when viewing meta-analysis across the spectrum of qualitative research, argue that it (MA) demonstrates the investigation of how the existing analysis is reproduced. They further regard meta-analysis as a viable tool in determining what has been left out and taken account of, as well as the justifications for such decisions.

Catts (1992, p.9) proclaims that meta- analysis relies upon data from quantitative research, and thus excludes qualitative research from the data analysis phase. It may however, offer the link between the two approaches by examining the effects of social, cultural, and political factors identified in qualitative research, across a body of quantitative literature(Catts (1992, p.9). To investigate social and political differences between studies, Catts recommends the meta-analyst must first set up a theoretical

frame which draws on qualitative and quantitative research to identify relevant variables.

Though some research scholars criticise the success of meta- analysis in the qualitative research domain for obscuring important qualitative information through averaging simple numerical descriptions across studies, others realize the importance of mutual support between qualitative and quantitative work which occurs fittingly when quantitative analysis support experiential data (Bangert-Drowns & Rudner 1991, p.49).

What is advantageous about meta-analysis is, according to Lipsey and Wilson (2001, p.5) the fact that its dealings enforce a useful discipline on the process of summarizing research findings. Meta-analysis represents key study findings in a manner that is more differentiated and sophisticated than conventional review procedures that rely on qualitative summaries or vote counting and statistical significance. Meta-analysis provides an organized way of handling information from a large number of study findings under review (Lipsey & Wilson 2001, p.6)

Contrary to the goodness of meta-analysis, are the weaknesses or disadvantages that are highlighted by Wilson (1999, p.12) who argues that meta-analysis needs a good deal of effort and, sometimes mechanical aspects don't lend themselves to capturing more qualitative distinctions between studies. Since earlier research studies done by the Human Science Research Council in South Africa, concerning science and maths achievements, will be used as a secondary sources that yield quantitative data in enriching and strengthening the study, the image depicting the difference in science achievements amongst KZN schools in general, and rural socio economic contexts in particular will therefore emerge. Thorne (1994) recommends that the use of secondary sources should be accompanied by consultation with the primary researchers through interviews in order to obtain additional data or to pursue in a more controlled way the findings emerging from initial analysis. In abiding with Thorne's recommendation an interview with HSRC researchers was conducted in order to investigate the circumstances of the original data generation and processing. Such recommendation emanates from the difficulty usually encountered by a secondary analyst if he/she is not an experienced researcher and was also not part of the original research team (Heaton 1998). This is because the data may be small, simple, micro level and has been preformatted for use with a particular statistical package such as SPSS, SAS or STATA (Haley 2003). The nature of these secondary data sources I will use in this investigation

comprises of the lists of all the KZN schools that were samples of the Human Science Research Council's study and, indicate how these schools have achieved in TIMMS Grade 8 Science test.

However, the researcher is warned to assure that the secondary data chosen appropriately address the research question to avoid the dilemma of being caught altering the hypothesis in order to fit the data (Haley, 2003). Such an alert is drawn from a notion that using data from secondary sources may be disadvantageous in terms of validity and reliability of information which may vary remarkably from source to source, data may contain personal bias, data may be unavailable and formatted in such a way that it does not suit the requirements of the study. (Kumar 2005).

I selected schools from poor socio economic backgrounds and analysed their results in comparison with other schools whose cultural and socioeconomic statuses and, whose performance in Science subjects and geographical location differs from that of rural contexts. Analysis of secondary data is the use of existing data collected for the purposes of a prior study, in order to pursue a research interest which is distinct from that of the original work; this may be a new research question or an alternative perspective on the original question (Hinds, Vogel & Clarke-Stephen 1997; Szabo & Strang 1997), cited in Heaton (1998). By so doing I will be attempting to determine why rural learners from poor socioeconomic background perform differently in Science compared to their counterparts from advantaged backgrounds. In fact, I want to determine whether poor socio-economic background as an independent variable links to achievement or performance (dependent variable) in Science amongst learners from rural areas.

Lipsey and Wilson (2001, p.15) recommends that the research findings of this sort, where there is an association of variables, might be reported as a correlation coefficient or as some index of association derived from a cross tabulation of the variables, e.g., a chi square coefficient, odd ratio, or the like. Haley (2003) agrees with this proposal when regarding secondary data research as seeking to replicate analyses already carried out by primary researchers in order to verify, extend, or to elaborate upon original results, or to analyse the data from an entirely different perspective.

The study is again toned up by the TIMMS's achievement results in Science which shows that South Africa performed poorly by achieving the least scores, respectively in the 1995; 1999 and 2003 studies (HSRC, 2005; Reddy, 2006, p.45).

Scholars attribute these poor performances to an incompetent educational system, among others, when compared to the best performing countries internationally, which is exacerbated by insufficiency of both human and physical resources, particularly in poor rural environments (Howie, 1997, p.54; Mabogoane, 2004, cited in Howe, Scherman & Venter, 2006, p.4).

Relating to the above background, Bourdieu (1977) proclaims that educational systems, instead of pursuing the fair gospel of pedagogy in policy and practice, promotes a system that fails the pupils of the working class in tests and examination because they lack the dominant culture and this subsequently prevents learners from the working class to enter into institutions of higher education. In this regard, the educational performance of social groups, says Bourdieu, is therefore directly related to and ultimately determined, by the amount of 'cultural capital' they possess.

It is therefore within this setting that meta-analysis has been adopted as a methodology with a clear landscape to explore the role that 'cultural capital' plays in the difference in achievement in the TIMMS Grade 8 Science test amongst rural secondary schools of KwaZulu -Natal.

## 3.3 DATA COLLECTION STRATEGY

The methodological approaches, as mentioned earlier on, employed in this research study are qualitative and quantitative approaches. These approaches were chosen as a result of the type and quality of data needed for the study, as well as the nature and epistemological stance of the critical research questions. Qualitative approach is meant to collect data that will generate qualitative statements needed to answer critical research questions. Such qualitative statements should yield data on the understandings of researchers and policy makers about the difference in achievement amongst KZN schools in rural socio-economic contexts in the TIMSS Grade 8 Science test, and what cultural variables are perceived by these stakeholders as important in Science achievement.

On the other hand a quantitative approach used secondary sources to collect quantitative data that will be extracted from Human Science Research Council's recent TIMSS studies that were conducted amongst KZN secondary schools. This statistical data was utilised to determine how schools from rural socio-economic context achieve in TIMMS Grade 8 Science tests compared to other schools in urban areas. Subsequent,

the statistical data was used to conclude whether poor cultural capital as the independent variable impact on the achievement in Science tests (dependent variable) of learners from rural socio-economic contexts.

These variables were measured on an ordinal or ranking scale in order to get precise relationships between cause-and -effect. Ordinal or ranking scale is, according to Smith (1991, p.72) the scale that measures variables by categorising individuals, responses, objects or properties into subgroups on the basis of a common characteristic, and these subgroups are ranked in a certain order that reflects the magnitude of variation in the variable, for examples, socio-economic status (upper, middle, low) or achievements (above average, average, below average). Kumar (2005) enunciates that variables are important in bringing clarity and specificity to the understanding of a research problem, to the formulation of the hypotheses and to the development of a research instrument.

The data generated through these approaches will have a strong influence on the selection of the data collection instruments that was used in this research study. Data collection instruments include semi structured interviews which was the first instrument to be distributed to the target group followed by probe and lastly secondary sources.

The use of the combination of different data collection instruments to answer critical research questions is commonly used by qualitative researchers because they make the researchers confident about the findings of an investigation (Cohen & Manion, 1994). This multiple data collection strategy is again recommended by Denzin (1978) as another form of methodological triangulation, and also by Patton (1987) as assisting to build checks and balances into the research design so that the strength and rigour of the evaluation is enhanced. Mertens (1998) explains methodological triangulation as checking information that has been gathered from various sources or methods for consistency of evidence across sources of data; hence the use of multiple data collection instruments in this investigation will, in abundance, yield data that should be checked of any irrelevant and unnecessary aspects that may eradicate evidence consistency.

As it has been mentioned earlier on that the target groups that were the sources of data for this study are researchers and policy makers, so this means that my investigation, after satisfying certain ethical and administrative obligations to gain access and acceptance, pursued into educational settings.

## 3.4 ACCESS AND ACCEPTENCE

After receiving an ethical letter of consent from my institution I sent it to the offices of Human Science Research Council for permission to interview researchers. Arrangements to access secondary sources and meeting researchers at HSRC for consultation and accessing data had to be done following certain procedures because HSRC is a Non –Government Organisation that works on an independent capacity. Though there was a delay from researchers owing to their busy schedules and research related activities, I eventually obtained an informed consent to interview them. Maruyana and Deno (1992) warns that identification of appropriate persons who have the power to grant access is a complex issue in itself, and researchers should consider complications that may be stumbling blocks to sampling.

Similarly, Bell (1993, p.52), cited in Hopkins (1989), advises that prior arrangements to procure permission for an investigation must be done at an early stage by making a formal written approach to the concerned individuals and organisations, outlining your plans. My letter of consent was therefore structured in such a way that it seeked permission from all the potential participants of the study and also outlined what is expected from their participation. This is congruent with the argument by Schinke and Gilchrist when they write:

*Under standards set by the National Commission for the Protection of Human Subjects all informed -consent procedures must meet three criteria: participants must be competent to give consent; sufficient information must be provided to allow for reasoned decision; and consent must be voluntary and uncoerced. (1993, p.83)*

The sample of this study which are researchers and policymakers were chosen consistent with the research methodology and, considering again data collection instruments chosen that would possibly not limit access to the sample.

## 3.5 SAMPLE

Accessing secondary sources and records from HSRC as a sample for this study nourished it because statistical data from these sources was compared to the data that had been collected from semi structured interviews and probe to substantiate whether poor socio-economic background relates to rural learners' achievement in Science. Hedrick et al. (1993) suggests that researchers sample the desired records on a pilot

basis to ensure that the records contain information required for the study and that they are appropriately organized for the research study. Such suggestion emanates from the fact that records and sources may not contain substantial data for the study, may not be centralized to researcher's location and sometimes confidential in the sense that they contain names of people, and thus, organizations may reserve the right to accessing them.

## 3.6 DATA COLLECTION

Having specified earlier on that the data collection instruments for this investigation were probe and interviews protocols, utilized respectively in order to respond to the critical questions, to get consistent evidence and a clear pattern of the collected data.

### 3.6.1 Critical Question 1

What is the difference in achievement amongst KZN schools in the TIMSS Grade 8 Science test, with particular reference to rural schools?

The data set for this question was provided by the secondary sources from HSRC. This data comprises statistical analyses of TIMSS Grade 8 results in Science collected in 1995, 1999 and 2003 in South Africa.

### 3.6.2 Critical Question 2

How do researchers and policy makers explain/make sense of the relationship between learners' achievements in the TIMSS Grade 8 Science test and their socio-cultural economic background?

The data for this question was collected through probing. This means that the respondents were provided with the version of the researched body of information which was used as a point of reference when responding to the critical research question. The following statement was used to probe:

*According to Sara Howie the following factors have been identified to have a link in learners' achievements in science in the TIMSS studies*.

They are:

- the home environment

- general school environment
- quality of teachers and teaching
- peer environment
- gender factors
- homework
- language of instruction
- curricula
- student motivation

What do you think?

### 3.6.3 Data source 2: interviews

Semi-structured interviews were employed. Researchers and policymakers were interviewed individually at their offices. They were interviewed once to determine their perceptions of the nature of the relationship between socio-economic background and performance of Science learners.

I chose individual interviews as opposed to group interviews because group interviews have a tendency of being dominated by some members of the group and leave others looking like observers. These interviews are semi-structured and were recorded on a tape recorder. Individual interviews encourage the subject to talk in the area of interest and the researcher has the chance to probe more deeply, picking up on the issues and the topics that respondents initiate.

## 3.7 DATA ANALYSIS

Data analysis is the organization of collected data, after it (raw data) has been edited and coded, into convenient, logical patterns which will reflect valid interpretations and findings (Kumar, 2005; Glaser & Straus in Hopkins, 1989). The patterns of the data collected through questionnaires, stories and interviews as well as secondary sources was sought and linked to critical research questions by means of content analysis. At this stage data was triangulated from semi structured interviews and probe, and was verified in terms of relevancy and contextual meaning to the study.

Analysis of quantitative statistical data from secondary sources was carried out by means of cross tabulations where poor socio-economic background as an independent variable and achievement in Science as a dependent variable was evaluated to determine whether there is a relationship between them. Such analysis may be done manually or by using computer programs like SPSS and SAS (Kumar, 2005). Since there were a few variables to analyse, I preferred using manual analysis by simply coding data directly onto large graph paper in columns in the same way as I would enter it into a computer.

## 3.8 LIMITATIONS

This study involves document analysis of the already researched body of information, so limitation in terms of time constraints were encountered when trying to reach primary researchers for consultation and further clarification of the data, since the participants needed prior arrangements in order to meet them.

Thorne (1994, p.76) recommends that the use of document analysis should be accompanied by consultation with the primary researchers through interviews in order to obtain additional data or to pursue in a more controlled way the findings emerging from the initial analysis.

Secondly the data may be irrelevant, invalid and outdated and sometimes biased. Such an alert is drawn from a notion that using document analysis may be disadvantageous in terms of validity and reliability of information which may vary remarkably from source to source ; data may contain personal bias ; data may be unavailable and formatted in such a way that it does not suit requirements of the study.(Kumar 2005, p.82).

Thirdly policymakers and researchers are in most cases inaccessible due to their busy schedules and geographical location; this may delay the time frame of the study.

## 3.9 CONCLUSION

This chapter presented the research methodology used to guide the study which is apposite enough to answer the critical research question. The research instrument selected to collect qualitative data are semi structured interviews, probe and secondary sources. While the quantitative data was generated through document analysis of the TIMSS 1995, 1999 and 2003 tests and reports.

The data collection strategy was discussed and means to analyse and interpret the generated data was also presented. Access to the participants of the study was conducted as per research requirements including ethical issues. Validly and reliability of the study was also discussed along the line of study trustworthiness and credibility. The chapter concluded by discussing limitations of the study with regards to inaccessibility and authenticity of the collected data.

The next chapter deals with data analysis, discussion and presentation with critical research questions as underlying guidelines.

# CHAPTER 4
# PRESENTATION OF FINDINGS OF RESEARCH QUESTION 1

This chapter addresses the first research question which sought to explore: *the difference in achievement amongst KZN schools in the TIMSS Grade 8 Science test, with particular reference to rural secondary schools.* The data was first generated through document analysis of secondary sources that comprised statistical analysis of TIMSS Grade 8 Science results collected in 1995, 1999 and 2003 by the Human Science Research Council (HSRC).Due to the failure to get direct answers with regard to this research question, it was decided, we rather focus on *how grade 8 students performed in the TIMSS Science tests internationally (1995-2003)* and then focus on the South African grade 8 students' national performance, foregrounding the rural provinces' performance.

## 4.1 BRIEF BACKGROUND TO TIMMS 1993, 1995 AND 2003

The largest studies conducted thus far, after and under the auspices of IEA's, were by TIMSS in 1995, 1999 and 2003, where forty-five international countries, including South Africa participated in the first TIMSS study of 1995 (HSRC, 2005). TIMSS 1995 focused basically on how grade eight students learn Science and achieve in Science tests by considering home, school and national contexts as relevant background factors within which education takes place (Beaton, et al, and 1996b).

**Table 4.1: Trends in science achievements from 1995 to 2003)**

| Year | 1995 | 1999 | 2003 |
|---|---|---|---|
| Position of South Africa | 45/45 | 38/38 | 50/50 |
| Best average performance | 580 (Singapore) | 569 (Chinese Taipei) | 578 9Singapore) |
| International average | 518 | 521 | 474 |
| South African score | 244 | 243 | 244 |

A second round of TIMSS 1999 Science study revealed that South Africa together with Morocco and Tunisia were the only three participating countries on the continent of Africa together with 38 other international countries at the grade 8 level. They all scored below the international mean score of 488 points in Science where South Africa again came last with 243 points (HSRC and Reddy, 2006).

The third round of TIMSS 2003 study comprised of 50 countries including five African countries:-Botswana, Egypt, Tunisia, Morocco, Ghana and South Africa that participated. These African countries all fell beneath the international mean score of 474, and for the third time South Africa sadly achieved 244 points which made it the 50$^{th}$ least performed country both internationally and regionally (Martin, et al, 2004; Reddy, 2005).

The table below indicates the performance of South Africa in relation to other African countries that participated in TIMSS 1995 TO 2003

**Table 4.2: SA's performance in relation to other African countries from 1995 to 2003)**

| | **1995** | **1999** | **2003** |
|---|---|---|---|
| Egypt | X | X | **421** |
| Tunisia | X | **430** | **404** |
| Morocco | X | **323** | **396** |
| Botswana | X | X | **365** |
| Ghana | X | X | **255** |
| South Africa | **244** | **243** | **244** |

TIMSS Science tests that covered six content dimensions (Earth Science, Life Science, Physics, Chemistry and environmental issues and the nature of Science) were given to middle school students from which all question types were generated. Special emphasis was placed on the eighth grade results including selected information about students' background experiences and teachers' classrooms practices in Science (Beaton, et al, 1996b).The table below shows different content subjects that were offered in TIMSS1995; 1999 and 2003.

**Table 4.3: Content areas explored in TIMSS 1995 to 2003**

| Content Area | 1995 | 1999 | 2003 |
|---|---|---|---|
| Earth Science | ✓ | ✓ | ✓ |
| Life Science | ✓ | ✓ | ✓ |
| Physics | ✓ | ✓ | ✓ |
| Chemistry and environmental issues | ✓ | ✓ | ✓ |
| Nature of science | ✓ | ✓ | ✓ |
| Scientific enquiry and the nature of science | **X** | ✓ | **X** |

## 4.2 RESEARCH QUESTION 1 : WHAT IS THE DIFFERENCE THE TIMMS GRADE 8 SCIENCE TEST, WITH PARTICULAR REFERENCE TO RURAL SECONDARY SCHOOLS

**Old Research Question 1: What is the difference in achievement amongst KZN schools in the TIMSS Grade 8 Science test, with particular reference to rural secondary schools?**

**New Research Question 1: How did grade 8 students perform in the TIMSS Grade 8 Science tests (1995-2003)?**

The quantitative data on the old research question was insufficient since the names of the schools that participated in the study were not available owing to confidentiality and ethical related issues. Their performance in the form of statistics as required by the study was also not accessible. However, their locations with no school names were denoted on the South African map using bold dots scattered and clustered unevenly on the map. What was deduced from the map of KZN is the fact that most of the dots were clustered along the coastal area where Mthwalume Circuit is situated.

The map indicated that, in as much as no names are given, almost all the dots indicate schools that had not performed well in the TIMSS studies with the exception of a few schools around the Western Cape and Gauteng (Reddy, 2003)

Due to the failure to get direct answers with regard to the first research question, it was decided, with consultation with my supervisor that we focus first on how grade 8 students performed in the TIMSS Science tests internationally (1995-2003) and then focus on the South African grade 8 students' national performance, foregrounding the rural provinces' performance.

### 4.2.1 How did grade 8 students perform in the TIMSS science test (international findings of 1995)?

Report findings from these studies reveal that 41 countries out of forty five completed all of the steps on the schedule in TIMSS 1995, with Singapore the top performing country in grade eight and seven Science tests, followed by Czech Republic, Japan and Korea (Beaton, et al, 1996b). South Africa, Colombia and Kuwait were the lower performing countries, where South Africa came last. There was a remarkable difference in average Science achievement between top performing and bottom performing countries where, for example, Singapore exceeded performance for 95% of students in the lower performing countries (Beaton, et al, and 1996b).

Boys' performance in Science achievement was higher in both grades compared to girls in most countries and internationally. Reasons for this gender differences were associated, according to Beaton, et al (1996), to significantly higher performance by boys to Earth Sciences, Physics, and Chemistry. Owing to different emphases in curriculum across countries, performances in Physics, Life Sciences and Chemistry were relatively better or worse in different countries. All participating students had difficulty with Chemistry related items since questions of how carbon dioxide fire extinguishers function was correctly answered by only half of both eight and seven grade students in many countries.

This difficulty was also noticed in multiple choice Physics items where students had to demonstrate knowledge of earth gravitational force acting on a falling apple. Though three quarters or more students from Czech Republic and Slovak Republic responded correctly in both grades, the overall students responses indicated a common

misconception internationally that gravity does not act on stationary objects when it is on the ground.

South Africa and Lithuania scored less than 10% on an extended response item that required students to apply scientific principles and draw diagrams denoting their understanding of the three steps in the water cycle. This poor performance was contrary to the 60% obtained by Flemish speaking Belgium students on the very same item.

In terms of attitude to Science, boys in countries like England, Hong Kong, Kuwait, Japan, New Zealand, Norway and Singapore reported liking Science more than girls. Studies reveal that there is a strong relationship between home factors and Science achievement on exclusively grade eight students in every country that participated in TIMSS 1995 grade 8 Science test study (Beaton, et al, 1996b). Amongst the findings, the availability of resources at home, number of books and educated parents all indicated that learners from such backgrounds achieve well in Science in every country.

However, according to the TIMSS studies, the time spent by grade eight students watching television was negatively associated with Science achievement across the spectrum of participated countries. Another impressive finding internationally that did not correlate inversely with achievement in Science was the class size; this finding was enhanced by the mere fact that some of the best achieving countries had relatively large class sizes (Howie, 1997).

### 4.2.2 TIMSS 1995 findings in our South-African context – Grade 8

The percentage of learners passing Science in our South African schools is, from my own perspective, scantily fluctuating if not merely declining. According to Howie (1997) the South African achievement in Science in TIMSS Grade 8 Science test was described as very poor compared to other countries internationally. This was established by its Science mean score of 326 out of 800 points, which was well beneath the international mean of 516 points (Beaton, 1996b). However the participation of South Africa although last, was significant in the sense that it was the only country in the Africa continent that participated in the TIMSS 1995 study (HSRC, 1995).

The findings reveal that in South Africa, just like in other international countries that participated in TIMSS, except Cyprus and Thailand, boys had higher Science scores of 337 score mean compared to the 315 score mean for girls (Howie, 1997 and TIMSS 1994-1995). When the performance of South African students viewed across

five major content areas like Earth Science, Life Science, Physics, Chemistry environmental issues and the nature of Science, it did not reflect any significant difference in the results across the content areas or between standards. The Science results, though very poor, were uniform throughout, with the possible exception of Chemistry particularly in standard five, where in most countries it tended to be low (Beaton, et al, 1996b).

It is reported that, from the examination of the performance of each country across five content areas, countries that did well in the test overall generally did well in every content area, and those that did badly overall also tended to do badly in each of the content areas (HSRC, 1995 &Howie, 1997). While Colombia had the oldest students in both grade seven and eight (14, 5 and15, 7yrs respectively), South Africa was the second oldest with grade seven having average age of 13.9 years and grade eight 15.4years of age.

### 4.2.3. How did grade 8 students performed in the TIMSS Science test (international findings of 1999)

The performance of Grade 8 student in TIMSS 1999 was topped by Chinese Taipei with 569 score followed by Singapore, which was the best performing country in 1995 by 580 score. There was an in increase in international average science scale score from 518 in 1995 to 521in 1999, which according to TIMSS's judgment was statistically not significant. Lower performing countries were Phillipines; Morocco and South Africa. South Africa achieved 243 score out of 800 points which made it the least performing country internationally and locally (Martin; Mullis; Gonzalez; Gregory; Smith; Chrotowski; Garden & O'Connor, 2000). Countries that had an increase in average science achievement between 1995 and 1999 were Latvia (Lss) 1; Lithuania; Canada and Hungary. Unlike TIMSS 1995 test round which covered five content domains in science, TIMSS 1999 covered six science content areas. Extensive questionnaire on the achievement data needed information about the home, classroom, schools and national contexts within which science learning takes place.

Boys achieved higher average science score than girls in 16 of the 38 countries in 1999.This higher achievement is due to the fact that boys excelled in chemistry, physics earth science, and environmental and resource issues. This average gender difference which showed a decrease from 1995 to 1999 was influenced by narrowing gap in Hong

Kong SAR, Slovenia and Israel. Students from home with high educational resource (books, study desk, dictionary and one parent with a university degree) had higher achievement than those students from home with few resources, on average internationally. But these achievements varied across countries internationally. Attitudes towards biology and earth science were positive and poor towards physics and chemistry.

### 4.2.4 TIMSS 1999 findings in the South-African context – Grade 8

South Africa again came last with 243 points in Science (HSRC and Reddy, 2006). It is reported that those provinces that are historically advantaged like Western Cape achieved best results in Science whereas poor provinces like Eastern Cape, Mpumalanga, KwaZulu Natal and Limpopo preformed least in the TIMSS Science test (TIMSS, 2002a and Howie, 2002). On average girls performed lower than boys. This lower performance of girls has been attributed to extra domestic chores exposed to them by parents and school teachers. (Howie, 1997; HSRC, 2006 and Reddy, 2005).

### 4.2.5 How did grade 8 students perform in the TIMSS Science test (international findings of 2003)

The third round of the TIMSS 2003 study comprised of 50 countries including five African countries including Botswana, Egypt, Tunisia, Morocco, Ghana and South Africa. These African countries all fell beneath the international mean score of 474, and for the third time South Africa sadly achieved 244 points which made it the 50$^{th}$ least performed country both internationally and regionally (Martin, et al, 2004 and Reddy, 2005).

The TIMSS science tests that covered five content dimensions (Earth Science, Life Science, Physics, Chemistry and Environmental issues and the nature of science) were given to middle school students. Special emphasis was placed on the eighth grade results including selected information about students' background experiences and teachers' classrooms practices in Science (Beaton, et al, 1996b). The five highest achieving countries were Singapore, Chinese Taipei, Republic of Korea, Hong Kong (SAR) and Estonia. The five poor performing countries were Ghana, Lebanon, Philippines and Botswana

### 4.2.6 TIMSS 2003 findings in the South-African context – Grade 8

The national average score achieved by South Africa in the 2003 TIMSS study was 244 points .The increase difference of one point compared to 243 mean score of 1999 is statistically insignificant (Reddy, 2005). When TIMSS results were analyzed according to 9 provinces, the Western Cape, Northern Provinces and Gauteng were the top performing provinces in both Mathematics and Science while the lower performing provinces were KwaZulu-Natal, Eastern Cape and Limpopo (HSRC, 2006).

There was a drop in average age of 0.4 years from 1999 to 2003 which indicated that there was either less repetition in the system or fewer learners left the system and then re-entered. Learners who were in ex-House of Assembly–previously only White learners, achieved better average scores that was next to the international average in Mathematics and Science while the average score of African learners, previously ex-DET schools, was almost half that of ex-House of Assembly. It was significant to note that there was no gender difference in the scores of boys and girls, but both groups still scored poorly.

South African learners performed poorly in almost all test items or questions. Less than 30% of learners achieved the correct answer in most of the multiple choice items whereas in the Science performance category it was better in the Chemistry domain and weakest in the Physics and Earth Science domains.

## 4.3 Conclusion

This chapter presented the quantitative data that was generated through secondary document sources. Critical research questions were underlying guidelines to align the study with the instruments for collecting data. The chapter started by classifying the research questions into two categories in order to create coherence in the collected data.

A brief summary of the TIMSS 1995, 1999 and 2003 was provided in order to address research questions one. This was followed by comparing Science achievement of learners both internationally and locally.

The next chapter deals with the data collected and discusses critical research question two.

# CHAPTER 5
# PRESENTATION OF FINDINGS OF RESEARCH QUESTION 2: – PART A

This chapter presents the qualitative data that was generated through semi structured interviews with researchers and document analysis of secondary sources from the Human Science Research Council. The data analyses are presented as responses to the following critical research question:

- ***How do researchers and policy makers explain/make sense of the relationship between learners' achievements in the TIMSS Grade 8 Science test and their socio- cultural economic background?***

The data was generated through semi structured interviews with two experts who had participated, researched and written extensively about the Trends in International Mathematics and Science Study (TIMSS) of 1995, 1999 and 2003. Conducted interviews were aimed at exploring the role that cultural capital plays in the difference in achievements of students in the TIMSS grade 8 Science tests among the rural secondary schools of KwaZulu-Natal.

## 5.1 RESEARCH QUESTION 2-PART A: HOW DO RESEARCHERS AND POLICY MAKERS EXPLAIN THE RELATIONSHIP BETWEEN LEARNERS ACHIEVEMENT IN THE TIMMS GRADE 8 SCIENCE TEST AND THEIR SOCIO-CULTURAL-ECONOMIC BACKGROUND?

The qualitative data that was generated through semi structured interviews and document analysis is presented in an integrated manner and is discussed. This means that the data that was generated through interviews and the one generated through document analysis are discussed simultaneously. Whilst it is evident that there is a link between Science achievement and socio-economic background, there is no one single factor that can be isolated as the only cause of poor achievement in Science. Instead, a number of factors were considered to have a link to Science achievement, and these factors have been categorised into the following nine themes:

(a) Home environment

(b) General school environment

(c) Quality of teachers and teaching

(d) Peer environment

(e) Gender factors

(f) Homework

(g) Language of instruction

(h) Curricula issues

(i) Student motivation.

### 5.1.1 Home environment

The data indicates that there is no divergence of views of the two participants regarding the effect of the home environment on learner achievement in Science. However, as much as there is no divergence, there is different emphasis on the environmental effects on achievement. For instance, Participant One felt that the link was not strong. She felt that there were some elements of home environment that influence achievement such as resources and or movable property such as television and car. She argued that these can be classified as home background to a certain level of a societal class stratum which in turn may suggest a level of achievement a learner from that home background may achieve. Commenting on how these themes emerged in the TIMSS study, this is what she had to say:

> *Every one of them except in terms of the home environment from the data there wasn't enough data as far as I could see that could show this, what it does, the data tells you that there are sort of certain proxies for what resources are in the home, do they have a TV do they have a car?, and all of these resources give you an indication of what is this, whether they be middle class or poor class but that doesn't tell us about them. We can't talk about the environment just the resources of the home, so it's more important to see that the home resources are very limited and they probably are an indication of the economic class of the group and therefore poverty seems to affect performance. (Lucy)*

This extract indicates that participant one did not think that the mere possession of these movable properties had any significant effect on the achievement of learners in Science subjects. However, the other participant had strong views about this factor. She argued that the home environment issue was historical in the sense that its impact dates from the apartheid era to the current democratic era. When asked about the effect of home environment on the achievement of learners in Science, she responded by saying:

> *Ja, okay well if that is the case then I think historically we have many reasons why the whole environment for instance would play a very important distinguishing role in terms of achievement in South Africa. So many of these underlying factors have to do with poverty, have to do with the fact that with the previous regime we had differential funding of schools, so if you take on your first list that you have here the home environment, homework, language of instruction, student motivation, those factors many of them are linked to the issue of poverty and home resourcing, education of parents which is not listed but is inherent in the home environment. (Charmaine)*

From the above extract it is clear that participant number two felt strongly about the link between home environment and achievement. However, they both seemed to agree on the effect of poverty on learner achievement. Both participants talk about poverty and how it impacts on learner achievement. Therefore, if both participants agree that poverty negated achievement, it is similarly true that poor socio-economic background has a remarkable impact on learner achievement. According to the IRIN Report (2007) communities in rural settings will continue to suffer the unbearable effects of poverty and inequality for as long as these problems remain unchallenged and unaddressed.

Such views on poverty and its role on the kind of education that learners receive concur with Bourdieu (1977), who argues that learners from middle class backgrounds possess wealth, power and high cultural status which Bourdieu calls cultural capital. This cultural capital of the dominant group is entrenched into the education system and thus favours learners from the middle class background by awarding them success at the expense of learners from working class backgrounds.

On the other hand an analysis of secondary sources from the TIMSS studies concur with the data from the two participants that home environment has a strong impact on the achievement of learners of Science. The TIMSS study of 1995 informs us that:

> *In every country, eighth-grade students who reported having more educational resources in the home had higher Science achievement than those who reported little access to such resources. In every country, the pattern was for the eighth grade students whose parents had more educational background to also have higher achievement in Science.(Beaton, Martin, Mullis, Gonzalez, Smit, and Kelly, 1996,p .4 and HSRC,1997)*

The data from the TIMSS study of 1999 indicates that:

> *The home educational resource index indicates that the percentage of eighth grade students in each country that had a dictionary, study desk or table, or computer, shows that students reporting having all three had higher average Science achievement than those without all three. (Martin, Mullis, Gonzalez, Gregory, Smit, Chrostowski, Gardenand & O'Connor,1999, p .118-119 and HSRC,2000)*

The data from TIMSS study of 2003 shows that:

> *Home backgrounds provide an insight into learners' social and economic capital. The past IEA assessments (PIRLS and TIMSS) have demonstrated that in most countries, learners from homes with most extensive educational resources have higher achievement scores than learners from less advantaged backgrounds.(HSRC,2006).*

The above data from secondary sources of TIMSS studies of 1995; 1999 and 2003 all indicate that the home environment has a strong impact on the achievement of learners in Science. In relation to the above statement, the data from TIMSS ,1995, point to the fact that those students whose parents have higher education and also who have access to educational resources in their home have higher achievements in Science

than those students whose parents have low educational levels, and are coming from poor home backgrounds with no educational resources. This data, according to the TIMSS study of 1995, was not observed in the South African context alone, but across countries internationally. Similarly the data from the TIMSS study of 1999 shows the same results in terms of resources and the educational level of parents. On the other hand the data from the study of TIMSS 2003, besides showing no difference with the latter studies, emphasises the fact that the home background presents an insight into the learners' social and economic capital. Howie (1997, p.51), cited in HSRC (1997) argue that many students come from poor socio economic background where parents are not educated and employed, survival is often given priority over education, as a result students do not get assistance with school work and fail to concentrate due to malnutrition. Arguing along the same line with Howie (1997) is Fitzgerald (??) who states that "irrespective of their academic ability or desire to learn, students from poor families have relatively little chance of securing success".

### 5.1.2 General School Environment

The data suggests that there is an agreement in views of both participants on the theme of the general school environment and its impact on learner achievement. Participant one felt that the physical environment of the school, like the condition of the building and the nature of the toilets indicate the level of the availability of resources that school has. Remarking on the physical resources of the school and its relationship to learner achievement, she responded by saying:

> *the general school environment that's everything, I suppose you've looked into TIMMS instruments which will also tell what information on those instruments that tell about general school environment, and they would have told you about the building, its more the physical, the instruments tested the physical environment of the school or sort data on the physical environment of the school, it tells you of the state of the building, the state of the toilets, what kind of resources are there. So one I suppose extrapolates from there, but it does say about resourcing.*

> *Again as you know that these would have been indicators to come to that conclusion, classes were not observed. (Lucy)*

From the above extract, participant number one believes that the physical resources of the school like the availability of classrooms, electricity, libraries and laboratories, amongst others, makes it easier to guess the amount of resources available in any school which in turn indicates the level of learner achievement that may be expected from that school. She further makes known the fact that classes were not observed.

However participant two had a different version as she looked at the school environment and its impact on learner achievement from the previous regime perspective. She felt that differentiated funding of schools and differentiation in teacher training by the previous regime resulted, in many cases, in unequal distribution of resources at schools. Participant two, unlike participant one, considered both physical and human resources as elements of the school environment which impact on learner achievement. In line with the above sentiment, the following was what she had to say:

> *So and then if we take the school environment this is a hangover still from the previous regime where we set differentiated funding of schools meaning some schools were funded much more richly than others resulting in few resources in many cases and also differentiation in teacher training. So those factors don't necessarily manifest directly in qualifications of teachers per se, but they certainly impact on the quality of the teachers themselves and the teaching that they are able to conduct and they certainly have an impact on the general school environment.(Charmaine)*

From the above extract participant two believed that human resources like teachers who received poor or differentiated training under the previous regime endure the resultant effect of their poor qualifications in teaching and learning. This also impacts negatively on the school environment as a whole.

Although both participants have divergent views on the notion of resources, participant one considered physical resources as a significant aspect of school environment while participant two strongly perceived both the physical and the human resources as the most important aspects of school environment. Nevertheless, they both

agree that resources have an impact on learner achievement, hence the school environment.

Arguing along the same lines with the above participants are the secondary sources that indicate in the TIMSS study of 1995 that the general school environment possibly affects the achievement of learners in Science. The data relating to the school environment, according to the TIMSS study of 1995 is presented as:

> *A great many schools have inadequate buildings, poor or non-existent libraries, laboratories and other facilities, overcrowded classrooms, textbook shortages, lack of teacher support mechanisms and weak school leadership. Physical and forms of isolation, leading to poor communication with the outside world, often cause serious problems. (HSRC, 1995)*

Data from the TIMSS study of 1999 indicates that:

> *Since resources are lacking in many schools and the teacher is often the pupils' resource to learning, it is not surprising when the end result is so poor. Howie (1999) and HSRC (1999).*

The data from the study of TIMSS, 2003 states that:

> *An important strategy for the improvement and change of score distribution is to increase the number of South African public schools producing good results. Performance is stratified along race and class lines – performance is much better in ex-HOA, which are, typically better resourced and located in areas of higher socio economic status .African schools face a daunting tasks in improving their learners' performance. Not only are these schools located in areas of poor socio economic status (itself a reason behind poor learner performance at school) ,but they also suffer from a migration of better performing and resourced learners to higher achieving , more affluent schools. Reddy (2006, p.118) cited in HSRC, 2006)*

The pattern of the data from TIMSS 1995; 1999 and 2003 studies as presented by the HSRC agree that the general school environment affect achievement of learners in Science.

However, although these studies share the same view on the school environment, they also point to other aspects that are related to the general school environment. The data from TIMSS 1995 study, considers a lack of Science resources like laboratories, overcrowded classrooms, shortages of textbooks and weak leadership as causing serious problems on the performance of learners in Science in many schools. The data also indicates that poor communication with the outside world as a result of distance from resource centres, and other forms of isolation exacerbate problems linked to the school environment.

Despite the fact that the data from TIMSS 1999 concurs with the data from TIMSS 1995 in terms of the impact of the unavailability of resources on the achievement of learners in Science, the data (TIMSS, 1999) further reveals that in cases where the Science teacher is the only resource, the achievement in Science will be definitely poor. On the other hand the data from the TIMSS 2003 study also concur with the data from TIMSS 1995 and 1999 that school environment has an effect on learners achievement .All these studies point to the unavailability of resources as a negative factor in the achievement of Science learners. But the study from TIMSS 2003 has a different view other than that of resources. The study argues that performance of learners at our South African schools is stratified along race and class lines. When the study looks at the performance of Science learners across the different ex-Departments of Education, it signifies that performance of learners in ex-House of Assembly, which was historically for whites only, typically well-resourced and located in areas of higher socio-economic status, has a much better performance. According to the study, African schools face an overwhelming task in improving their learners' performance which is far worse than that of well-resourced white schools.

Echoing from data of the TIMSS, 1995, 1999 and 2003 studies is Bourdieu, who argues that the major role of educational systems is the reproduction of power relationships and privilege between social classes. Social inequality is reproduced and legitimated. The underprivileged position of the lower classes is legitimated by educational failure while privileged positions of the dominant classes are justified by

educational success. The study reveals that not only do African schools located in areas of poor socio-economic status, is also a cause of poor performance of Science learners at these schools. But, argues the study, these schools have to endure the movement of better performing and resourced learners to higher achieving, more wealthy schools.

### 5.1.3 Quality of teachers and teaching

The data indicates that there is no variance on views from the two participants in relation to the quality of teachers and teaching and its impact on learner achievement. However participant one felt that the poor performance of South African learners in Science subjects is attributed to the quality of teaching and learning. She does not feel that the quality of teachers per se has an effect on learner achievement, but sees the quality of teaching and learning as having a strong impact on the general school improvement. Relating to her response, she said:

> *It is very difficult to isolate a single factor that causes poor performance, so of course everything affect the quality of teaching and learning, now there is a whole list of factors which any….., if you look at general factors of schooling that affect/contribute to school improvement or contribute to school environment, teaching and learning, I mean, those are all the ingredients of learning environment, and with such poor scores that the country achieve of course everything affects it so in some ways one can't sort of disagree with anything any sort of scores*.(Lucy)

It seems therefore that participant one feels that in as much as there are a number of factors that contribute to poor performance of learners in Science, the quality of teaching and learning is an underlying factor of poor achievement. She argues that quality teachers and the quality of teaching are the main ingredients of the learning environment which strongly contribute to better achievement of learners in Science.

Both participants strongly agree that if there is quality teaching and learning at school, learners will procure good achievement in Science subjects. However participant two further considers the differentiated training of teachers and their qualifications as having a negative impact on learner achievement. When asked about

the impact the training and qualifications of teachers will have on learner achievement, this is how she responded:

> *..... and also differentiation in teacher training. So those factors don't necessarily manifest directly in qualifications of teachers per say, but they certainly impact on the quality of the teachers themselves and the teaching that they are able to conduct. (Charmaine)*

From the above extract participant two, shares the same views with participant one on the quality of teachers and teaching, but she feels that the resultant effect of poorly trained teachers does not only impact on their qualifications, but on the teachers themselves and the teaching they conduct. From the foregoing, participant two argues that poorly trained teachers possess a poor knowledge base in Science subjects and this results in poor teaching and poor results of Science learners.

With reference to the secondary sources from the TIMSS study of 1995, as summarised by Howie (1997, p53), the data from these sources informs us that:

> *There is a severe shortage of properly qualified mathematics and science teachers at the secondary level. Unfortunately this shortage has been masked recently by the well-publicised surplus of teachers in other areas of education. The problem is exacerbated by the fact that many trainee mathematics and science teachers at teacher training collages have chosen the course very much as a second or third choice of career. Consequently, many of these students are not strongly motivated to become mathematics and science teachers (Howie & Wedepohl, 1993).*
>
> *Inadequate subject knowledge and poor motivation lead to a lack of confidence and inspiration in the classroom, which has a negative effect on the learning process. The teachers are then poor role models for students, which means that few of these students will wish to become teachers themselves one day. (HSRC, 1997)*

The data as presented in TIMSS study of 1999 states that:

> *On the whole, about half of the teachers reported feeling ill prepared to teach the content of either the mathematics or science curriculum. On*

> *inspection of the qualifications and experience of these teachers, this is not surprising. There appear to be few teachers with significant experience and a relatively small percentage have university level qualifications. Those that have qualified through the three year diploma from colleges of education probably did not go beyond repeating the subject they did at school in Grades 10-12. The lack of adequate preparation in terms of content knowledge in particular has left these teachers feeling poorly prepared to teach their pupils; the teachers are constrained by this in the classroom Howie (1999) and HSRC (1999).*

The data from TIMSS 2003 study on the quality of teachers and teaching informs us that:

> *Internationally, about three quarters of learners are taught by mathematics and science teachers with a university qualification. In South Africa, over 95 percent of the TIMSS learners are taught by mathematics and science teachers who indicated that they have completed a post-secondary qualification. Over two thirds of mathematics and science learners were taught by teachers who indicated that they had studied either mathematics or science in their pre service training courses. Therefore, the South African mathematics and science teachers could be classified as qualified and knowledgeable in their subject areas. However, in relation to the TIMSS cadre of teachers, the South African mathematics and science teachers appear among the group having the lowest qualifications.(HSRC,2006)*

The data from TIMSS, 1995 as summarised by Howie (1997, p.53) shows that the quality of teachers and their teaching has a strong relation to the performance of learners in Science. The data inform that there is an acute shortage of suitably qualified Mathematics and Science teachers at the secondary level which, in recent times has been obscured by a publicised surplus of teachers in other areas of education. Alexander, Badenhorst and Gibbs, (2005), cited in Howie et, al (2006) concur that schools for white children that were well located and resourced, received more funding than others received, had better amenities, properly equipped and with better qualified teachers. The data further discloses that since most of the Science and Mathematics

teachers at our schools chose teaching careers as a second and third choice, this has resulted in a less motivated teaching fraternity, that has an inadequate body of knowledge in the Mathematics and Science domains, and this in turn impacts negatively on the achievement of Science learners.

In relation to the data from the TIMSS 1999 study, there appears to be not much difference to what has been discussed in the TIMSS 1995 study. From the findings in the TIMSS 1999 study, half of the South African teacher community were reportedly feeling poorly prepared to teach either the Mathematics or Science curriculum. Upon inspection of their experience and qualifications, as indicated in the TIMSS 1995 study, it was found that very few teachers have significant experience in teaching Mathematics and Science subjects while a small percentage have university degrees in these subjects. At the centre of this qualifications measure, those teachers who procured college diplomas in these subjects lack sufficient content knowledge which makes them feel poorly prepared and constrained to teach.

On the contrary, findings from the TIMSS 2003 study differ from that of TIMSS 1995 and 1999 studies in terms of teacher's qualifications. According to the TIMSS 2003 study, South African Mathematics and Science educators could be classified as qualified and knowledgeable in their subject areas owing to the following factors. About 95 percent of the TIMSS learners in South Africa are taught by educators who completed a post-secondary qualification while two thirds of Mathematics and Science learners are taught by teachers who studied either Mathematics or Science in their pre service training courses. However the TIMSS 2003 study argues, on the basis of the aforesaid findings, that South African Mathematics and Science teachers, despite being classified as qualified and knowledgeable, when compared to the international TIMSS cadres of teachers, they fall under the least qualified Mathematics and Science group. It is therefore against this background that teaching and learning as a theme strongly impacts negatively on the achievement of learners in Science.

### 5.1.4 Peer environment

The data on peer environment seems to be insufficient in the sense that participant one admitted that she was not aware of any question on the instrument that asked about peer environments and its impact on learner achievement in Science. Participant two seems to feel that peer environment has a distinguishing role to play in achievement, though she looked largely at the whole environment without particularly talking much about peer environment. Referring to the peer environment, she said:

> *Ja,okay well if that is the case then I think historically we have many reasons why the whole environment for instance would play a very important distinguishing role in terms of achievement in South Africa.(Charmaine)*

Participant two feels that historically, South African environments, whether peer, school or poor environments all had a history of having an impact on learners' achievement.

Relating to the secondary sources as presented by the HSRC (1996), findings from the study of TIMSS 1995 on peer environment informs that:

> *The peer environment in many schools is not supportive of those students who do wish to do well academically. In an area where quality of opportunity sometimes leads to an expectation of equality of outcomes, students can feel uncomfortable if their achievement is notably better than the average. (HSRC, 1997)*

Data from secondary sources informs us that the peer environment has a strong impact on the achievement of learners in Science .Findings from this data indicate that peer environment in many South African schools does not support those learners who are determined to achieve high-quality results, so in cases where good opportunities needs an expectation of equality of income, students can feel uncomfortable if their achievement is better than the average.

On the other hand data from TIMSS 1999 and 2003 studies are silent on this theme. This means that TIMSS studies did not consider peer environment as part of their comparative study.

### 5.1.5 Gender factors

The data on gender factors reveal that only participant one had a view on this theme while participant two is silent. Participant one indicates that both the boys and girls performed poorly and she quoted from the TIMSS study of 2003. When asked about the impact on gender factors, she responded by saying:

> *As I have said in 2003 we found that both girls and boys did the same poor performance. (Lucy)*

With reference to the secondary sources, findings from these sources indicate that gender factors has a strong link to the performance of learners in Science. According to the data from the TIMSS 1995 it indicates that:

> *As in many countries, there are subtle and not -so- subtle discouragements for girls who have an inclination to enter into mathematics based or science based careers. Apart from the discouragements they sometimes from teachers, the burden of household work often fall on the girls in the home, which has a negative influence on study time.(HSRC,1997)*

Data from the TIMSS 1999 study reveals that:

> *The difference in the South African results for girls and boys was not statistically significant. The girls' average scale score was 234 (SE 9.2) compared to the boys' average scale score of 253 (SE 7.7). Internationally, the scale score average of girls was 480 (SE 0.9) compared to boys with 495 (0.9) and revealed a significant difference between the two groups with boys performing better than the girls. Similar to mathematics, substantial differences can be seen in Free State (51points) and Mpumalanga (42 points) where boys achieved on average 5-6% more on the test than the girls did. This may be because there is greater encouragement for boys when it comes to science subjects and the fact that in many homes girls have household jobs to do when*

> *arriving home after school and don't have the time to complete their homework. (HSRC, 2000)*

The TIMSS 2003 study reveals that:

> *In the national sample there was equal participation between boys and girls. Nationally, the science performance between girls and boys is similar, with the girls scoring 242(SE=7.2) and the boys scoring 244(SE=7.7) in TIMSS 2003 .This two point difference is not significant.(HSRC,2006)*

The data from secondary sources indicate that the gender factor has an influence on the achievement of learners in Science. According to the TIMSS study of 1995 there is a prevailing discouragement of girls who are willing to enter into Mathematics and Science based careers in many countries across the globe, including South Africa. The study indicates that girl learners are given more domestic chores with less study time than boys and are in certain instances discouraged even by their teachers to learn Mathematics and Science subjects. The effect of this attitude towards girls results in poor performance in Science. In the study of TIMSS 1999 the data concur with the findings of the study of TIMSS 1995 that girls are in most cases overburdened with domestic work and do not get enough time to complete their homework which negatively affect their performance in Science subjects. The study reveals that the boys achieved an average scale score of 253 points compared to an average scale score of 234 achieved by the girls. The study indicates that this difference is not statistically significant. On the other hand the TIMSS 2003 study informs us that there was equal participation between boys and girls but their achievement differed with two points where girls got 242 points in relation to 244 points acquired by boys. This difference was, as it happened in TIMSS 1999, statistically not significant.

### 5.1.6 Homework

The views of the two participants on this theme are diverse. Participant one indicates that, quoting from the study of TIMSS 2003, learners were asked how often they did homework or they did not do it at all. Commenting on this theme, this is what she had to say:

> *There was a question on how learners were asked how often they did homework or no. (Lucy)*

This indicates that the view of participant one on homework is silent if not open ended in relation to the learners' achievements in Science. However participant two strongly feels that with many other factors mentioned, homework is, amongst others, linked to the issue of poverty, home resourcing and education of parents .Participant two confirms this when she said :

> *So many of these underlying factors have to do with poverty, have to do with the fact that with the previous regime we had differential funding of schools, so if you take on your first list that you have here the home* environment, *homework, language of instruction, student motivation, those factors many of them are linked to the issue of poverty and home resourcing, education of parents which is not listed... (Charmaine)*

From the above extract participant two agrees that homework is linked to the achievement of learners .She further believes strongly that learners who are from poverty stricken home backgrounds and uneducated parents probably face challenges with homework.

Central to the notion of homework, data from secondary sources indicate that there is also a strong relationship between the time spent doing homework in all subjects and student average Science achievement. Data from TIMSS 1995 study is presented as:

> *The relationship was curvilinear in many countries, with the highest achievement being associated with a moderate amount of homework per day (one to three). This pattern suggests that, compared to their higher achieving counter parts, the lowest performing students may do less homework, either because they do not do it or because their teachers do not assign it, or more homework, perhaps because they need to spend the extra time to keep up academically*

TIMSS 1999 informs us that:

> *Pupils seem to be given more homework than many of their international peers. However, it also appears necessary that more homework be given. More homework was not linked to greater achievement in South Africa, but was in other countries. This is perhaps due to below average pupils requiring more time to complete their assignments than more able pupils. In general, teachers checked the homework (although about 25% never did), but spent far more time doing so than teachers internationally. This would also cut into time perhaps allocated to new topics and therefore result in teachers not finishing the syllabus, a fairly common occurrence in South African schools. (HSRC, 2000)*

Data from TIMSS 2003 is silent on homework.

On the theme of homework, it appears in the study of TIMSS1995 that South African learners do less homework than the international average. The study recommends that the role of homework to both student's performance and their learning is so vital that if it can be improved through motivation and quality teaching, the level of learner achievement could be definitely improved. The data from the TIMSS 1999 study does not agree with the data from the TIMSS 1995 study. The data reveals that more homework was not linked to the greater achievement in South African context than it had in other countries internationally. It suggests that this may be caused by the fact that below average pupils require more time to complete their assignments than more able pupils. The study indicates that teachers in South African schools spend more time checking homework than teaching new topics, as a result, they fail to finish their syllabi in time and this impacts negatively on the learners' performance. The TIMSS 2003 study informs us that there was a question that asked the learners how often they do homework but the study does not tell the findings and responses to that question. It was significant to note that the TIMSS 2003 study on homework in relation to learner achievement is silent.

### 5.1.7 Language of instruction

The data on language of instruction shows that there is no divergence of views from the two participants. Both participants say that the language of instruction, which is either English or Afrikaans, used in tests and teaching has an impact on learner

achievement. However, participant one feels that the use of English or Afrikaans does not benefit every learner because the majority of learners have a different home language. Responding from the aforementioned statement, she said:

> *....again we found that, yes of course the language of instruction, because the tests would be in English or Afrikaans and the majority of learners have a different home language.(Lucy)*

From the above extract participant one strongly believes that the use of English or Afrikaans as a language of instruction in tests disadvantages the majority of Science learners in terms of understanding, particularly those whose home language is not English or Afrikaans and this consequently has an impact on Science learners' achievement. However participant two indicates that although language of instruction has an impact on learner achievement, she strongly feels that it should be viewed together with socio economic status of learners and their self-concept in order to have a detailed analytical tool. She argues that they did this in order to have an analytical tool to study the relationship between language and achievement. Commenting on how they studied this relationship in 1999, this is how she responded:

> *So when the 1999 study was done and I in fact my last work on this the strongest factor in actual fact was home language and its effect on their achievement, and of course that is taking into account all the other factors like the SES (Socio Economic status) as it was measured in that study and taking into account their self-concept. So we needed to have a more detailed analytical tool to really study those relationships and in the 1999 study we were able to do that by including a national option on home language, basically testing English language proficiency. So J a, that is one of the reasons we could actually have a look at that. (Charmaine)*

When referring to the above extract it is clear that participant two did not look at the language of instruction merely from a comprehension perspective, but further included socio-economic status, self-concept of Science learners and English language proficiency with an aim of generating enhanced understanding on this theme. Participant two informs us that she did a study on this theme in order to generate more

data about its effect on learners' achievement in Science. Hence, they developed an analytical tool where they included a national option on home language in order to test English language proficiency. Consequently the data indicated that there is a strong relationship between learners from poor socio economic contexts and those who are not proficient in English with their achievement in Science subjects. Furthermore poverty, argues participant two, is again perceived as an underlying factor in the language of instruction as in other aforementioned themes.

When analysing secondary sources from the TIMSS 1995 study on the language of instruction it appears that:

> *For many students (especially African students) the language of instruction in Standard 5 and 6 is not the same as their home language. This often leads to communication problems, particularly where unfamiliar new concepts in science and mathematics are involved. For this reason it is also important to phrase test questions in language that is as clear and direct as possible. (HSRC, 1997)*

Data from the TIMSS 1999 study is presented as:

> *The majority of pupils tested in South Africa were not fluent in the languages of testing, be it English or Afrikaans, and struggled to communicate. The possible lack of fluency on the part of the teachers would exacerbate this situation further and disadvantage the pupils even more. Although other countries had similar problems of pupils having to learn in languages other than the one they spoke at home – for instance Malaysia, Indonesia, Singapore and the Philippines – their pupils did not appear to have been disadvantaged by this. In at least two cases (Malaysia and Indonesia) there is one common language in which all pupils have to receive their instruction. Clearly the language issue contributes to the poor subject knowledge of both teacher and pupil in South Africa and if there is to be a commitment to improving the levels of pupils' performance in these core subjects in the future then solving the language issue is a critical part of this solution. (HSRC, 2000)*

Data from the TIMSS 2003 study.

> *Of the learner who attends ex HOA schools, about 60 percent always speaks the language of teaching and learning at home. Even with 40 percent of learners not always speaking the language of the test at home, the ex-HOA schools achieve an average of score in mathematics and science that is close to the international average.*
>
> *The above analysis shows that there is association between lower achievements and not speaking the language of the test at home (HSRC, 2006, p.90).*

The data from secondary sources as presented by the TIMSS 1995 study shows that the language of instruction has a strong impact on the achievement of learners in Science. The study indicates that many students, particularly African students encounter a problem where the language of instruction in grades 7 and 8 is English which is not the same as their home language. These African students suffer communication problems where foreign new Mathematics and Science concepts are introduced for the first time. The data further indicates that for these African students to understand they need the teacher to phrase and explain the test question in a language that is clear and understandable.

In relation to the above, the TIMSS 1999 study also concurs that the language of instruction has an impact on the performance of learners in Science. The study reveals that the majority of South African learners tested in the study were not fluent in English and Afrikaans and had a huge problem to communicate. This language problem is, according to the study, exacerbated if the teachers of these subjects are also not fluent in English because that further disadvantages the learners of Science. The TIMSS 1999 study recommends that, since the language issue in South Africa contributes to the subject knowledge of both the teacher and the learner, there is an obligation to improve the learners' performance in Science and Mathematics by solving the language problem as a significant part of the solution.

However the data from TIMSS 2003, agrees with the findings from TIMSS 1995 and 1999 studies that language has a strong impact on the achievement of Science

learners, but it looks at the language issue from the perspective of ex-Departments of Education.

The TIMSS 2003 study indicates that about 60 percent of the learners who attends ex-HOA schools speak the language of the teaching and learning at home while the remaining 40 percent of these learners not always speak the language of the test. The study reveals that an average achievement score on mathematics and science in these ex-HOA schools when compared to other countries was closer to the international average .From these aforementioned analysis the study confirms that there is an association between lower achievements and not speaking the language of the test at home.

It is therefore against the afore-mentioned background that Howie (2003, p.1) argues that English in South African schools is spoken as a first language by less than ten percent of the population and is the language of business and government. It is also one of two languages usually used at schools although it is not the most widely spoken language at home.

### 5.1.8 Curricula

The data on curricula reveal that there is congruence on the views of the two participants. Both participants share the same opinion that the curriculum that is taught at schools has an impact on learner achievement. However, participant one feels that curriculum coverage instead of curricular per se has a strong impact, as derived that from the instrument used in the TIMSS research. When asked to elaborate on curricula coverage, her response was:

> *The curriculum again what I think what she was referring to was curricular coverage and the curricular according to the TIMSS instruments research it's a particular curricular it's an international instrument, and the curriculum that is taught in schools where there might have been a mismatch of curriculum.(Lucy)*

Referring from the above extract participant one believes that in as much as there is a relationship between curricula coverage and learner achievement, there is also a mismatch of the curricula that is taught at school, meaning that it does not favour the

teaching and learning of Science learners and thus strongly impacts negatively on their achievement.

On the other hand participant two does not believe that curricula coverage has a strong link but feels that the curricula per se has a link and is failing many children . Sharing her opinion on curricula, she said:

> *Well I am starting to think that it is not even favouring those from a middle class society anymore. I think the system is failing many children. I think it fails the poor children horribly. (Charmaine)*

Participant two feels that the curriculum that is taught at school does not only favour learners from poor backgrounds but also disadvantage learners from historically well to do backgrounds.

Secondary sources as they are presented by the TIMSS 1999, 1995 and 2003 studies indicate that there is a link between learner achievement in Science and the curricula. Data from the TIMSS 1995 study indicates that:

> *A number of criticisms have been levelled at South African mathematics and science curriculum over the years. Some of these criticisms are: .Syllabi used is outdated, irrelevant and boring. The general approach is "chalk and talk" rather than "hands on". Assessment methods are inappropriate. In an attempt to deal with these problems, a major curriculum reform is currently under way in South Africa.*

On the other hand the data of the TIMSS 1999 study relate that:

> *The South African curricula for mathematics and science are undergoing development as part of the revision of Curriculum 2005. However, an analysis of the* interim *curriculum for these subjects revealed several similarities with curricula internationally. One of the exceptions was the lack of major emphasis in science on knowing basic science facts and understanding science concepts.*
>
> *While most countries placed a major emphasis on this in the curricula documents, South Africa did not. Given South African pupils' apparent lack of basic science knowledge and understanding of science concepts,*

> *it is possible that this may also be a contributing factor to South African pupils' underperformance in science. (HSRC, 1999)*

The data from the TIMSS 2003 study indicate that:

> *South African society is highly stratified. Amongst the disadvantaged groups, Africans experience the highest level of poverty. The new education system introduced in 1994 has undergone many changes. Since 1997, there have been curriculum changes and the introduction of outcome based education policy. The TIMSS assessment revealed that teachers were often uncertain regarding exactly what curriculum they should be implementing. Furthermore, the official curriculum in 2002, C2005 was characterised by (and criticised for) under –specification of basic knowledge and skills .The South African curriculum is also one where, when compared internationally, her is the least overlap with the TIMSS assessment frameworks. This might have been anticipated to have an effect on the achievement scores. However, an analysis of performance on topics teachers indicated they had covered indicted that performance was still very low: learners achieving only around 20 percent correct on those items. (HSRC, 2003, p.84).*

When referring to the secondary sources as they are presented by the HSRC in the TIMSS 1995 study, the findings inform that the curriculum has a fundamental impact on the achievement of learners in Science subjects. The study confirms this when it indicates that the South African Mathematics and Science curricula has constantly received criticisms owing to its irrelevant, boring and outdated syllabi. The chalk and talk approach and inappropriate assessment methods which have historically disadvantaged Science learners were the underlying problems that prompted the major curriculum reform in the South African education system. From the foregoing the TIMSS 1995 findings reveal that the condition of Science and Mathematics curricula has for decades deprived learners, particularly those of African descent opportunities to achieve in these gateway subjects. Chisholm (2003) argues that the introduction of Outcomes Based Education (OBE) and Curriculum 2005 was probably the most significant curriculum reform in South Africa in the last century. It, according to

Chisholm, restricts any reproduction of limited interest and domination of any one particular grouping at the expense of another; hence it cannot shape and be shaped by narrow visions, concerns and identities (Chisholm, 2003).

Findings from the TIMSS 1999 study confirm that curriculum has an impact on the achievement of Science learners. The study reveals that since South African Mathematics and Science curricula were undergoing development, the interim curriculum for Mathematics and Science showed some improvement with several similarities to the international curricula. What was lacking in the interim curricula, as compared to other countries internationally, were the knowledge of basic Science facts and understanding of Science concepts. It is therefore the lack of these two factors which the study believes was the possible cause of South African pupils' underperformance in Science.

The data from the TIMSS 2003 study indicates that though the new education system introduced in South Africa in 1994 has undergone many changes such as an OBE policy and Curriculum 2005, data indicates that in the TIMSS 2003 assessment, South African teachers were in many cases uninformed as to what curriculum they should implement. The official curriculum 2005, which was highly criticised for under specification of basic knowledge and skills, showed the least overlap with the TIMSS assessment framework in the TIMMS 1999 test. The study denotes that an analysis of performance on topics teachers claimed they had covered indicated very low achievement scores of around 20 percent correct on those items.

### 5.1.9 Student motivation.

The data on student motivation indicates that there is no divergence of views between the two participants because they both agree that student motivation impacts on learner achievement. However, participant one does not see a link between student motivation and the achievement of learners in Science on her own but refers to the data from the TIMSS 2003 study. Commenting on this theme, she said:

> *Student motivation I'm not sure about that because if one looks at the TIMSS data you find that actually South African kids perform the poorest but they always say they value Math's and that was the 2003, so if you are heading somewhere with this it's that all factors affect the poor*

> *performance in schools, if you take anything as a factor it is impossible to isolate one single factor that causes or doesn't cause poor performance. (Lucy)*

The above extract points out that participant one, though not sure of the relationship of this theme with student achievement, she agrees with the TIMSS that it does impact on leaner achievement. She mentions that in as much as South African kids are motivated to learn Science subjects; they still perform poorly in these subjects which impacts on their achievement in Science. Participant two believes that student motivation has a strong negative impact on children from poor backgrounds, unless they fortunately get extra tuition from a particular teacher or the learner has an exceptional cognitive ability. When asked to explain that, this is what she had to say:

> *So where we have children from very poor backgrounds, unless there are exceptional factors such as special tutoring by particular teacher, or exceptional cognitive ability of a child, these other factors are likely to have a negative effect on the child. But children who are coming out of poor environments where the parents at home have for instance have a very strong motivation towards learning themselves or really support the learners in terms of their studying at school, they can negate the poverty effects that we see across most of the studies.*

In referring to the above extract, participant two feels that student motivation has an impact on learner achievement since those learners from poor backgrounds who have no special assistance and motivation from their parents in their school work tend to achieve poorly in Science subjects.

Linking this data to the secondary sources as they are presented by the HSRC in the TIMSS 1995 study, it is said that:

> *Largely as a result of the above factors, the motivation of students to do well in mathematics and science tends to be low. Motivation is adversely affected by the fact that mathematics and science are widely considered to be difficult subjects by students. Also for 40 years there has been little encouragement for African students to study mathematics and science. (HSRC, 1997)*

The data on student motivation as it is presented in the TIMSS 1995 study confirms that this theme has an impact on learner achievement in Science. The data shows that the learners are not motivated to perform well in Mathematics and Science. The study associates this poor motivation to the fact that Mathematics and Science has all along been regarded as the most difficult subjects. There has been for the past 40years little encouragement for African students to study Mathematics and Science.

When referring to the TIMSS 1999 findings the data reveals that:

> *South African pupils have a very poor self-concept in mathematics and Science compared to pupils internationally. They find both subjects difficult, believe that they are not talented in either subject, and that it is not their strong point. (HSRC, 2000)*

The above data also concur with the findings from the TIMSS1995 study that student motivation impacts negatively on the achievement of Science learners. The data from this study shows that South African pupils have a negative self-concept in Mathematics and Science when compared with their counterparts internationally. This is exacerbated by the fact that they have a wrong belief that they are not talented in these subjects, hence they, as mentioned in the data of the TIMSS 1995 study, find these subject too difficult for them.

On the other hand the TIMSS 2003 study showed that:

> *In general, the attitude of South African learners to mathematics and science is positive –they have high self-confidence; they enjoy and value the subjects. We must consider that these may be socially desirable responses, and one would have to probe further to determine the real attitudes of learners. Internationally, and within South Africa there is no significant variation in achievement scores between learners who indicate positive attitudes towards mathematics and science and those who do not. (HSRC, 2003, P.95)*

The study of the TIMSS 2003 does not inform about student motivation per se as participant one mentioned, but considers the attitude of learners towards Mathematics and Science. From this theme the element of student motivation was extracted as the data from the study reveals that South African learners have high self-confidence, enjoy

and value Mathematics and Science. What is contradicting is the fact that in as much as they love and value these subjects, they still achieve poorly in them.

## 5.2 CONCLUSION

This chapter presented the qualitative data collected from researchers through semi structured interviews, probe and secondary sources from the TIMSS studies. The responses to research question two were divided into themes and sub questions which are dealt with in chapter six

# CHAPTER 6

## PRESENTATION OF FINDINGS OF RESEARCH QUESTION 2-PART B

After collecting data from the two participants through probing in reference to the documents from the TIMSS 1995, 1999 and 2003 studies, the following four sub questions of critical research question two were used to further interview the same participants of the study.

- *Is there a relationship between eco- socio- cultural factors and learner achievement in Science?*
- *What is your view on the relationship between eco-socio-cultural factors and Science achievements at South African schools?*
- *How do we explain poor performance in science across urban Black-Indian-White (ex-model C) schools*?
- *To what extent is poor performance a function of rurality?*

## 6.1 RESEARCH QUESTION 2-PART B: HOW DO RESEARCHERS AND POLICY MAKERS EXPLAIN THE RELATIONSHIP BETWEEN LEARNERS ACHIEVEMENT IN THE TIMMS GRADE 8 SCIENCE TEST AND THEIR SOCIO-CULTURAL-ECONOMIC BACKGROUND?

### 6.1.1 Is there a relationship between eco-socio-cultural factors and learner achievement in science?

Participant one in responding to this question preferred to focus on the relationship between socio-economic factors and the achievement in Science on the basis that she has no deeper understanding of cultural factors. This is noticed from the following statement:

> *I don't know about cultural that is the different matter so I would rather just talk about socioeconomic and learner achievement.*

From the foregoing, participant one then informs that she believes socio-economic factors have an impact on learner achievement in Science. This is deduced from the following quote:

> *.....but we try to look at what is the socio economic and the achievement and of course you don't need a study that your senses tells that there is an impact.*

To substantiate this belief that there is an link between socio-economic factors and achievement in Science, participant one referred to the data from the TIMSS study and she indicates that they had difficulty in finding a correlation due to performance related issues and how they alternatively used strategies to pursue the study. This is shown in the following statement:

> *Let's talk of the data first. In the TIMSS study we ask and try to correlate and again I must say because it was such a poor performance at the point it was very difficult to do correlation but we try to look at what's the socio-economic and the achievement and of course you don't need a study that your own sense tells you that there is an impact. The only way I could only differentiate was to look at the ex-Departments of Education and the correlation of scores.*

Participant one then informs that since Science learners performed poorly in the TIMSS study, it made it a predicament to do correlation. So they alternatively looked at the ex-Departments of Education and correlate the scores in order to differentiate and make the study meaningful. It is therefore within this setting, according to participant one, that the impact between these two variables could be established.

She argues that ex-model C schools or white schools are well resourced and in most cases characterised by racial groupings. When comparing African schools which are poorly resourced and located in deep rural areas and townships with ex-model C schools, participant one reveals that the data indicated that scores of learners in African schools was about half the scores of learners in the white schools. This measure of the ex-Departments of Education and the resources each one had in the past according to

participant one reveal that there is definitely an impact on the achievement, meaning that those ex Departments of Education that were poorly resourced had poor achievement in Science. This is deduced from the following quote:

> *African schools which are located in African townships, in rural areas in poor areas …I try to cluster both of them and of course the scores of the learners in the African schools was about half the scores of the learners in the white schools so in terms of that measure of the measure of …ex department and the resources that each one had in the past we could see that there is a definite impact in the achievement, so there is poor achievement then.*

Participant one further refers to the African schools which she says are poorly resourced and are again attended by learners from poor home backgrounds. Their homes are poverty stricken in the sense that parents have a low level of education and work long hours where they cannot assist their children with homework or any academic work. The following quote suggests that:

> *Are the factors you are talking about totally to socio-economic, I mean we have children who are in schools which are poorly resourced themselves coming from homes in the township with poor resources .. and of course you are talking about social capital or cultural capital. The homes are characterized by parents who work long hours themselves not having a high level education themselves not necessarily working with their children to do their homework or assist them with the kind of academic work that they do. So all of those things start to impact, so you have a poorly resourced school catering for kids from poorly resourced homes the home its self is not able to provide a whole lot of social capital in order to access the present curriculum that we have.*

In other words, participant one says that the poorly-resourced schools are attended by learners from poor rural homes and townships which themselves (poor rural homes) lack the social or cultural capital necessary to access the present curriculum offered at schools.

From the foregoing participant one strongly believes that it is not that the learners from poor socio-economic backgrounds do not have social or cultural capital, the fact is, as participant one argues, their social or cultural capital does not match or is not what is required by the present curriculum of the school system. Furthermore the expectation of the curriculum of the school system is based on the assumption that all learners are from a middleclass background and this results in a mismatch between the expectation of the curriculum and the cultural capital that the learners from poor rural contexts have. It is therefore against this background that, as participant one argues, learners from poor socio- economic backgrounds have difficulty in accessing the curriculum of the school system.

Participant two, when responding to the same question, concurs with participant one that there is a relationship between eco-socio-cultural factors and Science achievements. Participant two indicates this by confirming that she has plenty of evidence for this relationship in Mathematics and this to some extent, quoting from her research studies, is replicated in Science.

By referring to the following statement, participant two confirms this:

> *Certainly I think following on what I have just said in the first in response to your first question, I think we've got plenty of evidence certainly I have very strong evidence for the maths and then to some extent it is replicated for Science that indicates that in fact there is a very strong relationship between particularly between socio economic factors, yes that is also correlated with cultural factors in this country and that will be also highly correlated with economic practice so I would certainly say yes there is a relationship between those two.*

Central to this, she informs that the relationship between socio-economic factors and Science achievement also correlates with cultural factors and further highly correlates with economic practice of the country, and she admits that the relationship is very strong.

6.1.2 What is your view on the relationship between eco-socio-cultural factors and science achievements at South African schools?

Both participants agree that there is a link between eco- socio- cultural factors and achievement in Science. However, though they agree on the relationship between these variables, their views and responses on this question tend to have diverse significances. Participant one verifies this by saying that various studies have shown that the relationship is strong. From the following quote participant one indicates that:

> *In terms of the relationship between the socio-cultural and socio-economic and the learner achievement, various studies have shown that socio-economic factors have affected achievement and I think the economist would say that contributes to about 50% to explain differences of learners. I think the structure is so straight forward because after the literature tells us that if you looking at differences then it's not only poverty, because you have many poor communities and poor societies and poor countries that do perform o.k. But the issue is not so much a …in South Africa is the inequality.*

From the above quote participant one reveals that from an economist's point of view socio-economic factors and its effect on learner achievement could contribute to about 50% in explaining differences in learner achievements. She says this based on the fact that it is not only poverty or poor socio economic contexts that explain the differences, as literature indicates, but there are other factors that may be used to explain the differences on learner achievement in Science. This is because there are communities and countries like Botswana and Brazil whose socio-economic condition is similar to that of South Africa, but perform well in Science. Participant one argues that inequality, amongst others, plays a significant role in explaining differences in achievement in Science. She further feels that both poverty and inequality, in the South African context, seems to explain properly the differences in learner achievements. Though socio economic factors have an impact on Science learners' achievement, it cannot entirely be

attributed to learners' achievement, unless if combined with other associated factors like inequality. This is deduced from the following quote:

> *What South Africa does have is a highly unequal Society and after Brazil it has what we call the highest hegenical /heterogeneity….which is the difference in income between the richest and the poorest and the reason why we take countries of similar socio-economic status and they perform better than us it might be that ours is more an unequal society. . So socio economic affects but not in a straight kind of ways, so if the whole country is poor but type whole society is of a homogenous group, then the unequalness is also a contributing factor.*

From the above quote, participant one strongly argues that among the reasons why countries like Botswana whose economic status is poorer than South Africa, performs well in Science and Maths subjects is the fact that South Africa, after Brazil, has a highly unequal society. This heterogeneity, which is the difference of income between the richest and the poorest, as participant one asserts, benefits only the minority rich both in economic and educational achievements. In this regard the richest automatically gain power and control over the poorest majority and as a result dominates and leads both economic and educational resources .From the foregoing, heterogeneity does not only exacerbate the unequal socio-economic status between the working class and the middle class, but further tends to contest with the unequal achievement of learners from the rich families and the poor families. So it is therefore within this framework that poor socio-economic factors and high levels of inequality as participant one argues, become basic causes of poor achievement in science. Participant one further indicates that inequality has no impact in a society that has homogeneous groups.

Considering the relationship of these variables in rural school contexts, participant one admits that poverty as compared to inequality is rife in rural areas and has a strong impact on the performance of Science learners. Participant one sees poverty of income as a barrier in accessing the curriculum of the education system, which she says, is based on the middle class background.

This is denoted this in the following quote:

> *We are talking about national schools here, of course the poverty does more in the rural area than the unequalness because it's the poverty of incomes, and the curriculum you are trying to access is a middle class curriculum, it is based on the assumption that you would have the certain experience base that you would be able to move to a certain know experience base in order to move to formal knowledge.*

From the above quote participant one further reveals that the middle class curriculum that deprives learners from poor socio-economic backgrounds is structured in a way that a learner must have a certain experience-base in order to acquire a certain knowledge experience-base so as to move to formal knowledge. This means that the middle class curriculum that is implemented in our education system demands that a learner must have relevant knowledge/experience acquired from his home background. If the learner comes from a poor, rural home background where parents are poor, unemployed with little or no formal education, the child from such family background will, according to participant one, fail to match or access the middle class curriculum of our education system. In actual fact the curriculum of the school system favours learners from rich families and well-resourced home background with educated parents who will be able to assist the learner by mediating the home background knowledge to the curriculum of the school system.

Learners anywhere do have experience or home background knowledge, argues participant One, particularly science phenomena, but the problem lies with the resources and mechanism of mediating this experience to the curriculum of the school system. This is revealed from the following quote:

> *Kids do have experience about the science phenomena, I think anywhere they have this experiences, every day is an experience, the difference for the rural kids or kids from poor backgrounds is that there is no mediation of that experience and nobody sort of talking about it and making sense and moving towards some sort of explanation, I think that's the kind of difference I'd put on it more. It's the poverty of knowledge around but if you had, say, teachers staying in the area, the old days the priest was an important source of knowledge, so if you had*

> *sort of knowledgeable adults to engage with then you would be making sense of those experience and building ones knowledge.*

From the above quote participant one insists that the lack of mediation between the home experiences of learners from the poor rural backgrounds with the school experiences disadvantages them from fitting into the curriculum of the school system. It is against this background that participant one views the absence of knowledgeable human resources like teachers and pastors in poor rural contexts as some of the barriers that disadvantages rural learners. This is because knowledgeable people, according to participant one, would tend to talk about learners' experiences and making sense of them through explanations and as a result build their knowledge necessary for accessing the school curriculum.

Participant two, strongly believes that there is a relationship between eco-socio-cultural factors and achievements at South African schools. Unlike participant one who referred to various studies done and from an economist's view of this relationship, participant two quoted from the demonstrated statistical relationship she co-researched. From their study they found that the relationship is strong and historically based. Quoting from the following response this is what she had to say.

> *Well we have demonstrated statistical relationships between these and as I say I think the relationship is also historically based. It is a pity that still in this day and age in 2011 we still have such a strong relationship between poverty and achievement and that we are unable to eradicate this poverty. I think that is something that is holding the country back.*

Participant two strongly feels that the relationship between poverty and achievement is a historical phenomenon which still hinders the performance of Science learners even in the post-apartheid era. She argues that failure to eliminate the impact of poverty amongst learners, achievement will hold the country's educational developments back.

Comparing South African schools' performance with that of developed countries such as Scandinavia, participant two reveals that performance between schools in developed countries has little difference or variance of achievement scores. Great variance of scores in such rich countries is, according to participant two, are found only within the school itself.

Participant two associates the variance in achievement scores of the rich countries with the cognitive ability and the social capital found within that school.

This evidence by Participant two is found in the following quotation:

> *What we also see, if you look to the Scandinavian models and of course I am talking now about rich countries but there is very little variance in the achievement levels between those schools. In other words what I am saying the scores between the schools vary very little and yet in South Africa that is our biggest source of variation that is the difference in the scores between the schools. The biggest difference in fact in most developed countries lies within the school. So it boils down to the cognitive ability of children and again the social capital within that school. But it doesn't differ so much in other words if the resources are equally spread. So resourcing teaching so many things are very similar and that has to do with the provisioning of education. Then home background counts a lot more than even our country. Here we have the combined effect of the very high variance between schools and then in certain schools we very high variance within the school as well. So that has to do with the heterogeneity of the various schools that we have here where we do have integration of children.*

Participant two further informs that variance of scores does not differ much if resources are equally spread. In South Africa, unlike the rich countries internationally, the variance in the achievement levels or scores is desperately huge between the different schools as well as within certain individual schools. From participant two's perspective, the combined effect of high variance of achievement scores in South African schools lies with the heterogeneity of a variety of schools with mixed learner populations.

The arguments of both participants on the notion of heterogeneity and its contributory impact on learner achievement in the South African school system are similar. However in as much as they are parallel, participant one considered the heterogeneity from a broader perspective which is the class stratum, while participant two contextualised heterogeneity at the level of the school. But they, as mentioned earlier, strongly believe that there is a relationship between eco-socio-cultural factors and achievement of Science learners at our schools.

### 6.1.3 How do we explain poor performance in science across urban black-indian-white (ex-model c) schools?

The response of both participants on this question is dissimilar. Participant one indicates that she has difficulty in differentiating between a rural and an urban area in the South African context and as a result finds it difficult to provide substantial data on the explanation of poor performance across urban Black-Indian-White (ex-model C) schools. Participant two on the other hand strongly feels that there is evidence explaining poor performance in Science across urban Black-Indian-White (ex-model C) schools.

To describe performance of Science learners across rural urban divide, according to participant one, sounds more complicated and too artificial. To substantiate this argument she refers to a poor achieving township school situated closer to the metropolitan area and another well resourced, achieving school, situated in a deep rural inland area. By doing this Participant one denotes a contrary/incongruity (of the artificial ruling) between rural- poor performing school and urban- well performing school. Quoting from the following excerpt, this is what she said:

> *I try to take rural and urban, it was meaningless to me to differentiate, you take all those private schools that exist in the Midlands areas, I mean, You take all those schools in the private schools that exist in the natal midlands areas, now they pay enormous fees, if I had to draw on that how would their performance be? So I find that notion of what's rural what's urban very difficult to explain, I thinks it more complex than that and complicated than that……one has to do with in more expanded terms than straight rural urban…*

In view of the above quote participant one states that using a straight rural-urban divide does not provide any explanation, and is more complex and complicated and she instead recommends a more expanded term to explain performance of Science learners across urban Black-Indian-White ex-model C schools, which she does not at this stage reveal.

Participant two, believes that there is evidence explaining performance in Science across urban Black-Indian-White **(**ex-model C) schools. She says that the previous regime funded schools unequally across racial lines. Schools for Blacks were

funded least followed in ascending order of funding by Coloured, Indians and Whites who received more than three times the amount received by Blacks. In this view participant two believes that such inequality in funding of schools had a negative impact on the matriculation pass rate. Asked to substantiate on this, this is what she said:

> *Okay to compare their performance. Well I think if you look at it in very crude terms, you had a racially segregated dispensation that funded the schools in an unequal way so and starting with the Black schools at the bottom and then the Coloured schools and then the Indian and then the White and you just have to go Buckland and Hofmeyer's work in 1992 and you see it clearly and so if you had to look at the matriculation graduation rates you would see correlations with the funding formula and with those graduations successful, completion of matric and also university entrance, you would see that very clearly. We see I think it is not a secret that over the years we have more successful candidates coming out, particularly for science you have seen them coming out of the former White and former Indian environments.*

From the above excerpt participant two thinks that the schools for Whites, which were funded more than other schools, produces better results in Matriculation with no learner drop outs. Moreover the highest number of Science university entrants came from these Whites and Indian schools respectively. Participant two confirms that historically highly funded schools produces a more successful number of Science learners, and this still happens even in the new democratic dispensation.

The Department of Education (2005) discloses that as late as 1986, the South African state spent nine times more on each white learner than it spent on learners in the worst off Bantustans, which were largely rural areas of the country. Central to this argument participant two strongly believes that if there is a substantial funding and allocation of resources to the school, then there will be a higher number of successful Science learners produced in that school environment. Arguing for this, this is what she said:

> *...similarly the teachers were trained on the same kind of funding scale, with Black teachers receiving probably the worst deal in terms of the*

> *type, length and provisioned teaching, teacher training compared to the White candidates who would have received probably the best resourced training. So you know it is not too difficult to put those explanations together to say in a highly segregated setting then the lowest funding, worst resourced, worst provisioned teachers and school settings and teacher training colleges would probably produce the lowest performance in science and in fact all indications we have had over the years have been the same.*

Apart from funding schools unequally by the previous regime, participant two reveals that Black teachers too received inferior and poorly resourced teacher training compared to Whites who received superior and fully funded training. It is therefore against this background that participant two strongly believes that, in a highly segregated setting as the one mentioned above, poorly funded, resourced and provisioned teacher training and school settings equate to lowest performing Science learners across racial lines in our schooling systems. Historical inequality of resources and provisions offered in our education systems, as participant two believes, produces inequality in performance of Science learners across White, Indian, Coloured and Black schools. This equation of inequalities denotes the scourge that has all along constantly ravaged the education system of our country.

Similarly, the comparative perspective on Education conducted in rural areas of China and South Africa revealed that resources are generally not fairly allocated between rural and urban areas, and most governmental expenditures are invested in construction in urban areas which results in much better lifestyles and social support in urban areas than in rural areas (Gordon & Qiang, 2000; Ben Barka, 2005).

### 6.1.4 To what extent is poor performance a function of rurality?

The responses to this question from both participants indicate that schools in rural areas have more challenges in terms of resources than schools in urban areas. Both participants admit that performance of Science learners in poor rural contexts are generally poorer than learners in urban environments. Despite the fact that they both agree, that comparing the level of performance of Science learners using only rural

urban divide and resourced and non-resourced schools as the only criteria, is too simplistic and insufficient, they therefore reveal that there are other contributory factors that may be combined with the aforementioned factors (rural urban and resources) to benchmark the extent of poor performance as a function of rurality. Asked to justify this, participant one said:

> *When you say, eh…..again, I think resources are too shared, what do you mean by resources? Are we talking about an area where there is less interaction with outside communities, it is more homogenized or kind of community, perhaps, I don't understands, you are talking about "procreative" communities.. (Unclear), and there is both interactive within it selves, and there is some talk of education experiences of the group, that the resources of the group, the experience of the group, the occupational level of the group. It is all at the very low level, then all those things are starting to impact on how children going in that environment start understanding their experiences and building there …their science knowledge, I think that gives more the better kind of definition than a straight rural urban, resources or no resources, or , because there are physical resources plus er.... these er…far more knowledge resources etc. ,so go for expanded definition of something, but don't use these shared words like rural, urban, resources, er ..it is too simplistic and you find that explanation are more complex ,*

Participant one, though she does not recommend using words like rural, urban and resources which from her perspective are too simplistic, for instance, she says that there can be physical resources or far more knowledge resources. She admits that when all the resources, educational experience, access to the outside community and the occupational level of the group are at the lowest, then they start to impact on the level of Science knowledge and performance of learners in that environment. (From the foregoing the other factors are found in rural areas). Participant one further indicates that accessing the school in deprived environments is very poor and opportunity costs are more difficult and from her viewpoint she sees no reason for learners from such environments to waste their little family resources by going to school if they know very well that they will not pass. In view of this, participant one concludes that, other than

poor resources, the other contributory factors which she says affect performance in poor environments are poor interactions in the classrooms, lower level of education, poor working conditions and poverty which she believes adds to the extreme challenges faced by learners in poor environments.

Challenges in poor environments are not only faced by learners alone, but by teachers themselves. According to participant one, differentials of income and poor working conditions faced by teachers force them to move away from such environments. Asked to elaborate on this statement, participant one had this to say:

> *The quality of those interactions in the classroom are very poor because we have teachers one of the big things we have is that there is such differentials of income. or income differential, conditions are very poor a teacher earns a different salary they move out of that area, they do not want to stay in this poor area when they are earning this salary, so you might stay on the outside and come back and teach here or etc. And it's very difficult to attract people to come and teach in these areas. So people are poor and they come in with no social capital but further more everything also implicates against them in that the rich get richer and the poor get poorer because there is nothing to draw into that space, [ I think we should have a missionary education, because missionary schools were more clinical, … I am fed up and done with this…..but jokingly ]*

Participant one, from the above extract, exposes the circumstances of the poor environments where, owing to the unequal salaries earned by teachers and poor working conditions they experience, they are forced to stay outside of this environment and only come in when they have to teach learners She says it is even difficult to influence other teachers to come and work in such poor environments. People in these environments, besides being poor also have no social capital and in the long run, the conditions do not seem to improve. Instead those who are historically disadvantaged and poor get poorer while the historically rich get richer. It is therefore against this background that participant one recommends missionary education which she jokingly says was more clinical than the current education system.

The current schooling system according to participant one is expected to offer every learner a better deal. As a state responsibility it is expected to give everybody irrespective of class a better life, like providing what the home failed to provide. When asked to elaborate on this statement, this is what she had to say:

> *But let me use the term er… poorer environments the input from the home to access the school is very limited and in developing countries one expects far more, we expect the institution of the school to give you a better deal, and that's the state's responsibility. I mean the schools are the responsibility of the state they want to try and give everybody a better life. So of course that kid, and the parents everybody then looks to the school as this institution to provide something that the home couldn't provide and you want the school to operate very well it very, very well, you want the environment to be well you want it to be functioning, we want learning to be taking place we want the classroom interaction to be of such a high quality that even if the child didn't have such an experience at home it should be given at the school. Now I think in South Africa, we are failing the kids that those who need the schools most, schools aren't there for children and the poorer the community is the more the schools in those communities, and it is going to be a case of the rich will get richer. The schools that are resourced, parents come in, they are able to pay the extra school fees and you get a whole range of experiences, you in an urban area, you in a suburban area, you going back to a whole lot of experiences to improve your learning. So if you asking me, Do I think that poor people are getting a good deal for education, my answer is no?, I think that is what they looking for er..the* ***school as an institution and this institution is failing the poorest***

Participant one argues that the school system is there to function well and provide quality learning equally across all levels of the society. According to its underlying policy, it manifests itself as one size fits all, but from participant one's view there is a dichotomy between what the school system advocates and what it normally does.

To substantiate this, she reveals that the school system fails learners from poor environments by not providing them with well-established school facilities similar to those in urban and suburban environments. To acquire high quality education one must be in urban or suburban areas in order to find well-resourced schools which are afforded by only rich parents who can access it by paying exorbitant fees.

It is therefore in this vein that participant one strongly argues that the South African schooling system fails the learners from poorest socio-economic backgrounds and from the foregoing, strongly believes that poor performance is a function of rurality. Arguing the same line with participant one, participant two agrees that 95% of rural schools are not as adequately resourced and supported as schools in urban and suburban areas, with the exception of Michael House and Hilton College which happen to be a few rich and well-resourced schools in rural or semi-rural areas. Participant two admits that rural areas are poorer parts of the country that experience poor performance, and she indicates that this poor performance cannot be entirely attributed to a few factors but rather a number of factors that may not be easily noticed at the beginning. When asked to elaborate on her argument, this is what she had to say:

> *Well I think we've covered this partly in our discussion about Michael house. Let's say 95% of rural schools however are not Michael house. Michael house and maybe if you want to term Hilton College which may also be a rural school and there will be a few in the Eastern Cape province perhaps, that may also be semi-rural, these are clear outlines and again I think that the poor performance in rural areas has to do with a lot of things which may not be necessarily obvious at the beginning. Yes rural areas we know on average are poorer parts of the country, generally, unless you happen to be in the Hilton area (Laugh) which case we haven't had a discussion about it's definition but I mean these are issues to do with access, they issues to do with teacher deployment, management of schools, the challenges that face rural people on a daily basis, the need to survive versus the need t for education so does my child go and collect firewood and water today or do they walk to school? So there are some challenges particularly in the Kwa-Zulu Natal area, child headed households, responsibilities and chores at home that may*

> *prevent them from going to school on a regular basis, malnutrition, and so I think there are several explanations that would be particular to rural areas that perhaps would not be as common in the urban areas.*

Considering the above extract, participant two believes that factors that cause poor performance in rural contexts are not confined to rural-urban and resources but to issues like access, teacher deployment, management of schools, daily challenges of rural people, need to survive versus the need for education, child headed households and malnutrition. In view of this she agrees with participant one and at the same time confesses that the aforementioned causal factors are challenges and justifications that affect particularly learners in rural areas and do not apply to learners in urban areas.

Participant two confirms that the plight of the rural schools is worsened if it is entirely attended by learners from deprived backgrounds and at the same time affected by these particular rural factors even at the management level of the school. This affirmation from participant two is deduced from the following extract:

> *No I think if you area school in a rural area with all the children coming from severely deprived backgrounds and it is not properly managed and you don't have dedicated teachers and you have a large number of child headed households and you have no monitoring and supervision and support from the District office then yes you are a candidate for poor performance in Science. However, if some of those factors are not in place and you get good support and you get strong teacher dedication some of those factors can be mediated and therefore poor performance in Science doesn't necessarily to be the norm.*

Participant two once more indicates that if rural schools can be supported and provided with all necessary facilities ranging from physical to human resources then some of these factors affecting particularly rural learner communities can be mediated. Hence the extent of poor performance as function of rurality may be eased.

## 6.2 CONCLUSION

This chapter presented findings and recommendations of part B of critical research two. Findings of the study indicated that resources are not the only cause of poor performance but there are a number of deep seated factors contributing to underachievement like social and cultural capital of our rural learners that does not match the curriculum of the schooling system. The study concludes by recommending that rural schools be supported in terms of infrastructure and other resources in order to attempt addressing the weak performance of learners in Science.

# CHAPTER 7
# DISCUSSION AND RECOMMENDATIONS

This last chapter aims to present a discussion on the key findings of the study as well as offer recommendations based on these findings.

Learners in poor rural school contexts learn Science under conditions that are not necessarily the same as their counterparts in urban areas. The socio-economic backgrounds of most rural learners are poor to the extent that for many families the main source of income is in the form of grants, be it the grandmother's pension or a child grant in the instance of unemployed parents (Smith, 1992; Smith &De Young, 1992). Central to this, is the TIMMS Science test results of 1995, 1999 and 2003 showed that achievements in both Mathematics and Science in our schools, particularly in rural schools, was below that expected.

Arguing along the same lines with the above statement is Bourdieu who reminds us that the major role of educational system is the reproduction of power relationship and privilege between social classes. Social inequality is reproduced and legitimated. Underprivileged position of the lower classes, arguing Bourdieu is legitimated by educational failure while privileged positions of the dominant classes are justified by educational success. As a result of the above scenario, together with my 20 years of experience teaching Science and Mathematics in poor rural contexts, this study was undertaken *to explore the role that cultural capital plays in the difference in achievements in the TIMSS Grade 8 Science test amongst the rural secondary schools of Mthwalume Circuit*. The study sought to explore the nature of the relationship between educational performance in Science of rural schools and the cultural capital that these schools possess.

The following critical research questions were designed and used as an underlying guideline to collect, analyse and discuss the data of the study:

1. **What is the difference in achievement amongst KZN schools in the TIMSS Grade 8 Science test, with particular reference to rural secondary schools?**
2. **How do researchers and policy makers explain/make sense of the relationship between learners' achievements in the TIMSS Grade 8 Science test and their socio- cultural-economic background?**

Critical question 1 was addressed in Chapter Four. Critical research question two was, on the basis of clarity and formatting, divided into Chapters Five and Sixe in order to allow for coherence of the data analysis of the study. Chapter Five analysed and discussed the data collected through semi-structured interviews and a probe arranged in themes for two researchers involved with the TIMMS and analysis of secondary sources from TIMSS studies collectively. Chapter Six discussed the findings from the four sub questions generated from critical research question two.

The study combined both qualitative and quantitative methods to collect data. Document analysis of secondary sources that comprised statistical analysis of the TIMMS Grade 8 Science results, collected in 1995, 1999 and 2003, by the Human Science Research Council (HSRC), which statistically informed how schools, particularly those in rural socio-economic contexts, achieved in Science subjects, was utilized as quantitative data.

Through, semi structured interviews, the probe and analysis of documents from the TIMSS 1995, 1999 and 2003 tests as qualitative data collection sources of the study; I intended to acknowledge the link that is often alluded to between socio economic status and achievement in rural secondary schools. In other words, I wanted to enquire to the researchers and policymakers through the use of semi structured interviews and probing how poor socioeconomic backgrounds of rural science learners related to the low achievements in science subjects.

## 7.1 DISCUSSION OF KEY FINDINGS

Findings of the study have all indicated that inequality in our society is, as Bourdieu indicates, propagated by our educational system which favours dominant groups. Working class learners who are from challenging rural contexts possess social and cultural capital that does not match the curriculum of our educational system. In this regard, Bourdieu (1977) claims that in a school where classroom knowledge is largely based upon knowledge of the dominant group, teaching and learning will favour the children of the dominant group and discriminate against those from the lower social strata. As a result of this, working class learners, particularly science learners, will achieve poorly while learners from middle class backgrounds will achieve well.

Findings also revealed that the Science curriculum of our education system is not meant for every learner but for those learners coming from a middle class background. The notion of inequality of income was raised in the study where South Africa, after Brazil has a high level of inequality. This inequality of income has benefitted only the minority rich at the expense of the majority poor in terms of controlling the resources and achievement at school level.

The findings of the study concurs with Bourdieu's theory of cultural capital influencing the performance of learners, but they will be discussed in greater detail in the following themes and sub questions.

### 7.1.1 Research Question 1: What is the difference in achievement amongst KZN schools in the TIMSS Grade 8 Science test, with particular reference to rural secondary schools?

The quantitative data for this research question was insufficient in that the names of the schools that participated in the study were not available owing to confidentiality and ethical related issues. Their performance in the form of statistics as required by the study was not accessible. However, their locations with no school names were denoted on the South African map using bold dots scattered and clustered unevenly on the map. What was deduced from the map of KZN is the fact that most of the dots were clustered along the coastal area where Mthwalume Circuit is situated.

Reddy (2006, p.114) reveals that South African learners performed poorly in all tests with African schools on the lowest rung of the ladder. Provinces that performed well were Gauteng and Western Cape which were historically well resourced. Eastern Cape, KwaZulu Natal and Limpopo had the lowest performance. From this data one can deduce that there are few schools that performed well in Gauteng and Western Cape compared to schools in lower performing provinces.

### 7.1.2 Research Question 2: How do researchers and policy makers explain/make sense of the relationship between learners' achievements in the TIMSS Grade 8 Science test and their socio- cultural-economic backgrounds?

Findings from the integrated qualitative data that was generated through the semi-structured interviews, the probe, and the TIMSS 1995, 1999 and 2003 secondary sources were presented according to nine themes.

These themes as indicated in Chapter four are**:**

(a) the home environment
(b) general school environment
(c) quality of teachers and teaching
(d) peer environment
(e) gender factors
(f) homework
(g) language of instruction
(h) curricula
(i) student motivation.

In the following section each theme is discussed briefly.

*Home environment* has shown that it has a strong effect on learner achievement in Science since learners from well-resourced home backgrounds where there is television, movable property like a car and access to different educational resources like computers perform well in Science. This theme further showed that its effect on learner achievement is traced back to the apartheid era where learners who came from poverty stricken backgrounds where parents have little or no educational background, are unemployed and cannot assist their school going learners with homework, perform poorly in Science.

The study further reveals that a well-resourced home background does not only generate better performing Science learners, but also places that home at a certain level within a societal class stratum. This in turn, according to the study findings, presents an insight into learner social and economic capital.

*General school environment:* The relationship between learner performance in Science and the general school environment is, according to the findings of the study, based on the quality and availability of both physical and human resources. The study found that performance of Science learners in a school environment with physical resources like Science laboratories, library, textbooks, enough classrooms, and electricity, amongst others is far better than in schools lacking these resources. The study further revealed

that poor performance of Science learners in African schools is attributed to a number of school environmental factors. These, according to the study, include poorly trained Science educators, poorly funded African schools, unequal distribution of resources, poor communication with the outside world as a result of rurality and distance from resource centres.

In addition the findings revealed that achievement of Science learners in South African schools is stratified along race and class lines. When the study looks at the performance of Science learners across the different ex-Departments of Education, it established that performance of learners in ex-House of Assembly, which was historically for whites only, typically well-resourced and located in areas of higher socio-economic status, was a much better as opposed to rural schools. According to the study, African schools face an overwhelming task in improving their learners' performance which is far worse than that of well-resourced ex-white schools.

In addition the study reveals that for these African schools, location in areas of poor socio-economic status is also a cause of poor performance for the Science learners because of the school environments. However, the study reveals that these schools have to endure the movement of better performing and resourced learners to higher achieving, more wealthy schools in urban areas.

*Quality of teachers and teaching:* The study revealed that the quality of Science teachers and the quality of teaching and learning of Sciences also the cause of poor performance of Science learners. Poorly trained teachers, as the study discovered, possess a poor knowledge base in Science subjects and this results in poor teaching and poor results of Science learners. The study further found that the poorly trained Science teachers were as a result of differentiated training by the previous apartheid regime. The apartheid regime provided schools for whites which were well located and resourced with better amenities and better qualified Science teachers. African schools in poor rural contexts had poorly trained Science educators with an inadequate body of science knowledge and as a result they produce poor achievement in Science.

The findings suggest that there is an acute shortage of suitably qualified Mathematics and Science teachers at the rural secondary schools level which, in recent times has been obscured by a publicised surplus of teachers in other areas of education. The study further discloses that since most of the Science and Mathematics teachers at

our schools chose teaching careers as a second and third choice, this has resulted in a less motivated teaching fraternity, who also has an inadequate body of knowledge in Maths and Science domains, and this in turn impacts negatively on the achievement of Science learners.

Half of the South African teacher community, particularly those in rural areas were reportedly feeling poorly prepared to teach either the Mathematics or Science curriculum. Upon inspection of their experience and qualifications, findings, reveal that very few teachers have significant experience in teaching Maths and Science subjects while a small percentage have university degrees in these subjects. At the centre of this qualifications debacle, those teachers who procured college diplomas in these subjects lack sufficient content knowledge making them feel poorly prepared and constrained to teach and this strongly impacts negatively on the achievement of learners in Science.

*Peer environment:-*Findings from this theme in relation to Science achievement was insufficient since peer environment in many South African schools does not support those learners who are determined to achieve high-quality results. In cases where good opportunities needs an expectation of equality of incomes, students can feel uncomfortable if their achievement is better than the average.

*Gender factors:-*Very little data from the study indicated that gender factors affect performance of learners in Science except the fact that the poor performance of girls in relation to boys is due to the global trend of discouraging girls to study Science and Mathematics. The study indicates that girl learners are given more domestic chores with less study time than boys and are in certain instances discouraged even by their teachers to per sue Mathematics and Science subjects. The effect of this attitude towards girls results in poor performance in Science. In most cases girls in rural areas are overburdened with domestic work and do not get enough time to complete their homework which negatively affects their performance in Science subjects.

*Homework* contributes to the performance of Science learners. The study revealed that learners who are from poverty-stricken home backgrounds and uneducated parents probably face challenges with homework assistance at home. There is also a strong finding from the study that teachers in South African schools spend more time checking homework than teaching new topics and as a result, fail to finish their syllabi in time which impacts negatively on the Science learners' performance.

*Language of instruction:*-The study established that language of instruction contributes to the poor performance of learners in Science. The study found that the use of English or Afrikaans as a language of instruction in tests disadvantages the majority of Science learners in terms of understanding. There was a strong relationship found between learners from poor socio-economic contexts and those who are not proficient in English with an achievement in Science subjects.

The study informs that many students, particularly African students encounter a problem where the language of instruction in Standard 5 and6 is English which is not the same as their home language. These African students suffer communication problems where foreign new Mathematics and Science concepts are introduced for the first time. The study further indicates that for these African students to understand they need the teacher to phrase and explain the test question in a language that is clear and understandable. This language problem is, according to the study, exacerbated if the teachers of these subjects are also not fluent in English because that further disadvantages the learners of Science.

From these aforementioned findings the study confirms that there is a strong relationship between lower achievements and not speaking the language of the test at home.

*Curricula :*-Referring to curricula, the study revealed that there is a strong relationship between curricula coverage and learner achievement. Findings also mention that there is a mismatch of the curricula that is taught at school, meaning that it does not favour the teaching and learning of Science learners and thus strongly cause poor achievement of Science learners. The Science curricula taught at schools does not only favour learners from poor backgrounds but also disadvantage learners from historically well to do backgrounds.

The study confirms that the South African Mathematics and Science curriculum has constantly received criticism owing to its irrelevant, boring and outdated syllabi. The chalk and talk approach and inappropriate assessment methods which have historically disadvantaged Science learners, particularly those of African rural descent were the underlying problems that prompted the major curriculum reform in the South African education system. Science curricula lacked the knowledge of basic science facts and understanding of Science concepts. The study found that it was the lack of these two factors which was also the possible cause of South African pupils' underperformance in Science. South African teachers were in many cases uninformed as to what curriculum they should implement.

*Student motivation* was found to have a strong impact on the performance of learners in the sense that children from poor backgrounds are less motivated to learn Science, and do not get motivation from their parents unless they are fortunately to get extra tuition from a particular teacher or the learner has an exceptional cognitive ability. Mathematics and Science has all along been regarded as the most difficult subjects that is meant for the select few. In this regard the negative self-concept learners have together with the wrong perception that these subjects are for the talented learners only contribute to their poor level of performance

After collecting data from the two participants through probing and a reference to the documents from the TIMSS 1995, 1999 and 2003 studies, the following four sub questions of critical research question number two were used further to interview the same participants of the study.

- *Is there a relationship between eco- socio- cultural factors and learner achievement in Science?*
- *What is your view on the relationship between eco-socio-cultural factors and Science achievements at South African schools?*
- *How do we explain poor performance in Science across urban Black-Indian-White (ex-model C) schools*?
- *To what extent is poor performance a function of rurality?*

Discussion of the findings of the above sub questions of critical research question two is presented below.

### 7.1.3 Research Question 2: How do researchers and policy makers explain/make sense of the relationship between learners' achievements in the TIMSS Grade 8 Science test and their socio- cultural-economic backgrounds?

#### 7.1.3.1 *Is there a relationship between eco-socio-cultural factors and learner achievement in science?*

In relation to the above sub question, the study found that the relationship between eco-socio-cultural factors and achievement in Science is strong, particularly when viewed across ex Departments of Education and racial lines. Findings revealed that-model C schools or white schools are well resourced and in most cases characterised by racial groupings. When comparing African schools which are poorly resourced and located in deep rural areas and townships with ex-model C Schools, findings revealed that Science scores of learners in African schools were about half the scores of learners in the ex-white schools. This measure of the ex-Departments of Education and the resources each one had in the revealed that there is definitely an impact on the achievement, meaning that those ex Departments of Education that were poorly resourced had poor achievement in Science. In other words the study informs that the poorly resourced schools are attended by learners from poor rural homes and townships access the present curriculum offered at schools.

From the foregoing the study strongly suggests that it is not only that the learners from poor socio economic background do not have social or cultural capital, the fact is, their social or cultural capital does not match or is not required by the present curriculum of the school system. Furthermore, the expectation of the curriculum of the school system is based on the assumption that all learners are from a middleclass background and this results in a mismatch between the expectation of the curriculum and the cultural capital that the learners from poor rural contexts have. It is therefore against this background that, as findings of the study claims, learners from poor socio economic backgrounds have difficulty in accessing the curriculum of the school system.

In conclusion, the relationship between socio economic factors and Science achievement was found to correlate with cultural factors and further highly correlate with economic practice of the country, and certainly the evidence of the study reveals that the relationship is very strong.

*7.1.3.2 What is your view on the relationship between eco-socio-cultural factors and Science achievements at South African schools?*

Findings of the study in relation to the above sub question, besides being relevant to the study, also surprisingly revealed new interesting facts.

The study revealed that from an economist's point of view, socio-economic factors and its effect on learner achievement could contribute to about 50% in explaining differences in learner achievements. This is mentioned due to the fact that it is not only poverty or poor socio-economic contexts that explain the differences, as literature indicates, but there are other factors that may be used to explain the differences in learner achievement in Science. This is because there are communities and countries like Botswana and Brazil whose socio- economic condition is similar to that of South Africa, but perform well in Science.

From this viewpoint the study argues that inequality, amongst others, plays a significant role in explaining differences in learners' achievement in Science. The study further reveals that both poverty and inequality, in the South African context, seems to explain the differences in learner achievements. So, though socio-economic factors have an impact on Science learners' achievement, it cannot entirely be attributed to learners' achievement, unless if combined with other associated factors like inequality.

The findings revealed that among the reasons why countries like Botswana whose economic status is poorer than South Africa, but performs well in Science and Maths subjects is the mere fact that South Africa, after Brazil, has a highly unequal society. This heterogeneity, which is the difference of income between the richest and the poorest, as the study asserts, benefits only the minority rich both in economic and educational achievements. In this regard the richest automatically gain power and control over the poorest majority and as a result dominates and leads both economic and educational resources.

From the foregoing, heterogeneity does not only exacerbate the unequal socio-economic status between the working class and the middle class, but further tends to contest with the unequal achievement of learners from the rich families and the poor families. So it is therefore within this framework of poor socio-economic factors and high levels of inequality, as the findings of the study confirm, that poor achievement in Science originates. Evidence further indicates that inequality has no impact in a society that has homogeneous groups.

Considering the relationship of these variables in rural school contexts, the study found that poverty as compared to inequality is rife in rural areas and has a strong impact on the performance of Science learners. Poverty of incomes is, according the findings, a barrier in accessing the curriculum of the education system, which is based on learners of middle class background.

It was further revealed that the middle class curriculum that deprives learners from poor socio-economic backgrounds is structured in a way that a learner must have a certain experience-base in order to acquire a certain knowledge-experience-base so as to move to formal knowledge. This means that the middle class curriculum that is implemented in our education system demands that a learner must have a relevant knowledge/experience acquired from his home background. If the learner comes from a poor rural home background where parents are poor, unemployed, with little or no formal education, the child from such family background will, according to the findings, fail to match or access the middle class curriculum of our education system. In actual fact the curriculum of the school system favors learners from rich families and well-resourced home backgrounds with educated parents who will be able to assist the learner by mediating the home background knowledge to the curriculum of the school system.

Learners anywhere do have experience or home background knowledge, as the findings reveal, particularly Science phenomena, but the problem lies with the resources and mechanism of mediating this experience to the curriculum of the school system. In this regard the lack of mediation between the home experiences of learners from poor rural backgrounds with the school experiences disadvantage them from fitting into the curriculum of the school system. It is against this background that the study views the absence of knowledgeable human resources like teachers and pastors in poor rural contexts as some of the barriers which disadvantages rural learners. This is because knowledgeable people would tend to talk about learners' experiences and making sense of them through explanations and as a result build their knowledge necessary for accessing the school curriculum.

Since the relationship between poverty and achievement is a historical phenomenon which still hinders the performance of Science learners even in the post-apartheid era, the study warns that failure to eliminate the impact of poverty amongst learners, achievement will also hold the country's educational development back. The

variance in achievement scores of Science learners in rich countries where equality in resources prevails is little. Variance in achievement scores of the rich countries is associated with the cognitive ability and the social capital found within a school.

#### *7.1.3.3 How do we explain poor performance in Science across urban Black-Indian-White (ex-model C) schools?*

The study found that there is evidence explaining poor performance in Science across urban Black-Indian-White (ex-model C) schools. The study found that using a straight rural- urban divide does not provide any explanation, and is more complex and complicated and instead a more expanded term to explain performance of Science learners across urban Black-Indian-White ex-model C schools is recommended.

From the foregoing, findings revealed that the previous regime funded schools unequally across racial lines. Schools for Blacks were funded least followed in ascending order of funding by Coloured, Indians and Whites who received more than three times the amount received by Blacks. As a result, such inequality in funding of schools had a negative impact on the matriculation pass rate. The schools for Whites which were funded more than other schools, produced better results in Matriculation with no learner drop outs. Moreover, the highest number of Science university entrants came from these Whites and Indian schools respectively (Reddy, 2006). From this background the study confirms that historically highly funded schools produce more successful number of Science learners, and this also still happens even in this new dispensation.

Apart from funding schools unequally by the previous regime, the findings revealed that Black teachers received inferior and poorly resourced teacher training than Whites who received superior and fully funded training. It is therefore against this background that, in a highly segregated setting as the one mentioned above, poorly funded, resourced and provisioned teacher training and school settings equate to lowest performing Science learners across racial lines in our school systems. In this vein historical inequality of resources and provisions offered in our education systems, produces inequality in performance of Science learners across White, Indian, Coloured and Black schools. This equation of inequalities denotes the scourge that has all along constantly ravaged the education system of our country

*7.1.3.4 To what extent is poor performance a function of rurality?*

The findings to this question indicated, as in previous questions, that schools in rural areas have more challenges in terms of resources than schools in urban areas and that comparing the level of performance of Science learners using only a rural-urban divide and resourced and non-resourced schools as the only criteria, is too simplistic and insufficient. The study therefore revealed that there are other contributory factors that may be combined with the afore-mentioned factors (rural-urban and resources) to benchmark the extent of poor performance as a function of rurality. These factors include poor interactions in the classroom, poor working conditions, teacher deployment, need to survive versus need for education, child headed households, malnutrition and lower level of education.

Findings further revealed that accessing the school in deprived environments often difficult and opportunity costs are more difficult and from this viewpoint there is no reason for learners from such environments to waste their little family resources by going to school if they know very well that they will not pass. Challenges in poor environments are not only faced by learners alone, but by teachers themselves. According to the findings, differentials of income and poor working conditions faced by teachers force them to move away from such environments and only come in when they have to teach learners. People in these environments, besides being poor also have no social capital where in the long run the conditions do not seem to improve. Instead, those who are historically disadvantaged and poor get poorer while the historically rich get richer. It is therefore against this background that the study recommends missionary education which was more clinical than the current education system.

It was also revealed that the school system is there to function well and provide quality learning equally across all levels of the society. According to its underlying policy, it manifests itself as a one size fits all. But from the perspective of the study there is a dichotomy between what the school system advocates and what it normally does.

To acquire high quality education one must be in an urban or suburban area in order to find well-resourced schools which can be afforded by rich parents only, who can only access it by paying exorbitant fees. It is therefore in this vein that the study findings

stress that the South African school system fails the learners from poorest socio-economic backgrounds and from the foregoing strongly believes that poor performance is a function of rurality.

The conclusion recommends that if rural schools can be supported and provided with all necessary facilities ranging from physical to human resources then some of these factors affecting particularly rural learner communities can be mediated.

## 7.2 RECOMMENDATIONS

The study found that challenges experienced by Science learners in poor rural and poor socio-economic contexts are superficially understood because they are viewed merely through economic and geographical lenses. Challenges faced by poor, rural communities, which in most cases comprise the larger percentage of the country's learner population are deep rooted and if they continued to be perceived as general and normal, our education system will still lag behind and again remain categorised in the least bracket of the less functioning education systems.

From the foregoing the study recommends to policymakers, researchers and other relevant stakeholders that a broader view should be adopted in order to solve the problems of the country's poor performance in general, and poor, rural socio-economic backgrounds in particular. These broader views should be in the form of intensive broader and small-scale research if not longitudinal studies and surveys.

### 7.2.1 General recommendations

The study recommends that poor, rural schools be provided with substantial physical and human resources in order to mediate their problems of poor performance. There should be enough infrastructures in rural contexts so that there will be no exodus of teachers and learners to well-resourced urban schools. Changes to our curricula should be adjusted in order to suit equally both the social and cultural capital of the South African learner community. Sweeping statements like "there **are some** schools in rural areas that perform well in Mathematics and Science" from the Department of Education officials are encouraging, but at the same time discouraging. Innovative steps from the stakeholders to rescue the rural learner community from their deep seated challenges should be developed and implemented. This is because such statements may

blur the intensity and epicentre of the rural challenges and sabotage any contributory endeavours from any still willing to assist organisations and stakeholders.

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**APPENDIX A REQUEST LETTER TO CONDUCT RESEARCH**


THE DIRECTOR
HUMAN SCIENCE RESEARH COUNCIL
PO BOX 456
DURBAN
4000

DEAR SIR /MADAM

RE: Request to collect data for research study

I am a master's student from the University of KZN at Edgewood Campus conducting research on 'The role of cultural capital in the difference in achievements in TIMMS Grade 8 science test among rural secondary schools of Kwa Zulu Natal'.

It would be greatly appreciated if you could kindly allow me to interview you in relation to the aforementioned research topic. Should you agree to be interviewed, it will be again humbly appreciated if you could furnish the time and date on which interviews can be conducted.

In that regard the instruments or interview questions will be forwarded to you prior to the interview.

I would like to assure you that in any case, anonymity and confidentiality will be guaranteed in the sense that no real names will be used in the write up of the data, and that the actual data will be used for academic purpose only.

Thank you for your assistance. Any queries may be referred to the Supervisor, Dr B P Alant, (031 260 7606).

Yours sincerely.

M J Nxumalo (Mr.)-204001637

**APPENDIX B QUETIONNAIRE FOR RESERACHERS**

**QUESTIONS TO THE RESEARCHERS AND POLICY MAKERS**

- Introduce myself to the researchers.
- Mention the research title and focus.

**QUESTION ONE**

*According to Sara Howie the following factors have been identified to have a link in learners' achievements in science in the TIMSS studies,*

They are:

- the home environment
- general school environment
- quality of teachers and teaching
- peer environment
- gender factors
- homework
- language of instruction
- curricula
- student motivation

What do you think?

**QUESTION TWO**

Is there a relationship between eco- socio- cultural factors and learner achievement in Science?

Question three

*What is your view on the relationship between eco-socio-cultural factors and science achievements at South African schools?*

**CHAPTER 6**

*How do we explain poor performance in science across urban Black-Indian-White (ex-model C) schools*?

**CHAPTER 5**

*To what extent is poor performance a function of rurality?*

# APPENDIX C INTERVIEW WITH RESEARCHERS February 2011

## TOPIC: THE ROLE THAT CULTURAL CAPITAL PLAYS IN THE DIFFERENCE IN ACHIEVMENTS IN THE TIMMS GRADE 8 SCIENCE TEST AMONGST THE RURAL SECONDARY SCHOOLS OF KWAZUKU NATAL.

Justice: All right Professor Lucy the question one is, according to Sarah Howie the following factors have been identified to have a link in learner achievement in the TIMMS studies. They are the home environment, general school environment, quality of teachers and teaching, peer environment, gender factors, homework, language of instruction, curricular, student motivation, why so professor

Professor: Okay firstly one has to distinguish between the results coming out of the 1995 study and the 1999 study. So if I look and I see well in the south African environment in particular now I am assuming that you only referring to the South African environment? Ja okay well if that is the case then I think historically we have many reasons why the whole environment for instance would play a very important distinguishing role in terms of achievement in South Africa. So many of these underlying factors have to do with poverty, have to do with the fact that with the previous regime we had differential funding of schools, so if you take on your first list that you have here the home `environment, homework, language of instruction, student motivation, those factors many of them are linked to the issue of poverty and home resourcing, education of parents which is not listed but is inherent in the home environment. So where we have children from very

poor backgrounds, unless there are exceptional factors such as special tutoring by particular teacher, or exceptional cognitive ability of a child, these other factors are likely to have a negative effect on the child. But children who are coming out of poor environments where the parents at home have for instance have a very strong motivation towards learning themselves or really support the learners in terms of their studying at school, they can negate the poverty effects that we see across most of the studies. So when the 1999 study was done and I in fact my last work on this the strongest factor in actual fact was home language and its effect on their achievement, and of course that is taking into account all the other factors like the SES (Socio Economic status) as it was measured in that study and taking into account their self-concept. So we needed to have a more detailed analytical tool to really to really study those relationships and in the 1999 study we were able to do that by including a national option on home language, basically testing English language proficiency. So ja that is one of the reasons we could actually have a look at that. So I think poverty underlying many of these factors does play a very strong negative role and this is further supported by a lot of international research on the topic. So and then if we take the school environment this is a hangover still from the previous regime where we set differentiated funding of schools meaning some schools were funded much more richly than others resulting in few resources in many cases and also differentiation in teacher training. So those factors don't necessarily manifest directly in qualifications of teachers per say, but they certainly impact on the quality of the teachers themselves and the teaching that they are able to conduct and they certainly have an impact on the general school environment

Justice: Thank you very much Professor. Thanks very much for that response, besides being relevant, it also enhance an insight of my study, and question two

Professor: Is **there a relationship between eco socio and cultural factors and learner achievement in Science?**

Professor: Certainly I think following on what I have just said in the first in response to your first question, I think we've got plenty of evidence certainly I have very strong evidence for the maths and then to some extent it is replicated for Science that indicates that in fact there is a very strong relationship between particularly between socio economic factors, yes that is also correlated with cultural factors in this country and that will be also highly correlated with economic practice so I would certainly say yes there is a relationship between those two.

Justice: Thank you very much Prof. And Prof let me come to question number three. **What is your view on the relationship between eco socio cultural factors and science achievements at South African schools?**

Professor: hmmm could you elaborate a little bit on what you mean by your view?

Justice: In fact I humbly want Prof to express her perceptions on the impact these factors have on achievement and also to draw from the previous research that Professor Howie has done in relation to such factors.

Professor: Well we have demonstrated statistical relationships between these and as I say I think the relationship is also historically based. It is a pity that still in this day and age in 2011 we still have such a strong relationship between poverty and achievement and that we are unable to eradicate this poverty. I think that is something that is holding

the country back. What we also see, if you look to the Scandinavian models and of course I am talking now about rich countries but there is very little variance in the achievement levels between those schools. In other words what I am saying the scores between the schools vary very little and yet in South Africa that is our biggest source of variation that is the difference in the scores between the schools. The biggest difference in fact in most developed countries lies within the school. So it boils down to the cognitive ability of children and again the social capital within that school. But it doesn't differ so much in other words the resources are equally spread. So resourcing teaching so many things are very very similar and that has to do with the provisioning of education. Then home background counts a lot more than even our country. Her we have the combined effect of the very high variance between schools and then in certain schools we very high variance within the school as well. So that has to do with the heterogeneity of the various schools that we have here where we do have integration of children.

Justice: In other words you strongly believe that socio economic cultural factors contribute much to the achievement of science in our schools? You actually discussed these aspects Prof when I read one of your articles that you wrote in 2006 with Professor Venter, exploring what learners …….

Professor: Yes, yes.

Justice: Where you considered the levels of what socio economic context that they are actually disadvantaged than the ones which are better disadvantaged. I thought out of all the aspects you mentioned the they all point to the fact that socio economic conditions all affect what is achieved. You strongly believe in that?

Professor: Correct, correct.

Justice: And prof what about the issue of rurality? I just want an explanation because while I was interviewing another scholar she mentioned categorically that it is hard in South African context to find the difference between an urban and a rural area.

Professor: Yes

Justice: She mentioned so many things like the municipality borders of the new dispensation…….. {Unable to make out the word here) For instance in my context you see Durban used to start along the sea and end up as far afield as Isipingo which is almost +/-50kms from the center of Durban. But now in this new dispensation the borders have extended to far afield as Umkomazi. Umkomazi and Scottburgh were the areas which were usually explained as being rural but now it has been accommodated by the municipality of Durban. And what is your view on that prof? Whenever I ask I don't get precise information.

Professor: What is my view on the poor performance being an extent of rurality? (Laugh)

Justice: No in fact the issue of rurality.

Professor: How to define it?

Justice: Yes Prof yes because other scholars told me that it is difficult to define a rural area and a urban area.

Professor: Sure. I have to tell you that we have had, one for my sins I also sit in a International Questionnaire development group called Pearls and we

are a group of six international researchers and we have had many discussions over the definition of rurality. What's rural in South Africa tends to be slightly different in terms of what is rural in the Netherlands for instance and that simply in terms of distance from an urban area, so I think the geographers are the ones who are arguing about this one. (Prof laughs) And if I look at it geographers and the demographers are having quite a battle in terms of defining it in a way that we can use in terms of social studies. What I understand is in terms of once people move out of an urban area such that they don't have easy access to public amenities then I would start to term that as being in rural areas. Where there is quite some distance from municipal offices and public libraries and sports facilities so I know that there is quite a nuance discussion going on but for myself when I start to look at the denial of provision of resources and being let's say almost isolated from having to having access to what I think people should have access to then I think of rural areas.

Justice: On the notion of the school that is situated right in deep rural areas like you find here in Kwa Zulu Natal you find that there are good schools right in the rural area
Professor: Absolutely

Justice: The school is very well resourced and the results are absolutely superb so in relation to the rural areas and all the performance at such schools what can you say?

Professor: Well then clearly then it is not an issue of rural area is it? It is an issue of resourcing and provisioning of that school. So I think we have to be very careful in terms of classifying all schools in rural areas as being disadvantaged. I mean this is I mean they have to go hand in hand in terms

of their resourcing. I know Michaelhouse. It is a very sort after school both for pupils and for teachers. Teachers want to go and teach in that rural isolated area. I don't know to what extent the teachers want to go to the far north of Kwa Zulu Natal to go and teach in rural areas. Perhaps if they had the same opportunities and access to resources they would. So you know for me it is not only about rurality. It is about how do we provide quality of education in every part of the country. And you know on that note I think it is very important to say that it is not only a matter of socio-economic status equaling deprivation I believe that schools that are well run, well managed, organized, that have very good teaching staff can successfully mediate children's backgrounds when they come from severe poverty I think if you have very good teachers they can compensate the child's background in fact we see some of that in some of the magnet schools around the country so if you look at Mbiwe up in quite an isolated area in Limpopo and the results they have achieved in Science and mathematics you look at the ingredients of that school and amongst others you find that, Yes they have an over subscription of very bright children so the bright children in all that area come to that school because the parents identify it as a school that can make a difference. Why because they have a head who is passionate about Science and Maths. Who is very dedicated, who has recruited teachers who are equally passionate, well qualified, who are on a mission to improve and provide access to good quality education for children. So that has nothing to do with poor children or let's say less well-resourced than the Michaels Houses of this country but it has to do with quality, drive, passion for the subject and strong student and parent motivation.

Justice: Prof thanks very much for that response prof. It was very interesting. Prof if you find that at that Michael House School most of the learners who are sent there by their parents are the learners from the well to

do families. Those from the working class do not have access to that because the fees are so high.

Professor: Well there are a few that come in on bursaries.

Justice: That's right prof ja. So that reminds me of what Bourdieu notion of cultural capital ……. Which indicate that those learners who come from well to do families possess wealth, good culture and power and you find that they are the one who define the type who define the type of knowledge that must be learnt by the working class learners and what is your comment on that prof?

Professor: Yes I hear what you saying. I am familiar with Bourdieu and social capital but I have to say I have seen enough contrary examples that whilst you may say on average a child coming let's say from a more privileged background has a better chance, I have also seen many children that because they come from privileged background in fact lack the motivation to do well and often do not perform even when they are given the opportunities. So increasingly countries like in the Middle East for instance, Kuwait, Bahrain, Qatar, even east of Australia are having serious problems to motivate their children coming from well to do families because there is no real motivation to do that. They will take over their parent's business. They already have let's say all the privileges in place that it doesn't matter if they do well at school or not. They still have a plan whereas the children from poor backgrounds have no plan to fall back on. If they do not perform they go back into the cycle of poverty or they remain in the cycle of poverty. So I am not entirely convinced that theory holds in all circumstances and the idea of the middle classes determining what is knowledge and what is not knowledge, well that is a philosophical

discussion which of course yes partly holds true. (Laugh) Those that are creating the knowledge and are the so-called intelligentsia of the country obviously drive the knowledge agenda. I mean that is beyond dispute but whether or not that is ultimately is going to affect the performance of poor children, I have my doubts in all cases.

Justice: Thanks very much ,Prof. Thanks very much for the information. I want to know whether I can go on to question four?

Professor: Yes sure.

Justice: How do you explain poor performance in science across urban Black, White Indian ex model C schools?

Professor: Again I am not sure whether I understand your question in terms of how do we explain it, what do you mean by explain it?

Justice: In fact it is on to your earlier comments, you see Professor Howie historically you see our education system was divided into so many departments , basically they were House of Assembly, House of Representatives, House of Delegates and Department of Education and Training you see. From my experience Prof, how can you explain or how can you compare the performance among these four?

Professor; You asking me to compare their performance?

Justice: Of course yes Prof.

Professor: Okay to compare their performance. Well I think if you look at it in very crude terms, you had a racially segregated dispensation that funded the schools in an unequal way so and starting with the Black schools at the bottom and then the Coloured schools and then the Indian and then the White and you just have to go Buckland and Hofmeyer's work in 1992 and you see it clearly and so if you had to look at the matriculation graduation rates you would see correlations with the funding formula and with those graduations successful, completion of matric and also university entrance, you would see that very clearly. We see I think it is not a secret that over the years we have more successful candidates coming out, particularly for science you have seen them coming out of the former White and former Indian environments. So if you look proportionally then those environments will produce higher numbers of successful candidates in science but as I was saying right at the very beginning I think that this has to do with one, certainly the provisioning and the one the resources and then two, similarly the teachers were trained on the same kind of funding scale, with Black teachers receiving probably the worst deal in terms of the type, length and provisioned teaching, teacher training compared to the White candidates who would have received probably the best resourced training. So you know it is not too difficult to put those explanations together to say in a highly segregated setting then the lowest funding, worst resourced, worst provisioned teachers and school settings and teacher training colleges would probably produce the lowest performance in science and in fact all indications we have had over the years have been the same. What's interesting for me is to see whether that is shifting and if you take the Imbiwe example which is a rural black, I think entirely Black, maybe there is an Indian child there but it almost entirely Black, those children are competing on equal level in terms of top performance in terms of Maths and science. So what is it that makes it different if we talk about

good performance, which I also like to talk about instead of only the poor performance, then we can see some very important characteristics coming out explaining good performance and it happens to center around, time on task, teacher's dedication, good lesson planning and lets say a minimum level of resourcing, not good resourcing necessarily but a minimum adequate level of resourcing and then combine that with the desire to learn on the part of the learners and then you have a recipe almost for good performance. Poor performance is easy perhaps to explain but good performance we have to start to seek alternative answers in a more nuanced way when we look at deprived backgrounds.

Justice: Thank you very much prof. Now Prof question five, **To what extent is poor performance a function of rurality?**

Professor: Well I think we've covered this partly in our discussion about Michael house. Let's say 95% of rural schools however are not Michaelhouse. Michaelhouse and maybe if you want to term Hilton College which may also be a rural school and there will be a few in the Eastern Cape province perhaps, that may also be semi-rural, these are clear outlines and again I think that the poor performance in rural areas has to do with a lot of things which may not be necessarily obvious at the beginning. Yes rural areas we know on average are poorer parts of the country, generally, unless you happen to be in the Hilton area (Laugh) which case we haven't had a discussion about it's definition but I mean these are issues to do with access, they issues to do with teacher deployment, management of schools, the challenges that face rural people on a daily basis, the need to survive versus the need t for education so does my child go and collect firewood and water today or do they walk to school? So there are some challenges particularly in the Kwa-Zulu Natal area, child headed households, responsibilities and chores at home that may prevent them from going to school on a regular basis, malnutrition, and so I think there are several explanations that would be particular to rural areas that perhaps would not be as common in the urban areas. However, having said that on the fringes of urban areas you find informal settlements

and again the poverty issues around chores, survival maybe very similar to the rural areas so I think one has to be careful of simply saying it is a rural problem or it is a urban problem. I think you have poverty levels in the urban areas that are even more extreme sometimes than rural areas but in general I think you have more poverty at a deeper level in rural areas. So I am kind of saying a little of both (Laugh) I think you can't just make a general sweeping statement to say if you are a school in a rural area you are likely to have poor performance. No I think if you area school in a rural area with all the children coming from severely deprived backgrounds and it is not properly managed and you don't have dedicated teachers and you have a large number of child headed households and you have no monitoring and supervision and support from the District office then yes you are a candidate for poor performance in Science. However, if some of those factors are not in place and you get good support and you get strong teacher dedication some of those factors can be mediated and therefore poor performance in Science doesn't necessarily to be the norm.

Justice: Wonderful Prof. You see all these answers you gave me you see just opened another picture in my mind. Things that I was talking about are now clear Prof. No thanks very much Prof to have an interview with you Prof but lastly before I forget, so if you like Prof Learners from the middleclass families and those from the working class families according to Bhodo those from middle class families possess wealth, power and good culture, in order to succeed in the system, Prof what can you say about the education system of our country, does it cater for every individual body in poor environments and in well-resourced environments? Does it cater for those people or does it only favour those from a middle class family?

Professor: well I am starting to think that it is not even favouring those from a middle class society anymore. I think the system is failing many children. I think it fails the poor children horribly. I think with few exceptions we are starting to see some progress in some areas. I see some progress in Gauteng for instance in poor areas, I see some progress in the

western Cape, in some poor areas where there is a greater effort to resource them better, to monitor and support in a better way. That I do see but I think that the system is starting to put a very heavy burden on middle class government institutions. I don't want to talk about private institutions because if we talk about the system then we talk about the government system. I think in particular government is not supporting the middle class environments in the way it used to. So in fact those teachers are now far worse off than they were before, they not supported and worse they not supporting the poor children that go into those middle class environments. I am thinking now about the former Model C schools. If you talk about them, if you classify them as being middle class. In fact many of them were poor White schools as well in the former system. Now what is happening is that they are catering for a mix of children, many of them now cater for poor children, poor White, Black, Coloured, Indian children all mixed up in one. Those children are being failed too. So the system is certainly not advantaging I would say middle class children in systems where they had far more privileges. I think it is not supporting them adequately and I think it fails the majority of let's say working class which would probably predominantly be Black, Coloured, Indian and poor White areas. That they are certainly not doing enough to support and that is where our science is failing with very few exceptions.

Justice: Prof I just once read I just heard another scholar saying that the social capital of the rural or the learners from the poor rural areas doesn't match with the curriculum of this new dispensation, what is your comment on that Prof?

Professor:  well first you have to define for me what you regard as social capital within a South African environment. What do you see as the social capital?

Justice: Prof although I may not that much 100% clear but from my own perspective social capital is about good values, cohesion between social members helping one another in case there is a problem, caring and sharing a network of resources and all those things. All those issues of social capital. I don't know whether I am clear?

Professor: You see this is where it is interesting to have such discussion because I have some colleagues working in Austria and Germany, you are looking at social capital under the theory of Bhudo and they are defining and measuring social capital in a very different way In their environment so for instance when they try to measure they measure income, they measure parental education, they possessions in the home and in particular they measure something like musical instruments which they feel is a manifestation of social capital in their environment. Now if we measure in our environment musical instruments it doesn't reveal the middle class. It reveals really our more elite group of people in this country because it is not a typical middle class, as we understand it across the board attribute. It would be an upper middle class attribute to have musical instruments in your home but then in the poorest rural environments you may also have musical instruments, it may not be a violin but it may be a drum so how do you measure social capital in South Africa in a way that would be valid across communities and would make a distinction between rich and poor, urban and rural is something maybe to have a think about but I trust it would be somewhat different to the way we measure it in Germany and Austria. For instance we may look at the type of dwelling as opposed to

their definition in terms of housing we would maybe look at the quality of the flooring, the quality of the roofing, the quality of the walls, are we using stone. Wood, thatch, mud, brick, what are we using? And you couldn't use something like thatch because in the richest homes you have thatch, in the poorest homes you have thatch, this is not a distinguishing factor but a distinguishing factor would be mud bricks and cement and bricks. So then we getting to very more detailed and challenging forms of measurement.

Justice: No thanks Very much Prof. Now Prof I should thank you very much for allowing me to come and interview you. I think what I have acquired today will be much useful in my research. Thanks Prof.

Professor: I am very glad. Did you get the information which you required for your thesis do you think?

Justice: Yes Prof, yes even more than that. You see when I came here I had some doubting questions but now everything is clear. What I have procured here will be very much useful. I am sure my supervisor will also be very happy. Thanks very much. You have answered my questions very well Prof Lucy.

# APPENDIX D INTERVIEWS WITH REASEARCERS

## QUESTIONS TO THE RESEARCHERS AND POLICY MAKERS

- Introduce myself to the researchers.
- Mention the research title and focus.

### QUESTION 1

*According to Sara Howie the following factors have been identified to have a link in learners' achievements in science in the TIMSS studies,*

They are:

- the home environment
- general school environment
- quality of teachers and teaching
- peer environment
- gender factors
- homework
- language of instruction
- curricula
- student motivation

What do you think? (Dr Charmaine)

I guess you got that from Sara Howie's report where she did TIMSS study 99, now you know both in the TIMSS study of 99 and 2003 South Africa performed very poorly, now when you have such poor performances and, and what we call that a flaw effect of scores. It is very difficult to isolate a single factor that causes poor performance, so of course everything affect, now there is a whole list of factors which

any….., if you look at general factors of schooling that affect/contribute to school improvement or contribute to school environment, teaching and learning, those are all the ingredients often learning environment, and with such poor scores that the country achieve of course everything affects it so in some ways one can't sort of disagree with anything any sort of scores the only one that I can say in 2003 was not a factor was the gender factor because the boys and girls both performed equally badly there wasn't a significant difference in the scores. Every one of them except in terms of the home environment from the data there wasn't enough data as far as I could see that could show this, what it does, the data tells you that there are sort of certain proxies for what resources are in the home, do they have a TV do they have a car, and all of these resources give you an indication of what is this, whether they be middle class or poor class but that doesn't tell us about them. We can't talk about the environment just the resources of the home, so it's more important to see that the home resources are very limited and they probably an indication of the economic class of the group and therefore poverty seems to affect performance the general school environment that's everything, I suppose you've looked into TIMMS instruments which will also tell what information on those instruments that tell about general school environment, and they would have told you about the building, its more the physical, the instruments tested the physical environment of the school or sort data on the physical environment of the school, it tells you of the state of the building, the state of the toilets, what kind of resources are there. So one I suppose extrapolates form there it does say about resourcing.

The quality of teaching and learning. Again as you know that these would have been indicators, to come to that conclusion classes were not

observed. Peer environment, what's that, I'm not aware of any questions in the instrument that asked about peer environment and its impact. Gender factors as I've said in 2003 we found that both did the same, poor performance. There was a question on how learners were asked how often they did homework or not. About the language of instruction again, we found that of course language of instruction because the tests would in either English or Afrikaans and majority of learners have a different home language. The curriculum again what I think what she was referring to was curricular coverage and the curricular according to the TIMSS instruments research it's a particular curricular its an international instrument, and the curriculum that is taught in schools where there might have been a mismatch of curriculum. Student motivation I'm not sure about that because if one looks at the TIMSS data you find that actually South African kids perform the poorest but thy always say they value Math's and that was the 2003, so if you are heading somewhere with this it's that all factors affect the poor performance in schools, if you take anything as a factor it is impossible to isolate one single factor that causes or doesn't cause poor performance.

**QUESTION 2**

*Is there a relationship between eco- socio- cultural factors and learner achievement in science?*

Let me try to focus on the relationship between economic and socio-economic, I don't know about cultural, that's a different matter so I'd rather just talk about socio-economic and learner achievement. The test was given…..or you want this from the TIMMS study or in general?

(Answer; “both Dr. Charmaine” ). E’..m let me start at TIMMS study and will take on that

Let’s talk of the data first. In the TIMSS study we ask and try to correlate and again I must say because it was such a poor performance at the point it was very difficult to do correlation but we try to look at what’s the socio-economic and the achievement and of course you don’t need a study that your own sense tells you that there is an impact. The only way I could only differentiate was to look at the ex-Department of Education and the correlation of scores. Now of course one knows the ex-model c or white schools have that tone of different racial groupings and the kind of access point is whether you can pay the school fees or not and so if your African child in the school at least you can somehow pay the school fees or get a bursary so, one assumes a better socio-economic background. African schools which are located in African townships, in rural areas in poor areas …I try to cluster both of them and of course the scores of the learners in the African schools was about half the scores of the learners in the white schools so in terms of that measure of the measure of …ex department and the resources that each one had in the past we could see that there is a definite impact in the achievement, so there is poor achievement then. Are the factors you are talking about totally to socio-economic, I mean we have children who are in schools which are poorly resourced themselves coming from homes in the township with poor resources .. and of course you are talking about social capital or cultural capital. The homes are characterized by parents who work long hours themselves not having a high level education themselves not necessarily working with their children to do their homework or assist them with the kind of academic work that they do. So all of those things start to impact, so you have a

poorly resourced school catering for kids from poorly resourced homes the home its self is not able to provide a whole lot of social capital in order to access the present curriculum that we have. I think I'd like to very clearly differentiate that it is not such that they don't have social capital or cultural capital it's that they don't have the social capital which matches the curriculum that is in the school and what is expected the expectations of the curriculum is based on the assumption that the child is from a middle class background so there is a very big mismatch between the expectation of the curriculum and the social capital that the learners have and there for they have difficulty accessing it.

**QUESTION 3**

*What is your view on the relationship between eco-socio-cultural factors and science achievements at South African schools?*

In terms of the relationship between the socio-cultural and socio-economic and the learner achievement, various studies have shown that socio-economic factors have affected achievement and I think the economist would say that contributes to about 50% to explain differences of learners. I think the structure is so straight forward because after the literature tells us that if you looking at differences then it's not only poverty, because you have many poor communities and poor societies and poor countries that do perform o.k. But the issue is not so much a …in South Africa is the inequality. I think one has to look at both poverty and in equality and if you take some other countries, let's take Botswana for an example next to us, they perform much better. And if you take most of the Asian countries they also have the economic situation of individuals is not very good and yet their performance is higher. What South African does have is a highly

unequal Society and after Brazil it has what we call the highest hegenical ….which is the difference in income between the richest and the poorest and the reason why we take countries of similar socio-economic status and they perform better than us it might be that ours is more an unequal society. So socio economic affects but not in a straight kind of ways, so if the whole country is poor but type whole society is of a homogenous group, then the unequalness is also a contributing factor.

So would this unequalness be played out more in a rural area? We talking about national schools here, of course the poverty does more in the rural area than the unequalness because it's the poverty of incomes, and the curriculum you are trying to access is a middle class curriculum, it is based on the assumption that you would have the certain experience base that you would be able to move to a certain know experience base in order to move formal knowledge. Whether it about looking at motion and playing, it's not about the experience it's about the experience that gets mediated to become knowledge because if kids play anywhere, whether it would be in the rural or in urban area, and so you play a lot but the sense is that you are in a rural area and if you throw a ball up and it comes down who you going to ask about why does it come down, who's going to explain that there is gravity pulling it down. Because I'm coming from a middle class background I would explain that gravity acts and therefore things aren't just floating away. Kids do have experience about the science phenomena, I think anywhere they have this experiences, every day is an experience, the difference for the rural kids of kids from poor backgrounds is that there is no mediation of that experience and nobody sort of talking about it and making sense and moving towards some sort of explanation, I think that's the kind of

difference I'd put on it more. It's the poverty of knowledge around but if you had, say, teachers staying in the the old days, the priest was an important source of knowledge, so if you had sort of knowledgeable adults to engage with then you would be making sense of those experience and building ones knowledge.

**Justice:** I want to agree with you Dr Charmaine because there is a case where Sarah Howie on the TIMSS 1999 study, she mentions specifically that there are schools that are in poor rural areas, which tend to perform much better then schools in urban areas, she said that among the reason that could be attributed to that maybe, in that particular school, the kind of teachers are much better and the learners prefers to be present at school then absent.
Or maybe culture of teaching is still encouraged or maintained.

**QUESTION 4**

*How do we explain poor performance in science across urban Black-Indian-White (ex-model C) schools*?

**Justice:** On the issue that you've just raised that out of all the factors that Sarah Howie has raised concerning the poor performance at schools ,some of them may link and some of them may have difficulty in…what do the…but basically learners in South Africa performed poorly equally in science as they did in the TIMSS 1995, 1999 and 2003, and what has been noticed here is that on the TIMMS study of 2003,Dr Charmaine tried to explain the differences between rurality and the urban white schools by using ex houses of assembly, ex house of delegates, and what emanates that is that those learners who are from ex DET, tend to

perform poorly as compare to the learners form the ex-House of Delegates… so in other words blacks are right at the bottom…..white schools were right there at the top. And if you look at the performance of the black learners you will find that they performed very poorly as compared to those learners from white resourced schools, for instance they mention that in Western Cape was the only province in South Africa that performed better compared to other on e and in TIMSS studies internationally it was mentioned that countries s like Morocco Botswana and Tunisia they tend to perform much better in Africa. So in all there is a study which says that South Africa is specifically poor and rural, so that's why I say maybe the cause of this poor south Africa is… and that's why you will find that learners that are poor are form rural areas and that's why they perform poorly.

Response: I have great difficulty defining what is rural in South Africa and I find it easier an African school or …we can talk about Kwa Mashu you can say its urban, if you go down to the valley of a 1000 hills, is that rural or is that urban or semi-urban, if you take KwaZimkhulu( U Mzimkhulu) how would you define that, I mean it's just a few kilometers down the road, would you find it urban or rural. If you take Michael House in the Midlands, I try to take rural and urban, it was meaningless to me to differentiate, you take all those private schools that exist in the Midlands areas, I mean, You take all those schools in the private schools that exist in the natal midlands areas, now they pay enormous fees, if I had to draw on that how would their performance be? So I find that notion of what's rural what's urban very difficult to explain, I thinks it more complex than that and complicated than that. If you are to describe the schools maybe, I even have a map which has each of the municipalities but I think we also try to look at

the deciles ranking of the schools, so all of that plays a part in this but a straight rural urban divide is too simplistic and too artificial, so give me an example of what area is rural?

**Justice: Most** of the scholars have mentioned that they have difficulty at differentiating between rural and urban; because it is being mentioned in literature that countries like USA and Appalachia you find that there are areas, even if you consider distance from urban centers, as part of the division on urban rurality you find that they have a good economic background. Some scholars mention the issue of municipality ,as you said. You will find that ,for example in South Africa ,particular in this new dispensation municipalities have extended their boundaries, you find that Durban does no longer end along Isipingo but extends to far afield as Umkomaas so that is very confusing, Dr Charmaine.

**Response:** I find it artificially and confusing if you are trying to explain why the difference in performance one would have to do it in more expanded terms then a straight rural urban…

**QUESTION 5**

*To what extent is poor performance a function of rurality?*

Of course the set of resources the school in Kwamashu or Clermont has is more than a school in Ladysmith and Bergville, but I think it's not only the resources it's also the sort of interaction that the learner from Kwa Mashu has that is different from the learner in Drakensburg they have. Of course they are a whole lot of other factors which affect children from Kwamashu, discipline, family structure, poor teaching and so straight comparison again is not very easy to make. If you say the language of instruction is a factor and the language of the test was in English, somebody from Kwamashu

might be able to access the language easier than someone form Ladysmith Newcastle or Vryheid where it's believed to be a more rural area.

**Justice:** Dr Charmaine, there is a problem in making the difference between rural and urban in the study of mine, maybe if can try to divert from using rural areas and try to say schools situated in areas that have no resources, can't that maybe sound a bit correct?
Response: When you say, eh…..again, I think resources are too shared, what do you mean by resources? Are we talking about an area where there is less interaction with outside communities, it is more homogenized or kind of community, perhaps, I don't understands, you are talking about "procreative" communities.. (Unclear), and there is both interactive within it selves, and there is some talk of education experiences of the group, that the resources of the group, the experience of the group, the occupational level of the group. It is all at the very low level, then all those things are starting to impact on how children going in that environment start understanding their experiences and building there …their science knowledge, I think that gives more the better kind of definition than a straight rural urban, resources or no resources, or , because there are physical resources plus er.... these er…far more knowledge resources etc, so go for expanded definition of something, but don't use these shared words like rural, urban, resources, er ..it is too simplistic and you find that explanation are more complex ,

Justice: Dr Charmaine You find that here in south Africa we associate rurality with poverty, unemployment, and you find that learners are being taught by pensioners' money or some grants, they can't even buy the text book and pay school fees, and they go to school hungry, you will find that

in most of the families in rural areas ,access to food is given priority to a child's education.
So in that regard, what will be Dr Charmaine comment?

**Response:** I think anyone of us knows that it's very difficult to sit in the classroom if you're hungry and you're poor. And so of course the factors of poverty and the kinds of competing…..and then do you go to school and give in money or do you stay at home and try to build up an income so that your family can survive from that. In terms of accessing school and at the level of access why should people go to school when they know they are not going to pass but your draining the family's resources? One has to differentiate between in the first place er… because the access of these children becomes more difficulties… because the opportunity costs are too high …and the second thing er ,,,the quality of those interactions in the classroom are very poor because we have teachers one of the big things we have is that there is such differentials of in income. or income differential ,conditions are very poor a teacher earns a different salary they move out of that area, they do not want to stay in this poor area when they are earning this salary, so you might stay on the outside and come back and teach here or etc. And it's very difficult to attract people to come and teach in these areas. So people are poor and they come in with no social capital but further more everything also implicates against them in that the rich get richer and the poor get poorer because there is nothing to draw into that space,[ I think we should have a missionary education, because missionary schools were more clinical, … I am fed up and done with this…..but jokingly ] but generally most people aspire for a mobility they want to move out they don't want to move back into this description that you did give of an area that is very poor, but we all stay there they, but we all stay

there, you might stay there, but most people don't want to stay there it's very hard to draw them into the area.

**Justice:** I was born in rural areas, I've been teaching there… this is my 15th year, what happens is that you will find that learners are having these problems , nobody can help them with school work and they go to school and they encounter the same problem, so experience that problems at home and you will find another problem at school so when you find that the school is under resourced and teacher do not have enough knowledge of science and there are no desks and not enough space for studying, the furniture is old and there are not enough books, so I just specify that teachers rely on talk and chalk and taking everything form the books as it is and just give learners in the form of notes. The learners of science, when they learn science they just write notes from the teacher and they go and recite these notes so they can write them as they are on the test day which has been set by the teacher. This thing becomes problematic in exams because the purpose of the exams, they just set the exams up to a certain standard by the department of education. They don't consider people who don't have resources. So you find that maybe if the set questions ask the learners maybe about a voltmeter the learners in rural areas maybe battle to get it because they have never seen a voltmeter. They have a problem of, besides knowing the answer; they must try to understand what the equipment is because they have never seen it before. Even if the teacher can explain it to them, but if he doesn't have the model of what it looks like, students may hear that explanation but that thing cannot be instilled in their minds.

**Response:** I just want to be gently provocative Justice when I said to you, and I think we mustn't fixate on the resources like voltmeters and

ammeters. To ask kids to draw a leaf and the kind of questions one asks kids in an examination about a leaf, they still don't do it, they still battle with it and these are the resources around there, so I think that, I'm not disagreeing with you that resources are important but I think what is more fundamental than that is how science is accounted into the subject, we need formal instructions, someone needs to give formal instructions and this whole interactions between teachers and learners and the whole environment is what leads to learning and cognitive games and I think it's not just about the resources, it's far more than that. Now if one looks at, we say that educational outcomes are the intersection of home and the school; the inputs from the home and the inputs from the school. But let me use the term er… poorer environments the input from the home to access the school is very limited and in developing countries one expects far more, we expect the institution of the school to give you a better deal, and that's the state's responsibility. I mean the schools are the responsibility of the state they want to try and give everybody a better life. So of course that kid, and the parents everybody then looks to the school as this institution to provide something that the home couldn't provide and you want the school to operate very well it very, very well, you want the environment to be well you want it to be functioning, we want learning to be taking place we want the classroom interaction to be of such a high quality that even if the child didn't have such an experience at home it should be given at the school. Now I think in South Africa, we are failing the kids that those who need the schools most, schools are there for children and the poorer the community is the more the schools in those communities, and it is going to be a case of the rich will get richer. The schools that are resourced, parents come in, they are able to pay the extra school fees and you get a whole range of experiences, you in an urban area, you in a suburban area, you going back to a whole lot of experiences to improve your learning. So if you asking

me, Do I think that poor people are getting a good deal for education, my answer is no?, I think that is what they looking for er..the ***school as an institution and this institution is failing the poorest***

**Justice:** I don't know whether it's possible to get names of the schools that participated in TIMMS study; I understand that there are some of the schools that have participated in TIMMS I don't know if you have the school names, numbers and area?

**Response:** No I wouldn't be able to give you the school names because of confidentiality when we tested the schools, but there were 43 schools in KZN and I think the map at the will tell you where the schools were located. I can't give you individual school scores either because that would not be available, it's impossible to do that, but you will see from the dots there that it a spread if you looking at KwaZulu-Natal, let's say the northern areas, around Durban and around Portshepstone, there are some sort of schools that are not so-called urban as well. There are those rights up in the deep KwaZulu-Natal up in North Coast. If you look at say Northern Cape it's a very sparsely populated province and so of course (I don't know if you would call that rural) if you look at Limpopo, there is a sparse spread of learners but as I tried to say what was an urban/rural divide and get the scores. I just found it so difficult to do that and to get a definition that would work and that's why I didn't do it and I thought I would look up the ex-DUT schools and I also wanted to look at the quintile rankings of schools because we didn't get all the quintile rankings of schools. Okay Justice.

Thank you DR Charmaine……..