The Relationship between Parental Educational Level and Children's Cognitive Functioning

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Abstract

This study investigated the relationship between a child's measured intelligence and the educational level of that child's mother and/or father. Correlations between parental educational level and children's cognitive functioning as measured by a conventional South African intelligence scale, were examined. The instrument used to measure the children's cognitive functioning in this study was the Senior South African Individual Scale-Revised (SSAIS-R). The children's scaled scores were obtained from existing results on the SSAIS-R. Parental educational levels were obtained from existing intake questionnaires, which parents completed before their children were assessed on the SSAIS-R at the Centre for Psychological Services and Career Development (PsyCaD). Correlational analysis was used to investigate the relationship between the two variables of interest. The sample consisted of 23 cases. All of the children were aged between 8 and 10, spoke either English or Afrikaans as a first language, and belonged to the White, Indian or Coloured population groups. The results indicated that maternal level of education was positively and moderately correlated with children's cognitive functioning. Paternal educational level and children's cognitive functioning were found to have no correlation or to be inversely correlated. The correlation results between paternal level of education and children's cognitive functioning should be interpreted with caution since the sample size was very small. Thus, the results are not statistically significant.

Keywords: parental educational level, children's cognitive functioning, intelligence measures, SSAIS-R

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CHAPTER ONE

1. Introduction

1.1 Research Rationale

When interpreting intelligence scores, especially those of children, it is imperative to consider the social context wherein the child exists (Foxcroft & Roodt, 2005). This is even more important in a diverse country like South Africa, which consists of different cultures that are at different stages of Westernization, and includes multilingual groups that vary in level of education (Cockcroft, Amod, & Soelaart, 2008). South Africa is also characterised by vastly differing socio-economic living conditions, and by unequal access to basic resources. Several studies have investigated correlations between children's performance on intelligence tests and their experiences, as well as the contexts in which they live (Jansen & Greenop, 2008; Nell, 2000). According to these studies, it would appear that what children learn and when they learn is dependent on their socio-cultural background (Ferguson, 1954; Grieve, 2005). Grieve and Van Eeden (2010) support the view that a person's background and context should be considered when interpreting test scores. When a person's context is considered whilst interpreting intelligence measures test results, it is believed that a far more comprehensive understanding is gained about what the results mean for each person in his or her unique context (Carroll, 1997).

Even though researchers share the view that conventional intelligence test results are influenced by socio-economic variables, these tests are still frequently used to evaluate an individual's cognitive functioning (Foxcroft, Paterson, Le Roux, & Herbst, 2004). For example, the Senior South African Individual Scale - Revised (SSAIS-R) is one of the intelligence measures most used by clinical, counselling and educational psychologists in South Africa (Foxcroft et al., 2004). Although the SSAIS-R does provide useful information about a child's strengths and weaknesses as well as current cognitive functioning, results from the SSAIS-R should be interpreted with caution, especially in the case of children from poor socio-economic groups (Claassen, 1997). International intelligence measures, such as the Wechsler intelligence measures, are also popular measures used in the South African context (Grieve & Van Eeden, 2010; Kaplan & Saccuzzo, 2008). Numerous international studies have investigated the relationship between children's cognitive functioning on the Wechsler measures and parental educational levels. These studies report that parental educational levels need to be considered when children's performance on the Wechsler

intelligence measures are interpreted (Sattler, 2001). When international measures, such as the Wechsler Individual Scale for Children - Revised (WISC-R) are used with South African children, socio-economic status (SES) variables, such as parental educational level, may have an even greater effect on children's cognitive functioning (Shuttleworth-Jordan, 1996). Thus, results on internationally developed intelligence measures need to be interpreted with caution as SES factors may influence a child's results considerably. In addition, there is also a need for those international intelligence measures that are widely used in South Africa, to be normed and standardised for the South African context (Foxcroft et al., 2004).

SES is one of the most significant "contextual variables" (Sirin, 2005, p.417) that need to be considered when children's general cognitive functioning, development, and academic performance and/or achievement are being observed, interpreted and evaluated. However, it is one of the most complex variables to take into account (Foxcroft & Roodt, 2005). According to Sirin (2005), in recent years, numerous studies have been conducted on SES and its effects on children's general cognitive functioning and academic achievement. However, research published on children from poor socio-economic backgrounds remains limited (Cockcroft et al., 2008). According to Richter and Grieve (1991), further research is needed in order to explore the association between home environment and early cognitive functioning of children from different cultural groups. Sirin (2005) and Carroll (1997) also invite researchers to investigate further the relationship between SES and an individual's academic performance, general development and cognitive functioning. Research in South Africa is also lacking, specifically with respect to the relationship between parental educational level and children's cognitive functioning, and the possible effects of this relationship on South African-based intelligence measures (Cockcroft, 2013). Thus, there are limited studies investigating these variables of interest using a South African intelligence measure, such as the SSAIS-R.

On evaluation of the above discussion, it is evident that there is a lack of research regarding the effects of SES variables on persons' cognitive functioning, especially within the South African context and using South African-developed intelligence measures. Thus, the purpose of this study is to investigate the relationship between SES factors, parental educational level, and children's cognitive functioning. Furthermore, this research study utilised data from a South African population and obtained cognitive results from a South African intelligence measure – the SSAIS-R.

In practice, psychologists performing psycho-educational assessments mainly use conventional intelligence measures and are over-reliant on test scores alone. According to Adelman and Taylor (1979), the overall interpretation of psycho-educational assessment results and the decisions regarding intervention, need to consider the child's test results in conjunction with the environmental factors that may affect the results of these measures. Thus, the current study also wants to highlight the importance to students and intern educational psychologists, educational psychologists and any other professionals and persons involved in the psycho-educational assessment process, to be cognisant of the effects of contextual variables on the testee's overall development and performance on intelligence measures that usually form part of a psycho-educational battery.

1.2 Outline of Chapters

The research rational has been discussed above. Chapter Two provides a literature review, which discusses the background to this topic in more depth and provides a more detailed description of the research objectives as well as stating the research aim and questions. It also examines the theoretical literature and other research that has informed this study. In Chapter Three, the research methodology is delineated. Chapter Four presents the results based on the quantitative data obtained. In Chapter Five, a comprehensive discussion is offered which relates the theoretical observations noted in the literature review to the findings of the current study. Chapter Five also presents the conclusions drawn from the study and discusses the limitations of this specific study. Finally, it also provides recommendations for further research in this particular field of study.

CHAPTER TWO

2. Literature Review

This chapter begins from the assumption that various SES variables should be taken into account when interpreting a person's results on intelligence measures. The notion of intelligence measurement and relevant theories on intelligence, specifically the psychometric and contextual theories on intelligence, are discussed in order to highlight each theory's relevance when measuring intelligence. This discussion on intelligence will also include several definitions of intelligence. Views on testing within the South African context are also examined so as to emphasize shortcomings in assessment practices and proposed solutions to these shortcomings. The relationship between cognitive development and measuring intelligence is also discussed. Thereafter, a discussion of the SES variable, parental educational level, is provided in order to indicate the significance of parental educational level on children's cognitive functioning. Furthermore, studies using only one aspect of parental educational level, the father or mother's educational level, have been explored in order to provide sufficient justification for using both the maternal and paternal educational levels for this study. The effect of environmental aspects (focusing on the SES variable, parental educational level) on a person's general cognitive functioning has been investigated through reference to various, relevant academic literature reporting on studies done abroad as well as in South Africa. Finally, the study's research aim and research questions are stated.

2.1 Overview of Study

Conventional intelligence measures are used in order to identify children who may be academically at risk (Cockcroft & Blackburn, 2008). When children are identified as such, an understanding of their particular strengths and weaknesses is also obtained through these measures, which in turn supplies the psychologist with information as to how to intervene (Cockcroft & Blackburn, 2008). However, an important factor that needs to be considered when assessing children from different cultural and language backgrounds, ethnic groups and socio-economic classes, is the measuring instrument itself. In South Africa, the majority of measuring instruments used for assessing cognitive functioning are conventional measures that mainly assess crystallized intelligence. Crystallized intelligence can be defined as knowledge that consists of prior learning and experience that is based upon factual information, and is a person's stored knowledge (Sternberg, 2003). Conventional measures assess abilities such as verbal ability, numerical ability, mechanical ability, and deductive

reasoning. Thus, conventional measures predominantly consist of subtests that measure aspects of material taught in school and that is dependent on contextual experiences (Ardila, 1995). Therefore, scores on intelligence measures for school going children are good predictors of their school performance (Hook & Cockcroft, 2001). In addition, conventional intelligence measures are largely based on determining an individual's current cognitive functioning, which mostly displays the effects of previous educational exposure and socio-economic opportunities (De Beer, 2000). Therefore, conventional intelligence measures partly reflect a child's cultural influences and his or her parents' levels of education (Taylor, 1994) and socio-economic opportunities (De Beer, 2000).

The South African context during the apartheid era was one of social inequality, segregation and an environment of imbalance in the distribution of resources according to race. This inequality also pervaded the educational system, with different race groups receiving different quality education. For example, a person from a disadvantaged environment with a Standard 10 or Grade 12 qualification could not easily compete with a person from an advantaged environment who also had a Standard 10 or Grade 12 certificate (Shuttleworth-Edwards et al., 2004). This inequality in educational services, limited certain racial groups with regard to further educational prospects and career opportunities. Hence, parental educational level and occupation opportunities have determined what access a person may have to financial resources, health care services, libraries, quality education, exposure to technology and information, knowledge about child development, and familiarity with Western ways (Nell, 1997; Owen, 1991). It would be expected that parents with advantageous opportunities and access to these resources would create an environment conducive to their children's overall development of abilities and general cognitive functioning (Richter & Grieve, 1991). Thus, children growing up in such beneficial environments and who had good quality education should perform adequately on intelligence measures, and should have an advantage over children growing up in environments which lacked these resources and had received poor quality education (Shuttleworth-Edwards et al., 2004).

Despite the fact that a child's cognitive ability may depend on factors other than the socio-cultural environment, this environment remains one of the most influential variables affecting a child's cognitive functioning (Burg & Belmont, 1990). Conventional intelligence measures have been criticized as being culturally insensitive (Skuy, Taylor, O'Carroll, Fridjhon, & Rosenthal, 2000) and biased or "unfair" (Taylor, 1994, p.2). This is because

these measures focus primarily on what a child has learned and do not focus on a child's potential or learning potential. Foxcroft and Roodt (2005) also highlight the important point that people from deprived environments may perform poorly on intelligence measures, because the constructs measuring cognitive functioning and the way these constructs are measured may be unknown to the underprivileged, and that they may perceive the assessment process as unimportant. Thus, a person's culture may have an influence on factors such as familial socialization, primary language and the meaning assigned to intelligence measures (Ardila, 1995). Although Owen (1991) states that conventional South African intelligence measures are, overall, reliable and valid, he also emphasises that these measures are only appropriate for the groups for which they have been standardized. Therefore, when administering conventional cognitive measures in a multicultural society, such as South Africa, where there is a variety of different groups with respect to culture, language, quality of education and level of SES, the results from these measures must be closely scrutinised. The question then arises as to why no new intelligence measures have been developed for use in such multicultural contexts. This question has been partially addressed by Grieve and Van Eeden (2010) as follows:

> …because of the diversity of the South African population and the rapid changes taking place as a result of cultural and socio-economic transition to a modern technological society, it was not possible to develop one test that would be suitable for the entire population. (p. 262)

Owen (1989) corroborates this view by arguing that many challenges emerge in developing common measures that are appropriate for use across groups differing in language, level of education and level of SES.

The consensus seems to be that environmental circumstances do affect children's general cognitive functioning, which includes their cognitive development. However, the debate continues as to how much of a child's cognitive functioning is influenced by environmental circumstances and/or genetics (Conant et al., 2003). According to Huston, McLoyd and Garcia-Coll (1997), factors such as income, poverty and other associated circumstances have a greater effect on children's cognitive, academic and socio-emotional functioning than genetic factors. Foxcroft and Roodt (2005) mention that the SES factors that most affect a person's education, and thus cognitive development and functioning, are poverty, poor health, malnutrition, deficient school facilities, poor social adjustment, absence of cultural

stimulation, and lack of reading material. Families that come from such socio-economic environments frequently experience organizational chaos, lack of structure and routine, exposure to multiple stressors (Evans & English, 2002), excessive background noise, and overcrowding in their homes (Evans, 2006; Evans, Gonnella, Marcynyszyn, Gentile, & Salpekar, 2005). By contrast, families with improved SES have more access to resources such as sanitary facilities, good quality education, exposure to reading material and technology, financial assets, and familiarity with Western ways of thinking. All of these contribute constructively to the general cognitive functioning and overall development of children (Cockcroft et al., 2008).

In conclusion, it is imperative to consider social context when assessing persons and interpreting results from intelligence measures. It is thus important to integrate the results obtained from intelligence measures with other sources as well, such as interviewing the parents or caregivers and teachers, and to consider the SES factors that may contribute to the outcome of the intelligence measure (Claassen, 1997; Claassen, & Scheepers, 1990; Foxcroft, 2002). In addition, Foxcroft (2002) states that certain factors need to be considered even before testing is undertaken. These factors include "knowledge of the test-taker in relation to his or her cultural, family, linguistic, educational, and socio-economic background, and heritage" (p.8).

2.2 Defining Intelligence

Intelligence remains a complex construct as there are various perspectives on how to define, understand or explain, as well as measure intelligence. For example, Sternberg (2003, p.485) defines intelligence as "the capacity to learn from experience using metacognitive processes to enhance learning, and the ability to adapt to the surrounding environment, which may require different adaptations within different social and cultural contexts". Rindermann (2007, p.768) explains intelligence "as the complex ability to think, solve new cognitive problems, draw inferences, think abstractly, and to understand and realize relationships, contexts and meaning". These debates as to the definition of intelligence make it especially difficult for psychologists to agree on how to measure cognitive functioning (Foxcroft & Roodt, 2005). Over several decades, different theories on intelligence have emerged and these theories have offered diverse constructs with which to measure cognitive functioning for various purposes. For example, Binet developed a measure to identify children who

needed special education, while, in the South African context, intelligence measures were used in studies to 'prove' that white groups were superior to other racial groups (Nell, 2000).

Despite the fact that theorists attempted to define intelligence as far back as the 12th century, there is still no agreement on a common definition of intelligence (Sternberg & Detterman, 1986). Instead, the term intelligence is explained through examples of what an 'intelligent' person can or cannot do (Eysenck, 1988). Intelligence is primarily defined in three different, but related ways. These differing views on intelligence stem from biological, psychometric, or contextual standpoints. Biological intelligence refers to the structure of the human brain and its physiology, biochemistry and genetics (Eysenck, 1988). Biological intelligence can be measured by means of the electroencephalograph (EEG), evoked potentials, contingent negative variation (CNV), galvanic skin response (GSR), or measuring the reaction time of a person to a certain stimulus (Sternberg, 2003). In the section that follows, the remaining theories (on psychometric and contextual intelligence) are discussed in more depth.

2.3 Theories on Intelligence

This study focuses mainly on the psychometric intelligence theory, as it is the basis for most conventional measures of cognitive functioning (Foxcroft & Roodt, 2005). Conventional intelligence measures, such as the SSAIS-R, which are commonly used in the South African context, are also based on the psychometric theory of intelligence (Grieve, 2005). The psychometric theory on intelligence defines intelligence as "what intelligence tests measure", and this theory further assumes that standardized psychological tests are used to measure differences in performance on psychologically defined constructs, such as cognitive functioning (Foxcroft & Roodt, 2005, p.121). The other theory of intelligence that is discussed here is the contextual intelligence theory, which holds that cognitive functioning must be viewed within a particular context (Sternberg, 2003). Thus, when intelligence quotient (IQ) scores are interpreted, other factors should be taken into consideration before a person is pigeonholed as functioning below average; cognitively speaking.

2.3.1 Psychometric theories on intelligence

Spearman (1863-1936) began using the statistical technique of factor analysis to examine different intelligence measure scores in order to identify whether the different tests measure the same construct, and which aspects these tests have in common (Sattler, 2001). Spearman

further concluded that different tests have some shared construct in common and thus, it is generally believed that specifically standardized intelligence measures assess Spearman's general (*g*) intelligence or *g*-factor most accurately (Herrnstein & Murray, 1994). Spearman's *g*-factor implies that all measures aimed at assessing cognitive functioning will correlate positively with each other, which means that all these measures assess the same underlying construct. Most researchers agree that measures assessing cognitive functioning encompass some kind of general factor of cognitive functioning (Carroll, 1997). Thus, each intelligence measure and test-item measures *g* that is common to all the items of a test, and a specific factor (*s*) that is unique to that particular item. Therefore, it is assumed that intelligence measures provide information on a person's level of general intelligence (Anastasi & Urbina, 1997).

Other theories on intelligence also evolved out of such factor analysis and argued that *g* does not account for all of the commonalities among tests, but that some other common factors are also measured. For example, Thurstone's (1887-1955) multiple factors theory postulates that, for example, vocabulary sub-tests have been shown to have a lot in common with *g*. However, some of these commonalities are also due to a group factor of verbal ability and not only *g* (Anastasi & Urbina, 1997). In contrast, hierarchical theorists believed that if these group factors were themselves factor analysed, higher-order factors resulted. According to Vernon (1969), hierarchical theorists postulate that factors are layered and *g* consists of major group factors, minor group factors and specific factors (Walsh & Betz, 2004). Another hierarchical theorist, Cattell (1905-1998), divided intelligence into fluid intelligence and crystallised intelligence (Horn & Noll, 1997). Fluid intelligence is measured by constructs that consist mostly of non-verbal intelligence which are believed to be relatively culture-free and content-free. It further measures intelligence that is used whenever a task requires adaptation to a novel situation, including the ability to comprehend relationships (Owen, 1998). In contrast, crystallised intelligence is highly culturally dependent, and measures mostly learned skills and abilities (Owen, 1998).

Measures of general cognitive functioning include different subtests measuring verbal and non-verbal intelligence that collectively provide an overall score of general intelligence or an IQ. The verbal scale primarily assesses constructs that rely on learned knowledge or crystallised intelligence, typically based on school material, such as comprehension, numerical ability, and vocabulary content. However, the non-verbal scale focuses more on school-distant material or fluid intelligence, which does not generally include verbal,

numerical or knowledge-based questions (Rindermann, 2007). Thus, crystallized intelligence or verbal subtest scores are more dependent on cultural influences and quality of education than scores for fluid intelligence or non-verbal subtests (Taylor, 1994). Various factor analytic studies have shown that vocabulary subtest scores correlate more strongly than non-verbal subtest scores with the general intelligence factor (*g*) (Gregory, 1999; Lezak, Howieson, & Loring, 2004). For example, Van Eeden (1991) showed that scores on the verbal scale of the SSAIS-R were more strongly correlated with a child's academic success, compared with non-verbal scores. Gregory (1999) suggests that a plausible explanation for this might be that verbal intelligence is imperative for academic achievement, whereas non-verbal intelligence is not as important for this purpose.

Vincent (1991) states that individual differences with regard to achievement on intelligence measures are a gauge of education levels and economic opportunities. Hence, in a multicultural society like South Africa, psychologists and educationalists must also focus on assessing a child's cognitive potential in conjunction with his or her cognitive performance. Cognitive performance is equivalent to crystallized intelligence, and therefore displays what an individual has learned or what skills he or she has acquired at school, from his or her parents, as well as from life experiences gained. On the other hand, cognitive potential is equivalent to fluid intelligence; when an individual is faced with unknown material, he or she will have to rely on general skill transfer and acquisition strategies, and not on previously learned knowledge (Taylor, 1994).

2.3.2 Contextual theory on intelligence

While the psychometric theory on intelligence focuses on a person's general intelligence score to predict cognitive functioning, other theorists believe that an intelligence quotient as predictor of cognitive functioning is not the only aspect to take into consideration (Foxcroft & Roodt, 2005). Contextual theories of intelligence assume that contextual intelligence includes three factors: adaptation, selection and shaping. Adaptation refers to the skills a person develops that are required in order to function in a particular environment. Selection means that a person will leave his or her current environment and search for a new one that is more suitable for his or her skills and needs. Shaping involves changing the current environment so that it will better suit a person's needs (Sternberg, 2003). If a person is unable to adapt to his/her environment, he/she may need to select another, more suitable environment, or reshape his/her existing environment to ensure a better "fit" between him- or

herself and the environment, in order to meet personal goals (Sternberg, 2003). Therefore, context and socio-cultural factors can also be regarded as important factors in assessing a person's cognitive functioning (Sternberg, 2003). According to Sternberg and Wagner (1986), a person's cognitive ability plays an essential role in that person's ability to solve daily problems. However, numerous other non-cognitive internal and external factors also influence a person's cognitive functioning. These include health, life experiences, socio-economic status, motivation, nutrition, cultural factors, coping strategies, family structure, mental disorders, educational level, and personality.

An IQ score illustrates an individual's current level of functioning, the rate at which learning takes place, preservation of information in long-term memory, knowledge and skills learned at school, material taught by parents, and learning from everyday experience (Carroll, 1997). IQ scores obtained from conventional intelligence measures do not provide information on the future cognitive potential of individuals. In addition, various social and educational factors, such as parenting and home influences, quality of education, level of experience with communication media, other societal facilities, and general social interactions, may have an effect on some attributes that are measured by conventional intelligence measures (Carroll, 1997).

2.4 The Use of Intelligence Measures in the South African Context

Test use in the apartheid era of South Africa was characterised by unfair practices as most measures were only standardised for whites (Foxcroft & Roodt, 2005). Furthermore, the results of intelligence measures where used as 'evidence' of racial superiority and inferiority (Claassen, 1997). Critics have pointed out the cultural inappropriateness of using existing, Westernised measures on all racial groups (Biesheuvel, 1952; Owen, 1998). Such critique further highlights the fact that cultural and environmental factors, such as poverty, level of SES and acculturation have a significant influence on the development of intelligence (Foxcroft & Roodt, 2005), which needs to be taken into account when interpreting intelligence measure results. Since the advent of democracy in South Africa, additional criticism has surfaced which has resulted in the prohibition of the use of tests in educational settings. *The Draft Guidelines for the Implementation of Inclusive Education* (2004) states that psychometric tests "offer little in terms of programme planning" (p.17). The use and development of these assessment measures in South Africa was, and still is, politically sensitive and subject to criticism. However, the use of such measures has advantages, as it

provides valuable information regarding intervention options for persons (Foxcroft & Roodt, 2005).

Solutions to this stalemate need to be considered and implemented, so that the opinions of those opposed to the use of psychological measures in South Africa can be changed. Foxcroft (1997) proposes several solutions that may contribute to more fair and unbiased testing practices. Firstly, it is imperative to use intelligence measures and interpret results in combination with other sources of information, such as interviewing parents and teachers, obtaining information regarding the SES variables of the test-taker using intake questionnaires, and viewing school reports. Thus, intelligence measure results need to be interpreted in a comprehensive manner rather than through the use of only a normative approach (comparing the test-taker's score to the group norm), especially when Western measures are used to test individuals belonging to poor SES groups (Foxcroft, 1997). Although Western measures may be culturally inappropriate for use in the South African context, these measures can still provide valuable information when used on persons who live in urban environments and are familiar with Western ways, and who have received good quality education. However, test items identified as culturally loaded will still need to be revised or removed from these measures. In the case of test-takers who are less Westernised, exposed to an educational environment that is lower in quality and who belong to poorer SES groups, new and culturally-appropriate measures will need to be developed (Nell, 1997; Taylor, 1994). It has been further suggested that intelligence measures must be developed that assess individuals' learning potential rather than focusing mostly on their cognitive ability – especially for those belonging to disadvantaged groups. Lastly, the inclusion of new test norms for all cultural groups, including norms that consider level of education, is essential in establishing fair and unbiased testing practices. This is because level of education is believed to be the most influential variable on persons' test performance (Shuttleworth-Jordan, 1996).

2.5 Measuring Intelligence

The measurement of intelligence on conventional intelligence measures involves the comparison of a person's performance on a particular intelligence measure with his/her peers of the same age group. The SSAIS-R is a standardized intelligence measure that is administered individually, and the aim of this measure is to determine a person's general level of cognitive functioning (Foxcroft & Roodt, 2005). Furthermore, the SSAIS-R can be

used as a clinical and diagnostic aid since relative strengths and weaknesses with regard to areas of intelligence can be obtained (Van Eeden, 1997). The SSAIS-R is a revised version of the SSAIS, which was released in 1964. Test items were adapted and new norms were calculated, and the revised version was released in 1991 (Van Eeden, 1997). The SSAIS-R was standardized for only Coloured, Indian, and White South African children between the ages of 7 years and 16 years 11 months, with Afrikaans or English as mother tongue. Since socio-economic deprivation was found to have an effect on children's performance on the SSAIS-R, norms are included for environmentally disadvantage children (Van Eeden, 1997). However, these norms only included Coloured and Indian children and thus, there exists no norms for Black children.

The SSAIS-R consists of a scale divided into a verbal component (that includes six subtests) and a non-verbal component (that consist of five subtests). The skills measured by the different subtests include learning ability, general knowledge, judgement, concentration, spatial perception, just to mention a few. It takes about 90 minutes to administer the SSAIS-R and the instructions are available in English and Afrikaans. No evidence exists to suggest that the English and Afrikaans versions of the SSAIS-R are equivalent and only separate norms are available for each language for the Vocabulary subtest (Cockcroft, submitted). In terms of scoring the SSAIS-R, the raw scores of the subtests are converted to normalized scaled scores with a mean of 10 and a standard deviation of 3. The sum of the verbal subtests' scaled scores and non-verbal subtests' scaled scores are converted into Verbal Scale, Non-verbal Scale and Full Scale scores with a mean of 100 and standard deviation of 15 (Van Eeden, 2007). In terms of interpreting the SSAIS-R the Full Scale IQ, Verbal Scale IQ, and Non-verbal Scale IQ scores, Table 1 below presents how these scaled scores can be categorised in order to estimate a person's range of cognitive functioning at the time of testing.

A profile of a child's strengths and challenges can also be determined through interpreting the scores from each sub-test of the SSAIS-R. The sub-tests scale scores range from 1 to 20, and scores on sub-tests between 9 to 11, are regarded as average scores (Van Eeden, 1991). However, each child's unique performance should be taken into account when interpretations are made on the sub-test scores. For example, if a child's sub-test scores range from five to seven, a score of eleven on a particular sub-test, may be interpreted as a strength for that specific child (Van Eeden, 1991).

Table 1

Description of Different Intellectual levels for the SSAIS-R

Ranges of levels	Description of intellectual functioning
69 and Lower	Cognitively impaired
70 – 79	Borderline
80 – 89	Low average
90 – 109	Average
110 – 119	High average
120 – 129	Superior
130 and higher	Very superior

(Van Eeden, 1991)

Measures, such as the SSAIS-R, are often included in a psycho-educational assessment battery by educational psychologists (Foxcroft et al., 2004). The main purpose of psycho-educational assessments is to evaluate scholastic performance, behavioural adjustment, motivation, and emotional functioning, as well as a child's relations with significant family members (Kriegler & Skuy, 2005). A main concern of the SSAIS-R is the outdated norms and the fact that there are no norms for Black children (Van Eeden, 1997). Another concern is that the content of the SSAIS-R is based on Western cultural knowledge, which may hinder children's performance on this test, particularly those hailing from disadvantaged environments, as their experiences and familiarity with Western knowledge may be limited (Van Eeden, 1997). According to Foxcroft (2002), test content, or the tasks to be performed by the test-takers, needs to be culturally appropriate. Some of the content of the SSAIS-R is also outdated and may equally disadvantage children who are familiar with Western knowledge. For example, in one subtest (Missing Parts), a picture of an envelope with part of the address missing is shown to the child; an envelope used for mailing letters may be unfamiliar to today's children as letter posting is not a frequent occurrence any longer (Van Eeden, 1997). The SSAIS-R needs to be re-standardised and re-normed, as the demographics of South African children and the educational curriculum have changed a great deal since the

original development of the SSAIS-R measure (Cockcroft, submitted). However, the SSAIS-R remains as one of the most popular instruments for use in evaluating children's cognitive functioning (Foxcroft et al., 2004).

2.6 Cognitive Development and Measuring Intelligence

Numerous factors affect children's cognitive development (Sattler, 2001). According to Piaget (1896-1980), cognitive development relies on interactions between genetic, psychic and environmental factors. Thus, cognitive development is not only dependent on a child's biology and physical development, but also relies on the child's practice and learning experiences (Cronbach, 1984). Children also adopt varying behavioural characteristics that determine their responses towards others' interactions with them (Scar, 1997). Therefore, adults (parents, teachers, and relevant others) in children's lives have a significant influence on a child's cognitive development (Bee & Boyd, 2004). As children grow older, environmental factors have a greater influence on their cognitive development and behaviour (Settler, 2001). Children's variances in learning and cognitive performance are more likely to be associated with their genetic differences when equal environmental opportunities for learning are present. However, when there is inequality in children's environmental opportunities for learning, their differences in learning and cognitive performance may be due to these environmental discrepancies (Scar, 1997). Thus, the amount and quality of interaction with adults, as well as environmental factors, will have an effect on a child's cognitive development and performance on intelligence measures. The environmental factors that ought to be considered include: access to stimulating or enriching experiences; adult-assisted exploration; adult-assisted teaching of basic skills and problem-solving skills; a responsive language environment; parents who believe in the importance of stimulation and learning; quality care giving and social support; minimal noise levels and crowding in the home; schools that foster achievement; stable neighbourhoods; positive reinforcement by adults; access to sources of knowledge; parental involvement in the child's learning and education; parental educational level; to mention a few (Spitz, 1996).

Several studies have suggested that, as a child grows older, the effect of certain external influences on his or her cognitive functioning will increase, rather than decrease. These factors include SES, structural family features, interpersonal attributes, as well as the physical environment (Gruen & Doherty, 1977; Siegel, 1984; Wachs, Uzigiris, & Hunt, 1971; White, 1965). According to Strauss, Sherman and Spreen (2006), the cumulative effect of

unfavourable factors in a disadvantaged environment accounts for the decreased cognitive functioning observed in children from such environments. Therefore, if parents provide a quality-stimulating environment early on in their children's lives, it will have a positive effect on the child's cognitive functioning (Ledingham, 2004). Furthermore, the earlier an intervention is implemented, the more positive the outcome it will have on a child's overall cognitive functioning and development (McLoyd, 1998).

2.7 Parental Educational Level

Parents with higher educational levels are more likely to enter occupations that offer higher income. Thus, children belonging to families where the mother and/or father have higher education will most likely belong to middle to high income groups, which would influence access to financial resources and other resources, such as medical services and quality educational services. Studies have investigated the effect of psychosocial factors, such as family background, parental education, and home environment on children's cognitive development and functioning (Brooks-Gunn & Duncan, 1997; Cockcroft et al., 2006; Granier & O'Donnell, 1991; Gregorio, 2006; Grieve & Van Eeden, 2010). These studies have shown that SES factors, such as parental education, are among the most influential predictors of children's cognitive performance (Vanderploeg, Schinka, Baum, Gremont & Mittenberg, 1998). SES factors, along with other home environment factors (such as providing a stimulating environment), appear to have an effect on the quality of a person's learning experiences that ultimately affects that person's abilities. Subsequently, such a person's performance on cognitive measures (Foxcroft & Roodt, 2005) as well as language proficiency (Hupp, Munala, Kaffenberger & Hensley, 2011) is dependent on these abilities.

According to Richter and Grieve (1991), the main gauges of SES are parental education, occupation, and income. These variables determine the variety of facilities that are available to the child, their attitudes towards education, and their experience in applying and developing cognitive skills. Parent participation in their children's learning development was found to be related to SES factors and, as such, parental participation has been found to have a positive effect on school-going children's achievement (Hickman, Greenwood & Miller, 1995). Poverty, poor health, malnutrition, inadequate school facilities, poor social adjustment and the absence of certain cultural aspects of the modern world are all strongly correlated with educational disadvantage (Halpern, 2000). According to McLoyd (1998), continued circumstances of poverty, disadvantage children in terms of their cognitive development,

performance and scholastic achievement. Furthermore, Brooks-Gunn and Duncan (1997) argue that childhood poverty affects a range of children's milestones across the physical health, cognition and academic achievement, emotional and behavioural spheres. Parental education is an attribute of SES that is consistent, as it tends to remain the same over time (Foxcroft & Roodt, 2005; Guidubaldi & Perry, 1984). Parental educational level is also an indicator of parental income and occupation as these three SES variables are highly correlated (Hauser & Warren, 1997). Thus, these variables will have an influence on children's development of cognitive abilities that conventional intelligence measures assess (Foxcroft & Roodt, 2005). Furthermore, number of years of formal education is one of the attributes that is the most compelling indicator of cognitive functioning on conventional intelligence measures (Nell, 1997; Shuttleworth-Jordan, 1996).

Over the years, studies have defined SES in various ways, including and/or excluding certain attributes. Studies investigating the effects of SES on cognitive functioning have reported a range of relationships of varying strength, from moderate to high correlations (Duncan & Seymour, 2000). Some researchers favour the inclusion of a diverse range of attributes of SES (Sirin, 2005). Sirin (2005) further emphasizes that if researchers use multiple attributes to define SES (parental income, occupation and education), the results should present a more accurate reflection of the association between SES and cognitive functioning. Using more than one attribute of SES, such as the mother's and father's educational level, might illustrate a stronger correlation between SES and the child's cognitive functioning, compared with the use of a single SES attribute, such as maternal educational level (Duncan, Brooks-Gunn, & Klebanov, 1994). Earlier studies typically focused on the father's occupation or educational level alone, but more recent studies have included the mother's occupation or educational level to cater for families where the father is absent (Duncan & Seymour, 2000). For example, Burg and Belmont (1990) only considered the father's occupation as a factor of SES, whereas the study conducted by Cockcroft et al. (2008) considered maternal level of education.

Another feature that needs to be considered with regard to SES variables is the source by which SES information is obtained. When such information is collected from test-takers themselves, as in a self-report survey, the reported correlation between SES variables and cognitive functioning might be less reliable than when parents or primary caregivers provide this information (Sirin, 2005). In this study, parental educational level

included both the maternal and paternal educational level. Only cases in which the parental educational level data was provided by the parent/s themselves, were included.

2.8 The Relationship between Socio-Economic Status and Cognitive Functioning

Most of the studies investigated that have relevance to this study showed moderate to strong positive correlations between SES variables and individuals' cognitive functioning (Sirin, 2005; White, Reynolds, Thomas, & Gitzlaff, 1993). This is despite the fact that these studies define SES differently (as discussed above, by either using a single attribute or aggregate attributes). When different variables pertaining to cognitive functioning, such as academic achievement, executive functioning, non-verbal abilities, verbal abilities, combination of verbal and non-verbal abilities, reading performance and language proficiency, were examined, a positive correlation between SES and these variables was also found. This is true of studies undertaken with varying population groups (ranging from infants to adults) and of studies using various intelligence measures (Sirin, 2005; White et al., 1993). Measures studied include the Griffiths Scales; the Wechsler Individual Scale for Children – Third Edition (WISC-III); the Wechsler Adult Intelligence Scale –Third Edition (WAIS-III); the Raven Progressive Matrices; and the Kaufman Assessment Battery for Children (K-ABC).

Of particular importance are those studies that have examined the influence of SES variables on developmental aspects associated with general cognitive functioning. These associated aspects include academic or school achievement, verbal abilities such as language skills and reading ability, executive functioning and, specifically, cognitive functioning as measured on cognitive measures. In this study, the relationship between the SES variable, parental education, and children's cognitive functioning as measured on an intelligence measure was the most relevant parameter.

Numerous international studies have shown a correlation between low SES and poor cognitive functioning (Sirin, 2005; White et al., 1993). For example, language skill has been shown to be associated with SES, in that low SES is related to poor reading skills (Duncan & Seymour, 2009; Hoff, 2003). In turn, reading ability and language proficiency is significantly correlated with general cognitive functioning (Caroll, 1997; Hupp et al., 2011). Studies conducted in various countries have shown that low SES negatively affects a person's executive functioning, which is also strongly correlated with cognitive functioning (Ardila,

Rossellini, Matute & Guajardo, 2005; Sarsour et al., 2011). The most relevant of these studies (that have investigated the effect of SES variables on individuals' cognitive functioning) are discussed below.

Brooks-Gunn and Duncan (1997) evaluated several studies that explored the relationship between poverty and children's development. They found that children belonging to poorer socio-economic groups scored between 6 and 13 points lower on various standardized intelligence measures when compared to children who hailed from middle or higher income groups. Another study conducted in America (Duncan, Brooks-Gunn, & Klebanov, 1994), has examined the influence of several environmental variables on children's cognitive functioning and behaviour. The variables examined included family income, maternal education or schooling, family structure, and ethnicity. The sample included 568 black and 796 white children. The children were assessed when they were 5 years old, using the Wechsler Preschool and Primary Scale of Intelligence (WPPSI). The results showed that a child's poverty status affected his or her cognitive functioning.

Conant et al. (2003) examined 56 American and 46 Lao children's visual memory span on 3 subtests of the K-ABC. This study concluded that there is an interaction between environmental and biological factors and that socio-cultural or experiential influences exert a significant effect on cognitive functioning and cerebral organization.

Another American study was conducted by Svanum, Bringle and McLaughlin (1982). In this study, which sampled children aged 6 to 12 years, 5 493 of the participants lived in homes where the father was present and 616 of the participants in homes with an absent father. The children were assessed on two subtests (Vocabulary and Block Design) of the WISC, as well as the Arithmetic and Reading subtests of the Wide Range Achievement Test (WRAT). The results showed that lower test results could be correlated with families where the father was absent, when father-absence was measured in conjunction with SES. This study highlighted that SES variables have an extremely strong influence on cognitive functioning.

A similar study by Guidubaldi and Perry (1984) investigated the effect of divorce and SES on the cognitive functioning of pre-school children in an American suburban district. The results of this study showed that single-parent status and SES, showed stronger correlation with children's cognitive functioning than family background, developmental history and health variables.

In another study, 320 Israeli-born children were studied in terms of their mental abilities (as expressed by verbal, reasoning, numerical and spatial skills). Children from middle socio-economic classes scored higher overall on these cognitive measures than children from lower socio-economic classes (Burg & Belmont, 1990). In a similar study, Gregorio (2006) conducted a study on Spanish children and investigated the relationship between children's cognitive functioning and parental educational level. The children ranged between the ages of 6 and 16 years and 11 months, and their cognitive performance was assessed on the Spanish adaptation of the WISC-IV. The results indicated that parental educational level is a strong predictor of children's cognitive functioning.

Vincent (1991) analysed various studies that investigated the differences in IQ scores between children of different racial groups (black and white). The children's IQ scores were compared with the norms for various cognitive measures (K-ABC, WAIS-R, Stanford-Binet-IV and the Raven Standard Progressive Matrices Test). Vincent (1991) found that discrepancies in performance on these tests between racial groups were decreasing. This decrease might be the result of improved access to equal educational, economic, and environmental opportunities for minority groups (Vincent, 1991). Cronbach (1990) reviewed various American studies on cross-cultural variables and concluded that, when populations are equivalent with regard to parental education, occupation, and income, the average IQ differences between different racial groups are reduced. The findings from these reviewed studies, thus illustrate that educational and economic opportunity has an effect on individuals' cognitive functioning.

In Africa, there are considerably fewer studies conducted on the effect of SES variables on children's general cognitive functioning. The one study that is specifically relevant here is from Nairobi, Kenya. This study examined the effect of certain variables (residence in particular neighbourhoods, gender, primary school type, and household SES) on school achievement. The results revealed that these variables had a negative effect on children's academic achievement (Ejakait, Mutisya, Ezeh, Oketch, & Ngware, 2011).

In the South African context, there are still fewer studies conducted on the correlation between SES variables and individuals' cognitive functioning when compared with the volume of work done abroad. Research in the South African context is specifically lacking with regard to an account of the relationship between parental education and children's cognitive functioning (Cockcroft, submitted). A study by Grieve and Van Eeden (2010) was

conducted on adults ranging from 20 to 55 years to establish the suitability of the Afrikaans translation of the WAIS-III. This study found that participants from urbanized environments who had good quality education scored in the same range as subjects from the UK and the USA. Other comparative studies in South Africa on Afrikaans translations of intelligence measures indicated that Afrikaans-speaking individuals performed lower on intelligence measures than English-speaking individuals, because of their educational and socio-economic disadvantage at that time (Claassen, 1997). Van Eeden (1997) also established a significant difference between English- and Afrikaans-speaking children's cognitive functioning on both the verbal and non-verbal scales on the SSAIS-R. However, as time passed, these differences decreased as the Afrikaans-speaking individuals' educational level and SES level changed for the better (Claassen, 1997; Murphy, Te Nijenhuis, & Van Eeden, 2009). The Flynn effect may be used to explain the increase in cognitive functioning for the Afrikaans-speaking individuals. The Flynn effect suggests that IQ scores increase from one generation to the next as environmental factors become more favourable (Flynn, 2007).

According to Jansen and Greenop (2008), environmental factors will also have an effect on what method children will use when visual and verbal tasks are approached. In Jansen and Greenop's (2008) study, K-ABC was used to asses cognitive functioning and achievement. The population consisted of children from Soweto between 5 and 10 years of age. The K-ABC was used to assess the children's cognitive functioning and achievement as this test was assumed to be less culturally loaded. A study conducted on black South African infants using the Griffiths Mental Development Scales (Griffiths Scales) illustrated that there were noteworthy differences between children from high and low SES groups (Cockcroft et al., 2008). Although the Raven Standard Progressive Matrices Test (RSPM) is viewed as relatively culturally neutral, since the items are in a non-verbal format, a study conducted by Freeman (1984) showed that children from urbanized environments, such as Soweto, performed better than children from rural environments, such as Venda and Transkei. A study by Van Eeden and Visser (1992), on the validity and reliability of the SSAIS-R and the General Scholastic Aptitude Test (GSAT) for different cultural groups, showed that environmental deprivation could, to some extent, explain the variation in performance across the cultural groups. Similar studies on the GSAT also found that differences in scores between cultural groups are associated with environmental factors, such as different levels of SES (Claassen & Schepers, 1990). The lack of pre-school educational opportunities among children from deprived environments correlated with poorer performance on intelligence

measures when compared to the performance of children from privileged environments (Foxcroft, 2004).

In conclusion, the studies discussed above indicate that the variables that are most likely to correlate with a person's cognitive functioning (as measured on intelligence measures) are language proficiency, cultural background, extent of urbanization, SES, quality of the home environment, highest standard passed and the educational level of the mother and/or father, as well as quality of education (Nell, 1997).

It is anticipated that the present study will yield similar results to those discussed above. Thus, the SES variable, parental educational level is expected to be correlated with a child's cognitive functioning.

2.9 Research Aim

This study has investigated the correlation between the SES variable, parental educational level, and a child's cognitive functioning. Although there is a great deal of research regarding numerous environmental factors, including SES variables, and its relationship with various aspects of individual's cognitive functioning, such research is limited in the South African context. Research undertaken in the South African context into the correlation between environmental factors and cognitive functioning, largely focused on translated versions of intelligence measures, or on measures that were not developed in South Africa. In contrast, this study focuses on the correlation between the SES variable, parental educational level, and children's cognitive functioning as obtained from a South African-based intelligence measure, the SSAIS-R.

2.10 Research Questions

i.) Is there a significant correlation between level of parental education and children's cognitive functioning as measured using the SSAIS-R?

ii.) If the independent variable of parental education includes both the maternal and paternal educational levels, does a stronger correlation emerge between parental educational level and the child's cognitive functioning (compared with the use of maternal educational level alone)?

CHAPTER THREE

3. Method

This chapter discusses the methods used to address the research questions set out for this study. It includes information on the research design, the sample, and sampling method, the validity and reliability of the measuring instruments used, the procedures used to obtain the data, the data analysis techniques utilised, as well as ethical considerations.

3.1 Research Design

The research design was a correlational and quantitative archival one that made use of existing data from psycho-educational assessments conducted at the Centre for Psychological Services and Career Development (PsyCaD). The independent variable of parental educational level was not manipulated or controlled; thus, the study has a non-experimental design. The study examined statistical correlations and did not investigate causal relationships. Both the independent variable (parental educational level) and the dependant variable (children's cognitive functioning), pre-existed at the time of the study and thus an ex-post facto design was required (Terre Blanche, Durrheim, & Painter, 2006).

3.2 Sample and Sampling

The study was conducted using archival data obtained from a sample of 54 school children from a primary school in Newlands, Johannesburg. However, the original database contained incomplete records for some of the variables of interest. Thus, only 23 cases were eligible for use in the present study. The population sampled in this study comprises South African children between the ages of 8 and 10 years, with their first language being either English or Afrikaans, and who attended the mainstream public primary school. The public primary school from which the sample was drawn is a dual-medium school that provides educational services to learners from largely disadvantaged backgrounds. Every year, the school identifies children who seem to struggle academically. These children are then referred to PsyCaD for a full psycho-educational assessment at no cost. The cognitive functioning of the sampled children was assessed using the SSAIS-R in 2011 and 2012.

Gender and age were the only additional biographical information obtained for the children as seen in Table 2 below. Age ranged from 8 to 10 years and the sample consisted of

9 boys and 14 girls. Most of the children were 8 years old with only 3 children who were 9 years old and the sample consisted of only one 10-year-old girl.

Table 2

Gender and Age characteristics of the Sample

Variable		
Gender	Male	Female
	N = 9	N = 14
Age		
8 Years	7	12
9 Years	2	1
10 Years	0	1

The sampling strategy used in this study was purposive, with a convenience sample that fulfilled the selection criteria. These criteria included the following: the assessed children needed to be between the ages of 7 and 16 years 11 months; they needed to be tested using the SSAIS-R; consent forms had to have been signed by the children's parent/s; the intake questionnaire on maternal and/or paternal level of education needed to have been completed; and the information on the intake questionnaire had to indicate that the child did not show any evidence of physical impairments, such as neurological impairment, trauma to the head, serious illness, speech impairment, motor impairment, and use of medication or other substances which might have affected his or her IQ score (Foxcroft & Roodt, 2005). This sample was deemed appropriate for this study since the researcher sought to determine the correlation between parental educational level (the independent variable) and children's cognitive functioning (the dependent variable).

3.3 Measuring Instruments

In order to obtain information on parental educational level, existing intake questionnaires completed by the children's parent/s were used. The SSAIS-R was the measuring instrument

used to obtain results on children's cognitive functioning during the years of 2011 and 2012. The SSAIS-R was administered, as per the recommended guidelines, by qualified psychologists, intern psychologists, psychometrists and intern psychometrists working at PsyCaD at that time. The subtests of the SSAIS-R are discussed in Table 3 below. The validity and reliability of the SSAIS-R are also discussed. The reliability of an instrument refers to whether or not an instrument is consistent in what it is supposed to measure, and if the measuring instrument is reasonably free from measurement errors. The validity of an instrument indicates whether or not the instrument does in fact measure what it claims to measure (Foxcroft & Roodt, 2005).

3.3.1 Intake questionnaire

Information on parental educational level was obtained from the existing intake questionnaires. These instruments were used at PsyCaD at the University of Johannesburg at the time this study was undertaken. The questionnaires (see Appendix A) were administered during a psycho-educational intake interview conducted by a psychologist or intern psychologist with the child's parent/s. The intake questionnaire included items on the educational level of the father and mother. According to Entwisle and Astone (1994), information about a child's SES, such as parental educational level, should be obtained from the parents, because data is less reliable when obtained from the child. In this study cases were only included in the sample if the parent/s provided information on their educational levels. Cases were excluded if information on parent's SES was fathered from the children.

3.3.2 Intelligence measure

Children's cognitive functioning were obtained from their results on the SSAIS-R. As already mentioned, this test measures general cognitive functioning as well as various mental abilities in order to profile a test-taker's strengths and weaknesses, and to assist in diagnosing mental impairments (Owen & Taljaard, 1995). The SSAIS-R is a deviation IQ scale where the standard deviation method is used to calculate norms for each sub-test and the composite scales, which include the Full, Verbal and Non-verbal Scales. A person's performance on the SSAIS-R can thus be compared with the performance of others belonging to the same age group (Van Eeden, 1997). The SSAIS-R was administered in psycho-educational assessments by psychometrists, intern psychometrists, psychologists or intern psychologists employed by PsyCaD at the time this study was undertaken.

The SSAIS-R has been standardized for use with children between the ages of 7 years and 16 years 11 months, whose first language is English or Afrikaans. The SSAIS-R norms were obtained from white, coloured and Indian children who met the criteria outlined under the heading "Sample and Sampling" (Van Eeden, 1991). Eleven subtests are included in the SSAIS-R, nine of which form a composite scale. The composite scale provides a Full Scale IQ score as well as Verbal and Non-verbal Scale scores. Two additional sub-tests are included for further optional diagnostic purposes, but are not included in the composite scales (Cockcroft & Blackburn, 2008). All subscales of the SSAIS-R were administered during the psycho-educational assessments on the children included in this sample. Thus, correlations between the results of the SSAIS-R and parental educational level include scores on all eleven substests. The aim and rationale of each of the nine composite scale sub-tests and the two additional sub-tests may be viewed in Appendix B.

The validity of a measure is also important in order to determine whether or not the measure was effective in measuring an individual's general cognitive functioning. Content validity refers to the extent to which the content in the measure represents the construct that is being measured (Van Eeden, 1997). Content validity, in the case of the SSAIS-R, is described under the heading "Rationale" in Table 3 for each sub-test. Construct validity refers to the extent the measure assesses the theoretical construct which it aims to measure (Foxcroft & Roodt, 2005). Construct validity for the SSAIS-R was determined through factor analysis as well as by investigating correlations of the SSAIS-R with other intelligence measures (Cockcroft, submitted). Factor analysis showed that significant loadings on one main factor, general intelligence, were present. Two other factor loadings were identified which showed sufficient variance between these two factors, which were verbal and non-verbal intelligence (Van Eeden, 1997). The SSAIS-R correlated significantly with other measures assessing cognitive ability. These measures include the New South African Group Test (NSAGT) and the Group Test for Indian South Africans (GTISA) (Van Eeden, 1997). Criterion-related validity refers to the extent to which scores obtained on the SSAIS-R can predict performance on a specific criterion, such as scholastic achievement (Foxcroft & Roodt, 2005). The predictive validity of the SSAIS-R for school achievement ranged from 0.24 to 0.51 for the non-verbal sub-tests and from 0.20 to 0.63 for the verbal sub-tests (Cockcroft, 2013).

The reliability of the subtests and scales of the SSAIS-R is an indication of the consistency of measurement of the respective cognitive abilities. The reliability coefficients of the sub-tests and scales for the ages 8, 9 and 10 years are presented in Table 3 below.

Table 3

Reliability Coefficients of the SSAIS-R

Sub-tests/Scales	8 Years	9 Years	10 Years
Vocabulary: Afrikaans	0.80	0.81	0.83
Vocabulary: English	0.89	0.90	0.88
Comprehension	0.76	0.78	0.77
Similarities	0.78	0.78	0.81
Number Problems	0.85	0.87	0.88
Story Memory	0.84	0.85	0.85
Pattern Completion	0.87	0.87	0.85
Block Design	0.91	0.90	0.91
Missing Parts	0.61	0.68	0.65
Form Board	0.69	0.70	0.71
Memory for Digits	0.74	0.74	0.76
Coding	0.73	0.71	0.82
Verbal Scale	0.93	0.94	0.94
Non-verbal Scale	0.89	0.90	0.90
Full Scale	0.94	0.95	0.95

(Van Eeden, 1997)

Van Eden (1997) reports that the reliability of the SSAIS-R subtests ranged from 0.61 to 0.91 on the sub-tests and range from 0.89 to 0.95 on the scales. The scales and sub-tests thus appear to be reliable, with the possible exception of the Missing Parts sub-test, for all three age groups. According to Bester (2003), reliability coefficients lower than 0.70 are below the accepted minimum.

3.4 Procedure

The archival data used is operational data (Olson, 2008) that had been obtained and stored in a database that was accessible after permission was granted by the Director of PsyCaD. Therefore, prior to gaining access to the data required for the current study, it was necessary to obtain permission from the Director of PsyCad. Thus, a letter pertaining information about the aim of the study, data collection and analysis procedures and ethical considerations (see Appendix C) was addressed to the Director of PsyCad asking for permission. The researcher and her supervisor and co-supervisor signed this letter. The relevant data was only collected and evaluated after the Director gave formal written consent to gain access to the archival records (see Appendix D).

After permission was given to access the records, all the records from psycho-educational assessments that were eligible for this study were reviewed to decide which cases would be included or excluded. Out of a possible 54 cases, only 23 eligible cases that complied with the criteria discussed above could be used for the current study. The collected data were captured electronically so that statistical analysis could be undertaken. The collected data included the following variables: number of years of completed education for each parent; the child's age, grade and gender as well as year of assessment; the Full, Verbal and Non-verbal Scaled scores, as well as the scores for each sub-test of the SSAIS-R.

The use of archival data presents several advantages, including ease of access to data in a cost and time effective manner. It is also usually more practical to obtain existing data than to collect new data (McCaston, 2005). The archival data obtained for this study was used to answer the main research question set out for this study. However, not enough cases that adhered to the sample criteria were obtained and, as such, the secondary research question has not been fully investigated. The use of archival data also has certain limitations; these are discussed later in this report, under the section headed "Limitations".

3.5 Data Analysis

Existing data captured during psycho-educational assessments at PsyCaD were analysed to determine possible correlations between the independent variable (parental educational level), and the dependent variable (child's cognitive functioning). The data included the information of an intake questionnaire completed during the psycho-educational intake interview with the child's parent/s as well as the child's test scores on the SSAIS-R. Archival data was obtained for the years 2011 and 2012 only. All the data captured were converted to numerical codes as to make the data compatible for statistical analyses. After the data was coded, it was entered on to an Excel spread sheet for descriptive analysis. Further, inferential statistical analyses, namely an analysis of variance (ANOVA) as well as a multivariate correlation analyses were performed using OpenStat (Miller, 2008).

3.5.1 Descriptive statistics

In any study, the basic features of the data are described using descriptive statistics (Trochim, 2006a). These provide simple summaries such as frequencies, measures of central tendency (the 'averages') – the mean, median and mode, and sometimes the measures of dispersion – the range, mean deviation, variance and standard deviation. The mean is the most common measure of central tendency and what is generally meant when the word "average" is used. It is the sum of the scores divided by the number of scores when the level of measurement is at least interval (Howell, 2004). The current study focused on presenting the mean, standard deviation, and the range on the interested variables.

3.5.2 Inferential statistics

When one wants to establish if the results obtained from the sample can be generalized in some way to the larger population, inferential statistics are used (Terre Blanche, Durrheim, & Painter, 2006).

One way of addressing the question posed in the current study would be to ascertain whether there are significant differences between the IQ scores of children when grouping their parents into National Qualification Framework (NQF) levels, which would indicate their level of formal education (SAQA, 1995). There were too few present fathers to perform a meaningful analysis on them, so only the mothers' levels were used. As there were five groups, a statistical technique for comparing more than two groups (as in the case of a t-test) would be necessary. Therefore, an ANOVA was used. In its simplest form, the ANOVA

provides a statistical test of whether or not the means of several groups differ significantly. ANOVAs are useful in comparing three, or more means. The purpose of the ANOVA is to predict a single dependent variable or outcome on the basis of one or more independent variables, and to establish whether these variables are good predictors or not (Cardinal, 2004).The ANOVA looks at between-group differences when the groups are independent, and within-group differences – repeated measures – when the same participant yields more than one score (Psych Study Guides, 2007). In this study, each child provided a Full, Verbal, and a Non-verbal Scale Score. This research used a two-way mixed analysis of variance (Keppel, 1973) with NQF level as the between factor and type of Scale IQ score as the within (repeated measures) factor.

The independent variable (parental educational level) was measured as a categorical (ordinal) variable when this variable was correlated with the dependent variable (child's cognitive functioning). Thus, parental education was categorised as follows:

- Level 1 (a value of 1 on the parental educational variable): Grade 4 to Grade 9 (Standard 2 to Standard 7)
- Level 2: Grade 10 (Standard 8)
- Level 3: Grade 11 (Standard 9)
- Level 4: Grade 12 (Standard 10 or Matriculation or a Trade Certificate)
- Level 5: a National Certificate, National Diploma or Occupational Certificate (SAQA, 1995).

3.5.3 Correlational analysis

According to Cherry (2012), the purpose of correlational studies is to look for relationships between variables. There are three possible types of correlation: a positive correlation, a negative correlation, and no correlation. A correlation coefficient is a measure of correlation strength and can range from –1.00 to +1.00. In a positive correlations, either variables increase or decrease at the same time. A correlation coefficient close to +1.00 indicates a strong positive correlation. In a negative correlation, as one variable increases, the other decreases. A correlation coefficient close to -1.00 indicates a strong negative or inverse correlation. In the case of no Correlation, there is no relationship between the two variables. A correlation coefficient of zero indicates no correlation.

The main research objective was analysed by calculating Pearson's Product Moment correlation coefficients. This investigated whether parental years of formal education was related to a child's cognitive functioning. The actual scores of both variables were used for the correlational analysis as when interval data for both variables are used, the data is possible less skewed (Howell, 2004). The strength of the relationship between these two variables was represented as a correlation coefficient, *r* (Howell, 2004). The sample size was too small ($n = 23$) to justify the use of regression analysis. With a larger sample, regression analysis could be used to predict whether scores on the independent variable (parental educational level) would predict scores on the dependant variable (child's cognitive functioning) (Huck, 2009). To detect a small (0.15) or moderate (0.30) effect size at statistical power of 0.8 and a probability level of 0.05, samples of either 55 or 30 children, respectively, would be necessary for regression analysis (Rosenthal & Rosnow, 1991). In addition, the data on parental education was incomplete in that, in 16 of the 23 cases, the PsyCaD database provided details of the mother's level of education but not the father's.

The study also investigated whether a stronger correlation occurred between parental educational level and a child's cognitive functioning when parental education was measured using both parents' educational level rather than just the mother's educational level. Thus, according to Sirin (2005), if parental educational level consists of the mother and father's educational levels, the correlation would be stronger between parental educational level and a child's cognitive functioning. Although the variables were analysed by calculating Pearson's Product Moment correlation coefficient, the sample size was too small ($n = 7$) to be interpreted as significant.

3.6 Ethical Considerations

Ethical clearance for this study was granted by the University of the Witwatersrand HREC Ethics Committee (see Appendix E).

Formal permission was obtained from the Director of PsyCaD to conduct the research at the PsyCaD offices. This permission was essential because the PsyCaD database is confidential and is owned by PsyCaD, and data may not be removed from the premises.

The study reviewed existing data from client records and files, thus the usual requirement for obtaining written informed consent from the parents and legal guardians of the children was waived. They had given their consent for their children to be assessed at PsyCaD, and

the PsyCaD assessment consent form stipulates that PsyCaD have the permission to use relevant information for research purposes (see Appendix F).

Lastly, information used for this study remained anonymous and confidential. No clients have been identified by name in any research report or publication resulting from this study. A unique identification number was used when electronically capturing data for individual children. Records and files analysed are kept in a locked filing cabinet at the PsyCaD offices.

CHAPTER FOUR

4. Results

In this chapter, the results of statistical analysis of the archival data are presented. Descriptive statistics are presented first in order to summarise the distribution and describe the sample. This is followed by inferential statistics using an ANOVA test to present the results on the correlation between maternal educational NQF levels and children's IQ scores measured by the SSAIS-R. Paternal educational NQF levels were not used for this analysis since a sample size of seven would most probably yield statistical insignificant results. Lastly, a Pearson's Product Moment correlational analysis was performed on the actual data of the independent variable (parental years of formal education) and the dependent variable (children's Full, Verbal and Non-verbal Scale IQ scores).

Data analysis was performed using Statistical Programs for the Social Sciences (SPSS) and Microsoft Excel software for descriptive analysis. Further, inferential statistical analyses, namely analysis of variance (ANOVA), and a Pearson's Product Moment correlational analysis were performed using OpenStat (Miller, 2008).

4.1 Statistical Abbreviations

Abbreviations are used in this section since the size of tables was insufficient to include lengthy descriptions. Table 4 provides a list of abbreviations used for the sub-scales/tests of the SSAIS-R and other key variables.

Table 4

Abbreviations for the Sub-scales/tests of the SSAIS-R and other Key Variables

Variable	Abbreviation
Full Scale IQ	FIQ
Verbal Scale IQ	VIQ
Non-verbal Scale IQ	NVIQ
Vocabulary	VC
Comprehension	CO
Similarities	SI
Number Problems	NP
Story Memory	SM
Pattern Completion	PC
Block Design	BD
Missing Parts	MP
Form Board	FB
Memory for Digits	MD
Coding	CD
Maternal Educational Level	MEL
Paternal Educational Level	PEL
Maternal Years of Education	MYE
Paternal Years of Education	PYE

4.2 Descriptive Statistics

Descriptive statistics are presented with regard to data obtained on all SSAIS-R scales and sub-tests, age and gender of the children, as well as maternal and paternal educational level and their amount of years of formal education. For each variable, the mean (M), standard deviation (SD), and minimum (MIN) and maximum (MAX) scores are outlined in tables together with simple graphic presentations.

4.2.1 The children

There were 9 boys and 14 girls. The children's ages ranged from 8 to 10 years old, with a mean age of just over 8 years old. Nineteen of the children were 8 years old, three were 9 years old and only one was 10 years old at the time of testing. Six children were in Grade 1, fourteen in Grade 2 and three in Grade 3 at the time of testing. Ten were assessed in 2011, and thirteen in 2012.

Table 5 presents the descriptive statistics on the SSAIS-R for the Full, Verbal, Non-verbal IQ Scale scores and the sub-tests scores. The Full Scale IQ scores ranged from 49 to 92 with a mean of 72.23 (SD = 12.93). The Verbal Scale IQ scores ranged from 49 to 110 with a mean of 74.13 (SD = 15.17). The average of the Non-verbal Scale IQ scores was slightly higher than that of the Verbal Scale IQ scores and ranged from 49 to 100 with a mean of 75.09 (SD = 15.71). The mean for the Full, Verbal and Non-verbal Scale IQ scores are represented graphically in Figure 1 below. From Figure 1 it can be seen that on average the children fell into the 'below average' range on the Full, Verbal and Non-verbal Scale IQ scores.

In terms of the sub-test scores (also presented below in table 5), the Vocabulary scores had the highest mean of 9.35 (SD = 2.71), and was further the only sub-test with a mean that fell within the average range of functioning which is a sub-test score between 9 to 11. The lowest averages were observed for Similarities (M = 4.48; SD = 4.15), Number Problems (M = 4.7; SD = 2.27), and Pattern Completion (M = 4.96; SD = 3.59). Even though the means of the other sub-tests were higher than four, these sub-tests' means were still significantly below the average range of functioning. The means of the sub-test scores are represented graphically in Figure 2 below. From Figure 2 it can be seen that the Vocabulary sub-test had the highest scores, while performance on the Similarities was the weakest on average. This will be analysed further in a later section.

Table 5

Full, Verbal, and Non-verbal Scale IQ Scores and Sub-test scores on the SSAIS-R

SSAIS-R	M	SD	MIN	MAX	N
FIQ	72.23	12.93	49	92	23
VIQ	74.13	15.17	49	110	23
NVIQ	75.09	15.71	49	100	23
VC	9.35	2.71	0	13	23
CO	6.78	3.72	0	14	23
SI	4.48	4.15	0	14	23
NP	4.70	2.27	0	9	23
SM	5.09	2.60	0	10	23
MD	6.09	2.73	1	11	23
PC	4.96	3.59	0	12	23
BD	6.26	2.22	1	11	23
MP	6.83	2.89	0	13	23
FB	7.3	3.5	0	12	23
CD	6.13	3.28	0	13	23

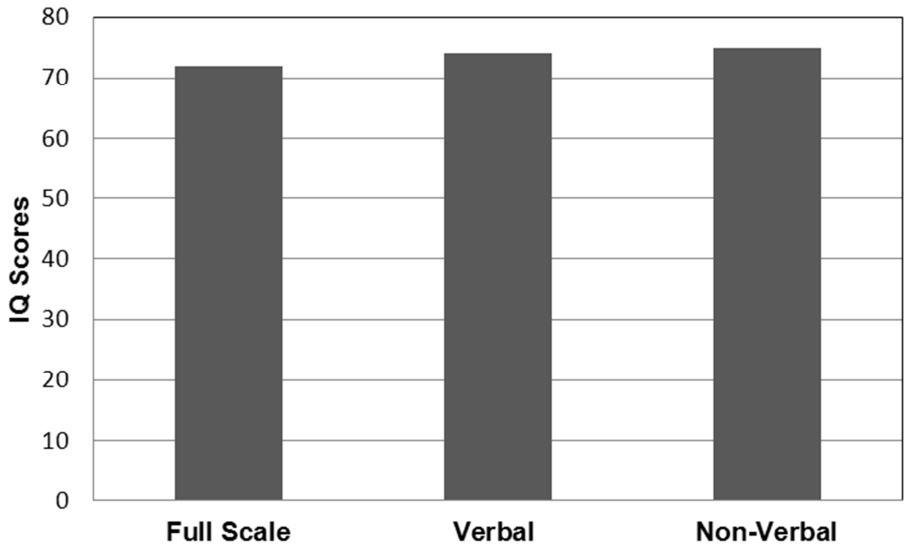

Figure 1. Means of Full, Verbal, and Non-verbal IQ Scale scores

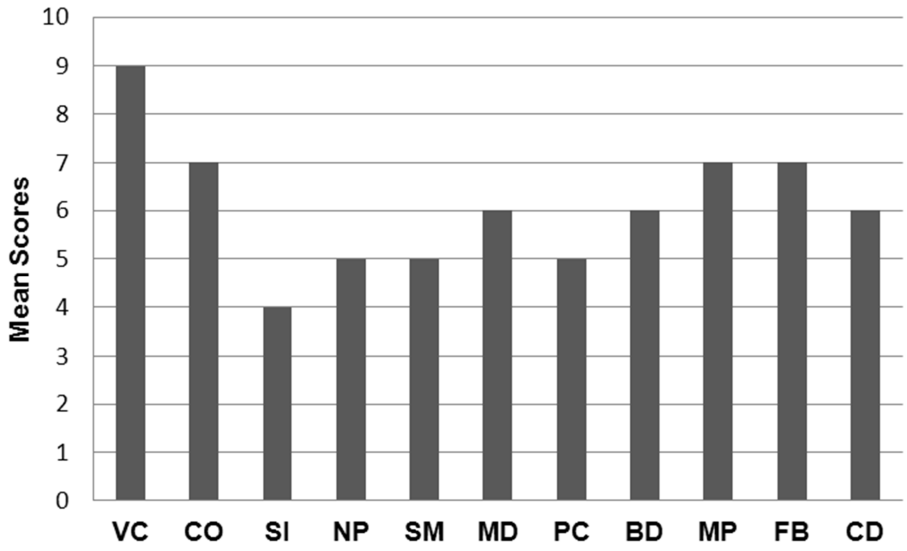

Figure 2. Means of sub-test scale scores

4.2.2 The parents

All of the children had a mother present, but only 7 children had a father present as well. The mean number of years of completed formal education for each parent was 10 years for the fathers, and 10.2 years for the mothers. These figures were sorted into NQF levels, and may be seen in Table 6 and are represented graphically in Figure 3 below.

Table 6 presents the descriptive statistics for maternal educational level which shows a mean of 2.48 (SD = 1.34) and a range of between 1 and 5. Paternal educational levels show a mean of 2.29 (SD = 1.25) and a range of between 1 and 4.

Table 6

Maternal and Paternal NQF Level

Variable	M	SD	MIN	MAX	N
MEL	2.48	1.34	1	5	23
PEL	2.29	1.25	1	4	7

From Figure 3 it can be seen that most parents tended to lower levels of education, with only six having finished secondary school, and a further two mothers who studied at a tertiary level.

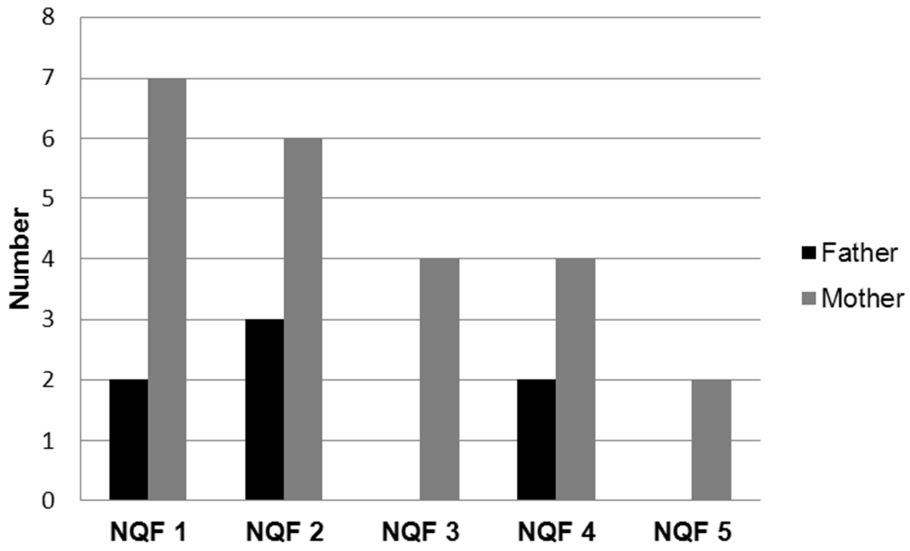

Figure 3. Maternal and paternal NQF levels

4.3 Inferential Statistics

When the sample data wanted to be used to generalize in some way to a larger population, inferential statistics are used. For the purpose of this study, the inferential technique that was employed was an ANOVA since maternal level of education ranged over five groups (NQF levels one to five).

4.3.1 Maternal NQF level and children's IQ scores

The hypothesis of the study infers that children whose parents had received a higher level of education would score higher on intelligence measures than those children whose parents had received a lower level of education. Since the data collected for paternal educational level only yielded a sample size of seven, it is considered as a too small sample to provide statistical significant results. Thus, only maternal level of education were analysed through an ANOVA test.

The means for the Full, Verbal and Non-verbal Scale IQ scores of the children for mothers across the NQF groups may be seen below in Table 7, and are represented graphically in Figure 4. These results give an overall picture with respect to profiles of the children's Full, Verbal and Non-verbal Scale IQ scores.

Table 7

Maternal NQF Level and Children's Full, Verbal, and Non-verbal Scale IQ Scores

NQF Level	FIQ	VIQ	NVIQ
1	60.000	61.429	63.714
2	71.167	78.833	68.000
3	82.750	82.250	88.750
4	81.250	80.750	84.500
5	79.000	75.000	90.000

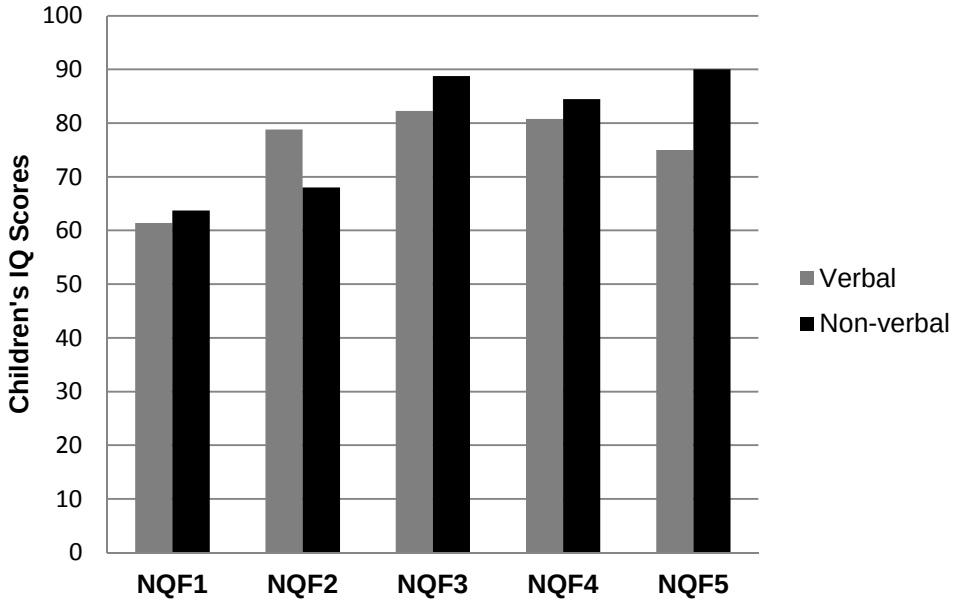

Figure 4. Maternal NQF level and children's FIQ, VIQ, and NVIQ

The ANOVA Summary Table may be found in Appendix G. The ANOVA yielded a significant result for the NQF group ($F(4;18) = 4.996$; $p = 0.0069$). The type of scale IQ score did not reach statistical significance ($p = 0.5259$), nor did the NQF x IQ interaction ($p = 0.3436$). The results showed that the children of the mothers with the two lowest NQF levels had IQ scores that were significantly lower than the children of mothers with a NQF level of three or higher. This partitioning of the groups would be further expanded by carrying out a correlational analysis. This will be described in the next section.

4.4 Correlational Analyses

This research used the Pearson Product Moment Correlation Technique, which is appropriate when data are at least interval in measure. This technique uses the symbol *r* to indicate the strength of a correlation (Runyon & Haber, 1980). Schmidt (2000) has provided schematic representations of the types of scatterplots yielded by correlational research, which may be viewed in Appendix H:

An approximate guide to correlation strength *r* is as follows:

- $r = 0$ shows no correlation
- $r = \pm 0.1$ to $r = \pm 0.3$ indicates a weak correlation
- $r = \pm 0.4$ to $r = \pm 0.6$ shows a moderate correlation
- $r = \pm 0.7$ to $r = \pm 0.9$ indicates a strong correlation
- $r = \pm 1$ shows a perfect correlation

(Rosenthal & Rosnow, 1991).

Besides strength, correlations also need to be tested for statistical significance. This means that one needs to make sure that the calculated correlation coefficient will indeed hold true at least 95% of the time, so that the chances of a Type I error (finding a result which is actually not true for any of a number reasons, such as sampling error) is less than 5%. This is usually done by computing a t-test (Janda, 2001), and from this establishing a probability level *p*, which must be less than 5% and is expressed as a decimal. The smaller the *p*-value the greater the statistical significance.

4.4.1 Years of Completed Education of Parents and Children's IQ Scores

The current study correlated the number of completed years of formal education of each parent with the children's Full, Verbal and Non-verbal Scale IQ scores, as well as with the children's scores on all the sub-tests of the SSAIS-R. The correlation matrix is presented in Table 8 below, and the data for mother's number of completed years of education and Full IQ as well as mother's number of completed years of education and Non-verbal IQ are shown graphically in Figures 5 and 6 respectively. (A full correlation matrix of all variables may be found in Appendix I).

Correlations of $r = \geq 0.65$ are considered moderate (Schmidt, 2000) and showed high statistical significance despite the small sample size. Maternal years of completed education showed a significant, moderate and positive correlation with a child's Full Scale IQ score ($r = 0.611$; $p < 0.01$), and a slightly higher correlation with the child's Non-verbal Scale IQ score ($r = 0.658$; $p < 0.001$). With regard to the sub-test scores on the SSAIS-R, maternal years of completed education correlated moderately and positively with five sub-tests namely; Comprehension ($r = 0.468$; $p < 0.05$), Number Problems ($r = 0.576$; $p < 0.01$), Pattern Completion ($r = 0.516$; $p < 0.05$), Block Design ($r = 0.538$; $p < 0.01$), as well as Missing Parts ($r = 0.681$; $p < 0.001$).

Paternal years of completed education was not correlated or was inversely correlated with a child's IQ scores on the Full, Verbal, and Non-verbal Scale IQ scores, as well as the sub-tests scores. Thus, more completed years of paternal education might even be associated with lower IQ scores in the child (e.g. the r for paternal completed years of education and Pattern Completion was $r = -0.312$; $p < 0.001$). Overall, the paternal completed years of education appeared not to be correlated with the child's Full Scale IQ score ($r = -0.043$), Verbal Scale IQ score ($r = 0.039$), and Non-verbal Scale IQ score ($r = -0.107$). Data on paternal years of completed education were obtained for only seven children. Thus the results had low statistical power and the changes of making a Type II error were high. In a Type II error, the null hypothesis is not rejected even though it is false.

There was a moderate positive correlation between the mother's education and the children's Full Scale IQ ($r=0.611$) and the children's Verbal Scale IQ ($r=0.6558$). The weak positive correlation between the mother's education and the children's Non-Verbal Scale IQ ($r=0.371$) was not statistically significant. These results indicate that more years of completed education in mothers is associated with higher IQ scores generally in their children, and specifically higher Verbal Scale IQ scores.

Table 8

The Number of Completed Years of Education of Each Parent with the Children's Full IQ, Verbal IQ, and Non-Verbal IQ, as well as Sub-test Scores on the SSAIS-R

SSAIS-R	MYE	N	PYE	N
FIQ	0.611	23	-0.043	7
VIQ	0.371	23	0.039	7
NVIQ	0.658	23	-0.107	7
VC	0.255	23	0.013	7
CO	0.468*	23	0.100	7
SI	0.032	23	0.038	7
NP	0.576**	23	-0.158**	7
SM	0.177	23	0.066	7
MD	0.254	23	0.205*	7
PC	0.516*	23	-0.312***	7
BD	0.538**	23	0.187	7
MP	0.681***	23	0.066	7
FB	0.273	23	-0.085	7
CD	0.305	23	0.272	7

* Significant at $p < 0.05$

** Significant at $p < 0.01$

*** Significant at $p < 0.001$

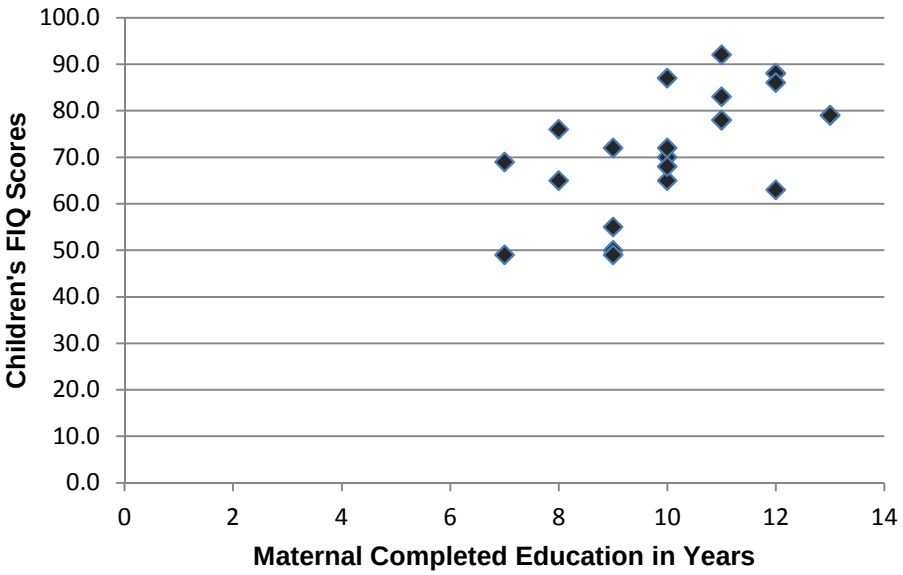

Figure 5. Scatterplot of the maternal number of completed years of education with the children's Full Scale IQ scores

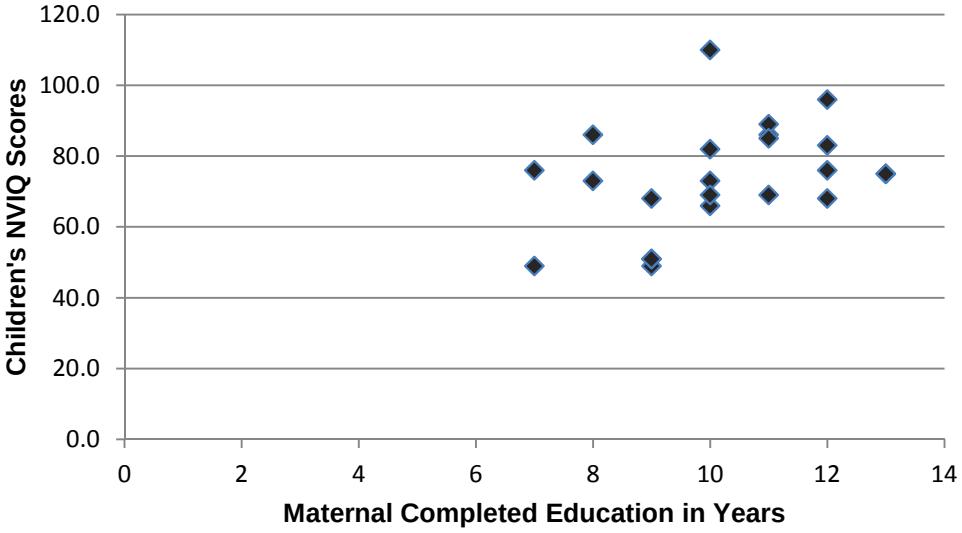

Figure 6. Scatterplot of the maternal number of completed years of education with the children's Non-verbal Scale IQ scores

4.5 Sample Size

A convenience sample was used in this study, where data pertaining to 23 children was obtained. A sample of this size provided a low level of statistical power, at approximately 0.30 for a two-tailed correlation test (*r* statistic). A power of approximately 0.70 (or more) would have been preferable to reduce the likelihood of making a Type II error, but this would have required a sample of 65 (or more) children. A Type I error occurs when the researcher

rejects the null hypothesis because the statistical results indicate a lack of significance in the findings, even though the null hypothesis is in fact true. The level of significance (*p*-value) reflects the likelihood of this type of error, also known as the alpha level. By contrast, a Type II error entails not rejecting the null hypothesis when it is false. The statistical power reflects the likelihood of this type of error, also known as the beta level (Rosenthal & Rosnow, 1991). Thus, a Type II error might occur if the results suggest that no important relationship exists between the variables in question, although in reality this relationship is in fact important. The small sample in the current study provided low statistical power, meaning that there was a strong chance of making a Type II error based on the statistical results. Thus, the results must be interpreted with caution. The lack of a significant relationship between paternal educational level and the child's IQ does not necessarily mean that these variables are unrelated, but might rather reflect the influence of a small sample size.

4.6 Conclusion

Taken all the analyses completed into account, the results obtained indicated a significant difference in the IQ scores of children with mothers whom had higher levels of education compared to those with lower levels of education. This was particularly the case with respect to the Non-Verbal Scale IQ scores of the SSAIS-R. This result was further highlighted with a Pearson Product Moment correlational analysis which showed a positive correlation between maternal years of completed education and children's Full and Non-verbal Scale IQ scores. Further, there were significant differences in performance on the sub-tests, with certain tests scores being significantly higher or lower. Maternal years of completed education also correlated positively with certain of the subtests. The finding that maternal level of education is related to the child's IQ score, means that the null hypothesis was rejected for this particular research question.

There were too few data present for paternal level of education or paternal years of completed education to carry out meaningful analysis on these scores, or to find statistical significant results. Therefore, the findings for paternal educational level were less clear cut, and the null hypothesis was not rejected for either sample for this research question (n = 23 or n = 7). Any finding pertaining to paternal level of education or years of completed education should be interpreted with caution, because of the small sample size and the risk of a Type II error.

CHAPTER FIVE

5. Discussion

In this chapter, the results obtained in this study are critically discussed with regard to the theoretical framework outlined earlier in this report. The main objective of this study was to investigate the relationship between parental educational level and children's cognitive functioning as measured by a conventional South African-based measure, the SSAIS-R. The discussion that follows in this chapter includes mention of how the research questions were addressed and explains why certain aspects of the research questions could not be satisfied by this study.

Thereafter, the chapter offers conclusions as to the main arguments and findings of the study. This is followed by a delineation of the limitations of this study so as to avoid over-generalisation when interpreting the results. Outlining these limitations also indicates recommendations for possible future research within this area.

In this section, the sample is discussed by referring back to the descriptive statistics undertaken in the analysis. This is followed by a discussion of the key findings and how these results correspond to theoretical assumptions. Thereafter, the results pertaining to the relationship between maternal educational level and children's cognitive functioning are discussed, as well as the strength of the correlation between parental educational level and children's cognitive functioning.

5.1. The Sample

Descriptive statistics were undertaken on the scaled SSAIS-R scores, biographical information on the children's age and gender, as well as parental educational levels and parental years completed of education. These descriptive statistics proved to be beneficial to this study as they provided a context within which the results could be interpreted.

Cognitive functioning was measured using the SSAIS-R, which is standardised with a mean of 100 and a standard deviation of 15 (Van Eeden, 1991). Descriptive statistics were obtained for scores on the Full, Verbal and Non-verbal Scales as well as all the sub-tests scores on the SSAIS-R across the total sample of 23 children. The average Non-verbal Scale IQ score for the total sample was the highest, followed by the Verbal Scale IQ score. The Full Scale IQ score was the lowest. All of these mean IQ scores fall within the borderline range; 70 to 79 (see Table 1); of cognitive functioning (Van Eeden, 1991). The data obtained

on the SSAIS-R scores emanated from children in a mostly impoverished area. It was thus to be expected that the sampled children would perform poorly on an intelligence measure, as compared to children from more advantaged environments (Cockcroft et al., 2008). This would explain why the majority of the sample scored within the borderline range on the Full, Verbal, as well as the Non-verbal IQ scales.

With regard to the sub-tests of the SSAIS-R, means are set as 10 and the standard deviation as 3. The sample performed mostly below average on all sub-tests with the exception of the Vocabulary sub-test where the mean fell within the average range (8 to 11). The Vocabulary subtest requires the child to name or point to one of four pictures after words have been read out. Hence, the chance of guessing the correct answer is greater as the assessor cannot be certain if the child is pointing to the card because he or she knows the meaning of the word, or points randomly and by chance selects the right card. Scores on sub-tests pertaining to Comprehension, Memory for Digits, Block Design, Missing Parts, Form Board and Coding, fell within the 'below average' range (6 to 7). Scores in the sub-tests pertaining to Number Problems and Pattern Completion were, on average, in the 'borderline' category. Scores in the Similarities sub-test fell within the 'well below average range' (1 to 4).

Descriptive statistics showed that the average age of the sampled children was 8 years and 2 months, and 9 cases were male and 14 cases female. The age range of the children was between 8 and 10 years, which was appropriate for use of the SSAIS-R, since this measure can be used for children between the ages of 7 years and 16 years 11 months (Van Eeden, 1991).

With regard to the descriptive statistics on parental educational level, maternal educational levels ranged from level 1 to level 5. According to the National Qualifications Framework of South Africa (SAQA, 1995), level of education relates to the highest Grade or Standard passed as follows: level 1 equals Grade 4 to 9 or Standard 2 to 7; level 2 equals Grade 10 or Standard 8; level 3 equals Grade 11 or Standard 9; level 4 equals Grade 12 or Standard 10 (Matriculation) or Trade Certificate; and level 5 equals National Certificate, National Diploma or Occupational Certificate. Therefore, maternal educational levels ranged from 4 to more than 12 years of formal education (depending on the qualification). Only two mothers had completed a tertiary qualification. Paternal educational levels ranged from level 1 to 4 for a sample of 7 cases and thus, indicate between 4 and 12 years of formal education.

The mean maternal educational level was 2.5 for the total sample of 23, and the mean for paternal educational level was 2.3 for a sample of 7 cases. Overall, only six parents had completed secondary school and thus, the parents from this sample tended lower levels of education.

5.2 Parental Educational Level and Children's Cognitive Functioning

In this section, the correlations between the variables investigated (parental educational level and children's cognitive functioning) are critically discussed in order to address the main research questions. Furthermore, explanations are provided as to why the second research question could not be sufficiently analysed.

Overall, the results of the present study showed that a relationship exists between maternal educational level and children's cognitive functioning, and this point is discussed first. However, the discussion further delves into the relationship between maternal educational level and children's verbal and non-verbal cognitive functioning with regard to the theoretical concepts of crystallised and fluid intelligence. Thereafter, a discussion of the lack of (or inverse) correlation between paternal educational level and children's cognitive functioning is provided. Finally, a discussion is presented on the restriction of using only one variable (maternal educational level) rather than multiple variables on the strength of the relationship between these variables (parental educational level and children's cognitive functioning).

5.2.1 Maternal educational level and children's cognitive functioning

Quality of education and education level are variables that have a major effect on individuals' test performance (Skuy, Schutte, Fridjhon, & O'Carroll, 2001). Mothers with a higher level of education are more likely to enter professional occupations and, in turn, belong to wealthier socio-economic groups. This also allows for increased access to financial resources, health care facilities, social services, quality education, exposure to libraries, books and technology, and familiarity with Western ways. Access to these resources subsequently have an effect on a child's cognitive development and functioning (Nell, 1997; Owen, 1991; Shuttleworth-Edwards et al., 2004). According to Richter and Grieve (1991), mothers who are better educated are more likely to create stimulating home environments conducive for learning, when compared to mothers with lower levels of education. The assumption is that mothers with higher levels of education will read to their children more, engage in active play

with their children, and teach their children rhymes and songs. All of these kinds of activities promote the development of competence and cognitive functioning, as measured by conventional intelligence measures (Foxcroft & Roodt, 2005). It is thus to be expected that children from poorer socio-economic groups will score lower when assessed on intelligence measures (Cockcroft et al., 2008). In addition, maternal level of education may also influence hereditary as well as environmental factors (Bouchard & Segal, 1985). This means that children's cognitive development and functioning will be effected by environmental factors as well as hereditary influences.

The results of the current study indicate a significant and moderate relationship between maternal educational level and children's cognitive functioning. This result was expected since the children assessed belonged mostly to poorer socio-economic groups. Thus, maternal level of education will have an effect on children's cognitive functioning. To investigate this point further, the sample drawn was separated into the NQF level groups; where level 1 indicates the least amount of years of completed education, and level 5 the most years of completed education for this particular sample. The results of this analysis indicate that children whose mothers were better educated scored higher on the SSAIS-R, than those whose mothers obtained lower levels of education. Furthermore, the difference in the average scores obtained by children whose mothers were better educated as compared to those whose mothers were less educated, exceeded 10 points on the Full Scale. This finding further supports the theoretical assumption that maternal level of education will have an effect of children's cognitive development and functioning (Foxcroft & Roodt, 2005).

Theories on intelligence postulate that fluid intelligence is primarily measured on non-verbal sub-tests, while crystallised intelligence is primarily measured on verbal sub-tests. In addition, verbal sub-tests require learned information and practiced skills, which are heavily influenced by a person's educational experiences (Cronbach, 1984). Tasks requiring fluid intelligence, on the other hand, are primarily influenced by biological factors as these tests generally measure novel material that is not taught in schools, and they are thus less dependent on specific educational experiences (Owen, 1998). Since fluid abilities are less dependent on educational experience, it was to be expected that the children in this sample would perform better on the non-verbal sub-tests since the sample drew children from mainly poorer socio-economic groups. As discussed earlier, mothers from poorer socio-economic backgrounds are less likely to provide a stimulating environment for their children, which

will affect the child's cognitive development and functioning (Nell, 1997; Owen, 1991; Shuttleworth-Edwards et al., 2004).

The results further show that children's Non-verbal Scale IQ scores were higher than their Verbal Scale IQ scores, as measured on the SSAIS-R. Thus, maternal educational level had a stronger relationship with children's Non-verbal Scale IQ scores, than with their Verbal Scale IQ scores. The non-verbal sub-tests (Missing Parts, Block Design and Pattern Completion), showed the strongest correlation with maternal educational level. Overall, these three subtests measure the following abilities: perceptual organization, non-verbal reasoning, figural relations, symbolic classification, concept formation, spatial and/or visual processing as well as fluid ability (Taggart, 2010; Van Eeden, 1991). These tests are less reliant on language development, comprehension, spelling, and communication abilities (Sattler, 2001).

Statistically significant correlations were also found between the verbal sub-tests (specifically Number Problems and Comprehension), and maternal educational level. However, these correlations were only moderate in strength. The correlation between the Number Problems sub-test and maternal educational level was slightly higher than that between maternal educational level and the Comprehension sub-test. Although the Number Problem sub-test is categorised under the Verbal Scale, it measures both crystallised and fluid intelligence abilities (Taggart, 2010). The Comprehension sub-test largely measures crystallised abilities, such as verbal comprehension, social judgement, common sense, logical reasoning, knowledge of conventional standards, and long term memory. Thus, this significant correlation with maternal educational level is in conflict with the assumption that children from poorer socio-economic backgrounds will perform less satisfactorily on verbal sub-tests, since these sub-tests are more dependent on educational and cultural opportunities (Owen, 1998).

In conclusion, the results of this study demonstrate a significant and moderate relationship between maternal educational level and children's cognitive functioning. Upon further investigation, these results indicate that children's cognitive functioning is dependent on maternal educational achievement. Thus, maternal education levels may be viewed as a strong predictor of children's achievement on intelligence measures. Therefore, children's IQ scores need to be interpreted with caution as environmental factors also need to be taken into consideration before decisions are made on intervention strategies (Grieve & Van Eeden,

2010). Furthermore, maternal educational level was also more strongly correlated with scores on the non-verbal sub-tests of the SSAIS-R, as compared with the verbal sub-tests. This indicates that children's performances on verbal sub-tests, which mostly measure crystallised abilities, are more negatively affected by maternal educational level, than their performance on non-verbal sub-tests, which primarily measure fluid abilities.

5.2.2 Strength of correlations between parental educational level and children's cognitive functioning.

According to Duncan and Seymour (2000), the relationship between children's cognitive functioning and parental educational level will be stronger if information on both maternal and paternal educational levels is used for statistical analysis, as opposed to only maternal educational level. The second objective of this study was to investigate whether or not a stronger correlation would result between parental educational level and children's cognitive function if information on both parents' educational level was used, rather than just that of the mother. To this end, the study aimed to obtain information on both maternal and paternal educational levels. However, this information was not obtained since a large number of the intake questionnaires pertaining to the sample drawn did not contain information on paternal educational level. Only seven cases were collected where data on both maternal and paternal educational levels were available.

Although this sample size is too small to present statistically significant results, a Pearson's Product Moment correlation was conducted to investigate any trends that may have surfaced. The results indicate that parental educational level did not have a relationship with children's cognitive functioning. Some of the results actually showed a negative relationship with children's cognitive functioning. For example, higher levels of paternal education correlated with lower IQ scores on the part of the children. These results should be interpreted with extreme caution because of the very small sample size. Further studies of this nature, using larger samples, are necessary in order to clarify the relationships between paternal level of education and children's cognitive functioning.

5.3 Cognitive Development and Measuring Intelligence

No single environmental factor, such as maternal educational level, predicts cognitive development and performance on its own (Brody, 1997). Instead, diverse environmental factors need to be considered when interpreting children's IQ scores, especially in a country as diverse as South Africa (Carroll, 1997; Cockcroft et al., 2008; Foxcroft & Roodt, 2005).

Hereditary influences are still considered strong predictors of children's cognitive development and functioning (Conant et al., 2003). Although hereditary factors may set limits on a child's cognitive abilities, environmental factors may determine whether cognitive development and functioning are constrained or stimulated (Sattler, 2001). Since parental educational levels tap into parental heredity as well as environmental factors, it is imperative that information on maternal and paternal educational levels is obtained in order gain a more accurate understanding of the relationship between parental educational level and children's cognitive functioning (Bouchard & Segal, 1985; Sirin, 2005). Thus, further studies, using more variables of SES, are necessary in order to improve the accuracy of predictions of the relationship between parental educational level and children's cognitive functioning.

5.4 Conclusion

The primary objective of this study was to investigate whether or not there is a relationship between parental educational level and children's cognitive functioning. Since sufficient information was only available with regard to maternal educational level, the results and discussion section focused mainly on the relationship between this factor and children's cognitive functioning. Maternal educational level may be related to income and is thus indicative of access to social and economic resources (Cockcroft et al., 2005). This study has provided a description of the cognitive performance of children from poorer socio-economic backgrounds, as evident in the fact that most of their mothers had not completed secondary school education. The study found a significant and moderate relationship between maternal educational level and children's cognitive functioning. Thus, contextual factors, such as SES, should be considered during the interpretation of children's performance on the SSAIS-R, since it appears that SES variables, such as maternal educational level, could have an effect on children's cognitive development and functioning (Cockcroft et al., 2005).

Upon further evaluation of the relationship between maternal educational level and children's cognitive functioning, it was found that maternal educational level is more strongly correlated with Non-verbal Scales IQ scores, as compared to Verbal Scale IQ scores. It is thus argued that intelligence measures focusing on assessing crystallised abilities are more dependent on culture and acquired knowledge and, as such, SES factors such as low maternal level of education would have a more pronounced negative impact on children's performance on these tests (Owen, 1998).

Maternal level of education was also sub-divided into the NQF levels in this study. In this regard, it was found that the relationship (between cognitive functioning and maternal educational level) was stronger when mothers had higher levels of education, as compared to mothers who tended lower levels of education. This further supports the assumption that children's cognitive performance is dependent on the level of maternal education .

The second objective of this study was to determine whether or not the correlation between parental educational level and children's cognitive functioning would be stronger if both maternal and paternal educational levels are used, instead of only maternal educational level. Unfortunately, the data obtained did not present enough information on paternal educational level. As such, the results of this correlation analysis cannot be taken into account since the sample of only 7 cases did not produce statistically significant results.

5.5 Limitations

A number of limitations can be identified in this study. Because of these limitations, the results obtained should be interpreted with caution.

The research design employed was a correlational and non-experimental design. This type of design only allowed for potential relationships or predictions to be investigated since directionality could not be established (Leedy, 1989). Another important disadvantage of a correlational and non-experimental research design, is that causal inferences cannot be made and, as such, the relationship between parental educational level and children's cognitive functioning could only be described (Leedy, 1989). Therefore, correlational studies are limited in that while they can suggest that there is a relationship between two variables, they cannot prove that one variable causes a change in another variable. In other words, correlation does not equal causation. Variables may be linked or co-exist, but other variables may also play a role (Terre Blanche, Durrheim, & Painter, 2006).

Data collection for this study involved evaluating existing archival data, which had a negative impact on this study. First, the quality of the data could not be determined prior to when it was actually obtained. This resulted in the gathering of limited information on parental educational level, specifically paternal educational level. Thus, when the existing records at PsyCaD were reviewed in order to obtain information on the interested variables for this study, the researcher found that the data did not present the information expected. As discussed earlier, this limited information hindered important analyses of the relationship

between parental educational level and children's cognitive functioning. Another limitation of the use of archival data pertains to the fact that the data was originally collected by other researchers, which resulted in the fact that some of the information required for this study was not completed on the intake questionnaires. Furthermore, the original purpose of the data differed from the purpose for which it was used in this study. Thus, the goals and purposes of the original data collector could potentially have biased this study (McCaston, 2005). A further limitation of the archival data is that the parents might have provided information that was inaccurate or only partially accurate with regard to parental educational level.

Since the sample was drawn from a specific region and school in Johannesburg, ecological validity was also limited. Therefore, generalising across geographical regions would not be appropriate (Johnson & Christensen, 2012).

Although the SSAIS-R proved to have sufficient psychometric properties, it was developed during a very different era with regard to the demographics of South African children as well as the educational curriculum (Cockcroft, submitted). In addition, the SSAIS-R is based on a dated theoretical model and needs to be re-normed and re-standardised in order to make it more appropriate to the current South African demographics (Cockcroft, submitted).

The sample size for this study consisted of only 23 cases, and was thus too small to perform regression analyses in order to detect small or moderate effects at statistical significance (Rosenthal & Rosnow, 1991). Thus, the significance of even small effects could not have been detected and interpreted. Due to the small sample size, some results showed negative correlations on variables that were assumed to produce positive correlations. For example, the relationship between paternal level of education and children's cognitive function was negative. This result may be a reflection of insufficient statistical power for detecting genuine correlations between the variables under investigation (Huck, 2009).

5.6 Recommendations

Although this study did not find unexpected or significant results, it has still produced numerous practical implications for proposed studies. On evaluation of the above limitations, recommendations are provided for future research in this area.

In terms of using archival data, it is recommended that a preliminary review of the archival data be conducted in order to determine whether the data will produce quality and relevant information for the purposes of the proposed study.

In addition, it is recommended that a larger sample size be used when investigating the relationship between these variables. This might produce results that had better emphasise genuine relationships between the variables and that yield statistically significant correlations.

Since this study provided some evidence to suggest that children with mothers with poorer education obtained lower scores on cognitive measures, a more representative sample of maternal educational levels should be included if only one variable of SES is to be considered. In order to conduct a study with greater relevance to the South African context, more SES variables should be included, including sufficient sampling of both paternal and maternal educational levels.

5.7 Summary and Concluding Remarks

This study's main aim was to investigate whether parental educational level will be significantly correlated with children's cognitive functioning. Although numerous studies, locally and abroad, have studied varying SES variable's effect on differing aspects of children's cognitive functioning, there is limited research pertaining to the South African context. Furthermore, studies investigating the mentioned variables have not been done on a South African-based intelligence measure. According to Cockcroft (submitted), information is lacking regarding the effects of parental educational level on children's IQ scores, specifically on the SSAIS-R.

The researcher assumed that parental educational level will have an effect on children's cognitive functioning. Unfortunately, the main research question could only be answered partially since only limited information regarding paternal level of education was obtained. However, enough data on maternal level of education was obtained to perform statistical analysis. The results of the analysis between the maternal educational level and children's cognitive functioning was as assumed, and thus maternal level of education showed a significant and moderate correlation with children's cognitive functioning. The second research question wanted to investigate if a stronger correlation would exist if both maternal and paternal level of education were correlated with children's cognitive functioning, than

when only maternal or paternal level of education were used. As mentioned above, information pertaining to paternal level of education was limited, and thus the second research question could not be answered.

Since the current study and various other studies obtained results that showed some correlation between SES variables, such as maternal level of education, and children's performance on intelligence measures, psychologists involved in the psycho-educational assessment process need to be extremely cautious when interpreting children's IQ scores. This is further essential when any professionals decide on certain interventions for a specific child (Cockcroft & Blackburn, 2008). Thus, it is of utmost importance to retrieve as much relevant socio-economic and cultural information as necessary during the initial intake interview with people involved in the child's live before the child is being assessed on an intelligence measure (Foxcroft, 1997).

A further need for using and developing intelligence measures that assesses a child's cognitive potential and not just cognitive performance, appeared to emanate from the results of this study. The means for the Full, Verbal, and Non-verbal Scale IQ scores of the children assessed fell within the 'borderline' range of cognitive functioning. Thus, most of the children performed below their expected age level on the SSAIS- R. The results of this study assume that there is a need for the use of alternative intelligence measures in conjunction with conventional intelligence measures (Nell, 1997; Taylor, 1994).

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APPENDICES

APPENDIX A: PsyCaD Intake Form for Psycho-educational Assessments

Centre for Psychological Services and Career Development
(PsyCaD)

INTAKE FORM

1. BIOGRAPHICAL INFORMATION

Name of client:_____ Date of birth:_____

School: _____

Contact person:_____ Grade:_____

Physical address:_____

_____

Postal address:_____

_____

Siblings:

_____ Age:_____ Grade:_____

_____ Age:_____ Grade:_____

_____ Age:_____ Grade:_____

_____ Age:_____ Grade:_____

_____ Age:_____ Grade:_____

2. BIOGRAPHICAL INFORMATION: PARENTS/ GUARDIANS

	Mother	Father	Stepmother	Stepfather
Name and Surname				
Career				
Highest educational level				
Tel.no.				
Age				

Private/Confidential

Centre for Psychological Services and Career Development
(PsyCaD)

Medical problems				
Any other difficulties				

- ***In the event of a divorce:***

*Who has legal custody?*_____
*Who does the child stay with?*_____
*Does the other parent know about this intervention?*_____
*Who is responsible for the account?*_____

3. REASON FOR REFERRAL

Referred by (1):_____ Telephone number:_____
Referred by (2):_____ Telephone number:_____
Reason for referral:_____
_____
_____
Do you agree with the reason for referral. Is there anything else you think should be paid attention to?_____
_____
_____
What change would you like to see, or what information would you like to get?__
_____
_____
_____

Private/Confidential

Centre for Psychological Services and Career Development
(PsyCaD)

4. DEVELOPMENTAL HISTORY

Pregnancy

Was the pregnancy planned?_____

How did you react to the news that you were pregnant?_____

_____

How did the other parent react?_____

_____

Did you drink, smoke or use any other substances during the pregnancy. If yes, please specify._____

_____

Was there any complications during the pregnancy?_____

_____

_____

Birth-information

Was there any special circumstances or health problems during the birth?_____

_____

_____

Was there any complications?_____

_____

_____

How did you as parents react towards the baby?_____

_____

_____

How did the siblings react towards the baby?_____

_____

_____

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Centre for Psychological Services and Career Development
(PsyCaD)

What was the baby's birth weight?_____

Developmental history

Who looked after the child?_____

_____

Any feeding problems?_____

_____

How did the toilet-training go?_____

_____

When did the child Sit _____

Crawl _____

Walk _____

Talk _____

Has the child suffered from any specific or recurrent medical problems or had any accidents? _____

_____

_____

_____

Who handled the discipline and how?_____

_____

_____

Pre-school

What was the life circumstances of the child? _____

_____

_____

Private/Confidential

Centre for Psychological Services and Career Development
(PsyCaD)

Who was part of the immediate family?_____

_____

_____

Did the child go to pre-school. If yes, for how long, from which age? How did he/she adapt to it?_____

_____

_____

_____

School history

School	Year	Grade	Reason for school change	Relationships with teachers	Relationships with peers	Any changes in child

What activities does your child enjoy the most?_____

_____

What activities does your child enjoy the least?_____

_____

Is there any conduct or behavioural problems? If Yes, please specify._____

_____

_____

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Centre for Psychological Services and Career Development
(PsyCaD)

Medical history

Is the child currently under medical supervision or on any medication? If yes, please specify type, reason, dosage, duration and side effects experienced?_____

_____

_____

_____

How would you describe his/ her general health?_____

_____

_____

What medical interventions have the child experienced. Please specify the reasons._____

_____

_____

Has the child ever been hospitalized? If yes, please specify reason and duration._

_____

_____

Has the child ever been to a psychologist?_____

If yes:

- Reason_____
  _____
- Duration_____
- When_____
- What impact did it have on the child?_____
  _____
- What, in your opinion, helped? _____
  _____
- Why was it terminated?_____
  _____

Private/Confidential

Centre for Psychological Services and Career Development
(PsyCaD)

Has the child ever been to any of the following?

	Dates	Reason	Person	Contact nr.	Further comments
Speech therapist					
Occupational Therapist					
Neurologist					
Psychiatrist					
Optometrist					
Audiologist					
Medical specialist					
Other relevant professionals					

Private/Confidential

Centre for Psychological Services and Career Development
(PsyCaD)

5. GENERAL INFORMATION

Has the child suffered any trauma?_____

_____

_____

_____

What are your expectations of your child?_____

_____

_____

Is there any other information that you feel is relevant and has not been covered in any of the preceding questions?_____

_____

_____

_____

Name:_____ Date:_____

Signature:_____

Private/Confidential

APPENDIX B: Aim and Rationale of the Subtest of the SSAIS-R

COMPOSITE SCALES		
Verbal Sub-tests	Aim	Rationale
Vocabulary	Measures a person's verbal intelligence and verbal learning ability, and indicates a person's language development and language usage. Long-term memory and concept formation play a role in these abilities.	It is based on the assumption that the quality and extent of a person's vocabulary is a good measurement of his general intelligence.
Comprehension	The test items include a variety of social situations. The degree of comprehension that the testee shows for these situations represents intellectual functioning. Knowledge of conventional standards of behaviour is necessary for success in the test, and the ability to understand and use this information in a meaningful and emotionally relevant way is evaluated.	It is based on the assumption that social adaptation and social judgement are inculcated through everyday experiences and formal training The ability to reason logically is needed to evaluate the information gained through these experiences as well as to apply this information to other situations in a socially acceptable way.
Similarities	Logical, abstract reasoning, verbal concept formation, and long-term memory play a role in performance on this test. A rule has to be deduced from facts in order to make a classification. The ability to distinguish between essential and superficial similarities is therefore important.	It is based on the assumption that the ability to discern the similarities between dissimilar objects and situations and to form concepts based on the similarities is an important facet of general intelligence.
Number	It measures numerical reasoning	It is based on the assumption that

Problems	with underlying logical reasoning, abstract thought and mental alertness. Productive concentration is also important to succeed in this test.	the ability to solve number problems is an indication of general intelligence. The basic mathematical computations, namely addition, subtraction, multiplication, and division, are learned through practical experience and in formal education.
Story Memory	It measures short-term auditory memory. Meaningful verbal learning matter is used to measure the testee's ability to pay attention in a relatively simple situation.	It is based on the assumption that logical memory is one of the abilities of which a certain minimum is required at every level of intellectual functioning. The test is probably a good measure of general intelligence, especially at the lower level of intelligence, and may also have diagnostic value.

Non-verbal Sub-tests	Aim	Rationale
Pattern Completion	It measures underlying logical thinking. Accurate visual perception, concrete reasoning with the help of figures, concept formation, and concentration are important to succeed in this test. The mental manipulation of the pattern parts comprises mainly synthesis in the easier items, whereas the more difficult items possibly also require verbalizing the observed relations.	It is based on the assumption that reasoning by means of analogies is an indication of general intelligence.
Block Design	It measures non-verbal intelligence and non-verbal problem-solving skills. The testee has to solve problems in spatial relations by using logical reasoning. Shapes have to be observed and analysed	It is based on the assumption that the ability to analyse, synthesize, and copy an abstract two-dimensional geometric pattern is a valid criterion of general intelligence.

	by reducing a whole into its component parts and then reassembling them in an identical design. Thus, non-verbal concept formation, perceptual organization, spatial visualization and orientation, and abstract conceptualization are measured. Concentration and visual-motor co-ordination are also important.	
Missing Parts	It measures contact with reality, knowledge and comprehension of familiar situations, the ability to distinguish between essential and non-essential visual information and the ability to see the whole in relation to its parts. Visual concentration and organization are important and visual memory and verbal comprehension also play a role in performance on this test. Perceptual and conceptual abilities are measured, since these abilities are involved in visually recognizing, identifying and understanding familiar objects, and situations.	It is based on the assumption that visual comprehension and detailed perception of familiar objects and situations are an indication of general intelligence.
Form Board	It measures visual perception, organisation and concept formation and the ability to see the underlying relations between objects. Visual-motor co-ordination, where the motor activity is directed by visual perception and sensory-motor feedback, is also important.	It is based on the assumption that the synthesis of parts – concrete, visual shapes – into an organized, integrated whole constitutes a valid criterion of general intelligence. Although the *g* loading is not very high, the test does make qualitative evaluation of the testee's cognitive style possible.

ADDITIONAL SCALES

Verbal Sub-test	Aim	Rationale
Memory for Digits	It measures auditory short-term memory for numbers, but performance on this test is not necessarily an indication of memory for more complex information. The testee has to receive the information correctly, and recall order and vocalize it correctly. Attention and concentration are therefore also measured.	It is based on the assumption that memory, specifically mechanical memory, is one of the abilities of which a certain minimum is required at every level of intellectual functioning. The test also has diagnostic value.
Non-Verbal Sub-test	Aim	Rationale
Coding	The testee has to learn an unfamiliar task and implement what has been learned. The test measures visual-associative learning ability, psychomotor speed and visual-motor integration and co-ordination. Attention, concentration, motivation and short-term memory also play a role in performance on this test.	It is based on the assumption that the associative learning ability, which is required to learn and use the relation between specific symbols and digits, is an indication of general intelligence.

(Van Eeden, 1997)

APPENDIX C: Director Information Sheet

Emthonjeni Centre (EC)
School of Human & Community Development
University of the Witwatersrand
Private Bag 3, WITS, 2050
Tel: (011) 717 4513 Fax: (011) 717 8324

Centre for Psychological Services and Career Development
(PsyCad)
University of Johannesburg, Kingsway Campus, Building B 5
Johannesburg, South Africa
Tel: (011) 559 3106/3324

Dear Director Prof H. G. Pretorius

My name is Melani Byrne and I am conducting research for the purposes of obtaining a Masters degree in Educational Psychology at the University of the Witwatersrand. My area of focus is the relationship between parental educational level and children's general cognitive functioning.
I will be evaluating the existing data that was captured by the Centre for psychological services and career development (PsyCad) for the purposes of psycho-educational assessments. This existing data will include the intake questionnaire and the intelligence scores on the Senior South African Individual Scale-Revised (SSAIS-R).

The data would be evaluated and analysed at the offices of PsyCad and no original data will be taken out of these offices. All the data that will be used for analysis will be used with great care and safety. The data will also be kept confidential and no information that could identify any of the persons involved in the assessment process will be included in the research report or any other publication. The testees will be referred to by a pseudonym (e.g. Testee X, Testee Y) in the research. Only my supervisors and I will have access to this data.

If PsyCad chooses to participate in the study, please complete the form below. If you have any queries about the research I can be contacted telephonically at 073 268 2577 or via email at melani.byrne@gmail.com. Alternatively you can contact my supervisor, Joseph Seabi at 011 717 8331 or email him at joseph.seabi@wits.ac.za, OR Adri Vorster at 011 717 3219 or email her at adri.vorster@wits.ac.za. A summary of the research report will be send to PsyCad.

Your permission to conduct this study using data from PsyCad would be greatly appreciated.

Kind Regards

Melani Byrne

Joseph Seabi

Adri Vorster

APPENDIX D: Director Permission Form

PsyCaD
CENTRE FOR PSYCHOLOGICAL SERVICES AND CAREER DEVELOPMENT
KAROLO YA DITIRELO TŠEO DI AMANAGO LE [illegible] YA MOSOMO
ISIKHUNGO SEZINSIZAKALO EZIPHATHELENE NEZE[illegible] KANYE NOKUTHUTHUKISWA KOMSEBENZI OKHETHIWE
SENTRUM VIR SIELKUNDIGE DIENSTE EN LOOPBAANONTWIKKELING

Friday 9 November 2012

School of Human and Community Development
Private Bag 3, Wits, 2050, Johannesburg, South Africa
Tel: 011 717 4500 Fax: 011 717 4559

I, Prof HG Pretorius, herewith give consent to Melani Byrne to have access to relevant data for her research study on evaluating existing data that was captured during Psycho-Educational assessments at the Centre for Psychological Services and Career Development (PsyCaD).

I understand that:

- No information that may identify any person involved, during the Psycho-Educational process (testees or test administrators) will be included in the research report or any publication, and all the data will remain confidential.
- I am informed, as fully as possible, as to the aims of the research and possible implications of the research.

Signed: [signature] Date: 9/11/2012

www.uj.ac.za

Prof HG PRETORIUS
Director: Centre for Psychological Services and Career Development (PsyCaD)
Academic Development and Support (ADS)
Tel +27 11 559 3099
Fax +27 11 559 3108
E-mail hgpretorius@uj.ac.za
idegenaar@uj.ac.za

Find PsyCaD Online:
Find PsyCaD's Career Services Online:

OFFICIAL ADDRESS | Cnr Kingsway and University Road Auckland Park
PO Box 524 Auckland Park 2006 | Tel +27 11 559 2911 | www.uj.ac.za
Auckland Park Bunting Campus | Auckland Park Kingsway Campus
Doornfontein Campus | Soweto Campus

UNIVERSITY OF JOHANNESBURG

APPENDIX E: Ethical Clearance Certificate

University of the Witwatersrand, Johannesburg
Faculty of Humanities – Postgraduate Office
Private Bag 3, Wits 2050, South Africa • Tel: +27 11 717 8202• Fax: +27 11 717 4037

Student Number: 478933

Ms. Melani Byrne
P O Box 2016
Brooklyn Square
Pretoria
0075

12 June 2012

Dear Ms. Byrne

APPROVAL OF PROPOSAL FOR THE DEGREE OF MASTER OF EDUCATION IN EDUCATIONAL PSYCHOLOGY

I am pleased to be able to advise you that the readers of the Graduate Studies Committee have approved your proposal entitled "*The relationship between parental educational level and children's cognitive functioning.*" I confirm that Mr Joseph Seabi and Ms. Adriana Vorster have been appointed as your supervisor in the Psychology department.

The research report is normally submitted to the Faculty Office by 15 February, if you have started the beginning of the year, and for mid-year the deadline is 31 July. All students are required to RE-REGISTER at the beginning of each year.

You are required to submit 2 bound copies and one unbound copy plus 1 CD in pdf (Adobe) format of your research report to the Faculty Office. The 2 bound copies go to the examiners and are retained by them and the unbound copy is retained by the Faculty Office as back up.

Please note that should you miss the deadline of 15 February or 31 July you will be required to submit an application for extension of time and register for the research report extension. Any candidate who misses the deadline of 15 February will be charged fees for the research report extension.

Kindly keep us informed of any changes of address during the year.

Note: All MA and PhD candidates who intend graduating shortly must meet your ETD requirements at least 6 weeks after your supervisor has received the examiners reports. **A student must remain registered at the Faculty Office until graduation.**

Yours sincerely

MR NTSEARE

2012 -06- 12

Mpho Ntseare
Postgraduate Division
Faculty of Humanities
Private Bag X3
Wits, 2050
Tel: +27 11 717 4007
Fax:+27 86 211 7362

APPENDIX F: Informed Consent Form

For office use only

Informed Consent Form Number: _____

UNIVERSITY OF JOHANNESBURG

Centre for Psychological Services and Career Development (PsyCaD)

Client / Parent / Legal Guardian's Agreement to Intervention
Consent Form

Full Name of Client / Parent / Legal Guardian: _____

Full Name of Child (if applicable): _____ Male ☐ Female ☐

Address of Client / Parent / Legal Guardian: _____

_____ Code: _____

Postal Address: _____

_____ Code: _____

Contact Details:

Home Tel. Number: _____	Cell Phone Number: _____
Work Tel. Number: _____	E-mail Address: _____

Date of Birth of Client: _____ ID Number of Client: _____

*Intern Psychologist/Psychometrist/Social Worker (please underline the applicable title):

Name and Surname: _____ HPCSA Registration Number: _____

Psychologist/Psychometrist or *Supervisory Psychologist/Psychometrist (please underline the applicable title):

Name and Surname: _____ HPCSA Registration Number: _____

* An Intern Psychologist/Psychometrist/Social Worker works under the supervision of a Registered Psychologist/Psychometrist.

Nature of the Intervention: Therapy ☐ Psychological Assessment ☐

Psycho-education ☐ Parental Guidance ☐ Career Counselling ☐

Benefits of Therapy/Counselling

Therapy/counselling can help a person to gain new understanding about his or her problems and to learn new ways of coping with and solving those problems. Therapy/counselling can help a person to develop new skills and to change behaviour patterns. Therapy/counselling can contribute to improved ability to cope with stress and difficult situations and can increase understanding of self and others. It can also facilitate existing resilience and resources of strengths.

I understand that it is important that I mention promptly any concerns or questions to _____ that I may have at any time during the process of therapy/counselling.

Psychological Assessment

Through the use of a variety of standard psychological assessment procedures the PsyCaD of the University of Johannesburg (UJ) will attempt to answer the questions relating to this assessment. These questions generally concern learning disabilities, academic functioning, career development, and personality functioning or coping styles. Throughout the assessment process you have the right to inquire about the nature or purpose of all procedures. You also have the right to know the assessment results, interpretations and recommendations, within the limits of the ethical code for psychologists, and the relevant legislation that governs the use of psychological assessment.

Page 1 of 2

Agreement for Evaluation and Placement

I hereby confirm that it is clear to me that the psychological assessment I am about to do, is done on request of the UJ faculty to which I have applied. The information obtained will be used by the relevant UJ faculty to assist them in their decision regarding my placement into the relevant programme.

Informed Consent

In knowledge and appreciation of the benefits and risks as made known to me by _____, and as reflected in this form, I hereby give consent to participate in therapy/counselling/assessment for the sake of addressing _____

_____

_____

I further acknowledged that _____ must obtain my informed consent before changing or altering the nature of the intervention of psychological service provided to me.

Confidentiality and Limits on Confidentiality

I have been advised by _____ that all communications with me and all records relating to the provision of psychological services to me are confidential and may not be disclosed without my written consent. I have also been advised that the law places certain limits on the confidential nature of the psychological service provided to me. I have been advised that typically these limits on confidentiality may arise if _____perceives that there is a risk of harm in situations such as the following:

1. If I present an imminent danger to myself or others the law requires that steps be taken to prevent such harm;
2. If a child is in need of protection a report must be filed with the appropriate agency or authority;
3. If a vulnerable adult is abused or neglected a report may be filed with the appropriate government agency;
4. If a court orders the disclosure of records.

Availability of Confidential Information

I hereby grant permission to the PsyCaD of the UJ the following:

1. To make use of relevant information (which shall remain anonymous and strictly confidential) for research and training purposes, as well as for supervision purposes, where appropriate.
2. To make a video and/or audiotape recording during the course of therapy/counselling/assessment if necessary. Said recordings are treated strictly confidentially and anonymously, and I will be verbally informed prior to such recordings.
3. To make use of relevant information to my own advantage where appropriate.

Please note that written reports are only sent to official institutions. These reports are not suitable for court cases or appearances.

Waiver of Confidentiality

I understand that I have the right to confidentiality with respect to all communications with me and all records relating to the provision of psychological services to me. However, with my signature below, I waive my right to confidentiality in order to allow the PsyCaD of the UJ to release or discuss relevant information with _____
(full names of individual/s) for the following purposes: _____.
I have been informed of the consequences of waiving the right to confidentiality.

Acknowledgement and Consent

I _____ *(Client/Parent/Legal Guardian)* acknowledge that I have had the opportunity to carefully read this document to ask, and have answered, any questions or concerns I have about it or arising from it. I further acknowledge that I have read and understood the information contained in this document.

Full Name of Client/Parent/Legal Guardian: _____

Signed: _____ **Date**: _____

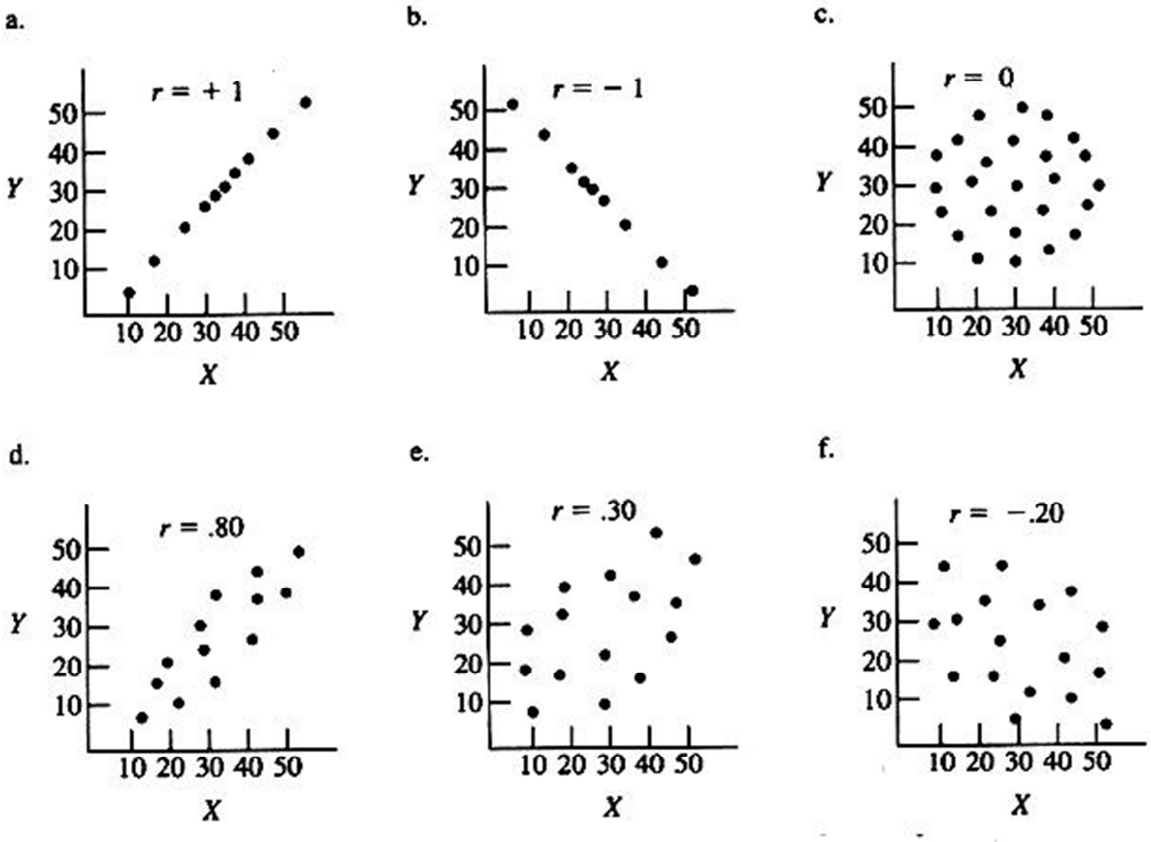
Client/Parent/Legal Guardian

Page 2 of 2

APPENDIX G: ANOVA Summary Table IQ Scores

Source	df	SS	MS	F	Prob.
Between	22	10769.884			
Groups (A)	4	5666.348	1416.587	4.996	0.0069
Subjects w.g.	18	5103.536	283.530		
Within Subjects	46	3502.667			
B Treatments	2	98.203	49.101	0.654	0.5259
A X B inter.	8	702.440	87.805	1.170	0.3436
B X S w.g.	36	2702.024	75.056		
TOTAL	68	14272.551			

APPENDIX H: Schematic Representations of the Types of Scatterplots of Correlational Research



APPENDIX I: Full Correlation Matrix

PARENTAL EDUCATIONAL LEVEL AND CHILDREN'S IQ SCORES

	Father Grade	Mother Grade	Full Scale	Verbal	Non-Verbal	VC	CO	SI	NP	SM	MD	PC	BD	MP	FB	CD
PYE	-	0.178	-0.043	0.039	-0.107	0.013	0.100	0.038	-0.158	0.066	0.205	-0.312	0.187	0.066	-0.085	0.272
t	-	0.829	0.196	0.177	0.493	0.059	0.461	0.173	0.733	0.301	0.959	1.505	0.872	0.305	0.391	1.293
p	-	0.416	0.847	0.861	0.627	0.954	0.649	0.864	0.472	0.766	0.348	0.147	0.393	0.764	0.700	0.210
MYE		-	0.611	0.371	0.658	0.255	0.468	0.032	0.576	0.177	0.254	0.516	0.538	0.681	0.273	0.305
t		-	3.539	1.830	4.001	1.211	2.424	0.146	3.230	0.824	1.203	2.759	2.924	4.267	1.303	1.467
p		-	0.002	0.082	0.001	0.239	0.024	0.885	0.004	0.419	0.243	0.012	0.008	0.000	0.207	0.157
Full_Scale			-	0.866	0.765	0.381	0.849	0.602	0.690	0.593	0.377	0.504	0.782	0.766	0.430	0.517
t			-	7.926	5.448	1.887	7.377	3.456	4.368	3.379	1.865	2.675	5.745	5.459	2.182	2.768
p			-	0.000	0.000	0.073	0.000	0.002	0.000	0.003	0.076	0.014	0.000	0.000	0.041	0.012
Verbal				-	0.364	0.477	0.901	0.784	0.657	0.712	0.348	0.140	0.541	0.532	0.105	0.494
t				-	1.793	2.487	9.510	5.778	3.996	4.642	1.700	0.650	2.951	2.879	0.482	2.603
p				-	0.087	0.021	0.000	0.000	0.001	0.000	0.104	0.523	0.008	0.009	0.635	0.017
Non_Verbal					-	-0.035	0.503	0.150	0.426	0.301	0.279	0.764	0.759	0.815	0.725	0.346
t					-	0.160	2.668	0.694	2.158	1.447	1.329	5.425	5.342	6.448	4.826	1.692
p					-	0.874	0.014	0.495	0.043	0.163	0.198	0.000	0.000	0.000	0.000	0.105
VC						-	0.302	0.146	0.337	0.229	0.076	0.039	0.272	-0.038	-0.285	0.220
t						-	1.449	0.677	1.639	1.077	0.348	0.179	1.293	0.176	1.365	1.033
p							0.162	0.506	0.116	0.294	0.731	0.859	0.210	0.862	0.187	0.313
CO							-	0.590	0.597	0.644	0.239	0.248	0.613	0.653	0.229	0.487
t							-	3.348	3.406	3.854	1.130	1.174	3.557	3.951	1.079	2.557
p							-	0.003	0.003	0.001	0.271	0.253	0.002	0.001	0.293	0.018
SI								-	0.383	0.448	0.273	-0.066	0.232	0.405	0.030	0.309
t								-	1.902	2.294	1.299	0.302	1.094	2.031	0.138	1.488
p								-	0.071	0.032	0.208	0.766	0.286	0.055	0.891	0.152
NP									-	0.268	0.181	0.435	0.351	0.534	-0.034	0.471
t									-	1.274	0.843	2.212	1.718	2.893	0.154	2.444
p									-	0.216	0.409	0.038	0.101	0.009	0.879	0.023
SM										-	0.468	0.040	0.501	0.342	0.268	0.282
t										-	2.427	0.181	2.655	1.670	1.274	1.347
p										-	0.024	0.858	0.015	0.110	0.217	0.192
MD											-	0.261	0.349	0.192	0.207	0.319
t											-	1.236	1.705	0.899	0.968	1.541
p											-	0.230	0.103	0.379	0.344	0.138
PC												-	0.435	0.491	0.313	0.406
t													2.216	2.583	1.510	2.038
p													0.038	0.017	0.146	0.054
BD													-	0.632	0.528	0.326
t													-	3.733	2.850	1.580
p													-	0.001	0.010	0.129
MP														-	0.451	0.348
t														-	2.318	1.702
p														-	0.031	0.103
FB															-	0.220
t																0.002
p																1.000