The relationship between home, school and test language in neuropsychological assessment.

Kaylee van Wyhe

ACSENT Laboratory

Department of Psychology

University of Cape Town

Supervisor: Dr. Kevin Thomas

External Supervisor: Helen Ferret

Word Count: 6018

ABSTRACT

In multilingual South Africa, clinical neuropsychologists often assess individuals whose home language or language of schooling is not English. This situation is problematic because there are few locally developed and standardized neuropsychological tests; the most commonly used tests in this country were developed in North America and Western Europe. This study focused on interactions between an individual's home language, the language in which he/she was schooled, and the language of test administration. 44 individuals, aged 7-23, from several different Cape Town schools and one tertiary institution, were administered a comprehensive neuropsychological test battery. Contrary to predictions participants with inconsistencies between home language, medium of instruction and test language performed much better on the battery than those with consistencies between the three. This however does not support previous literature regarding the crucial role of language in neuropsychological assessment.

South African clinical neuropsychologists are hampered in their practice by an alarming lack of locally developed, standardized, and normed tests. The use by South African neuropsychologists of tests that were developed, standardized and normed in the United States, the United Kingdom, and other Western industrialized countries can have vast practical implications and can result in gross clinical misdiagnosis (Anderson, 2001). For instance, the medium through which instructions during the neuropsychological assessments are transferred and negotiated is through language. The success of this is determined by the effectiveness of the communication between examinee and examiner. Hence, it would be fair to say that if the communication is inappropriate the instructions will not be transferred effectively. Furthermore, it seems logical that before any other neuropsychological assessment considerations are made language of test administration appears crucial. This study hoped to give voice to the problems created by inappropriate language use in neuropsychological assessments. The current study focused on the role of language (specifically, the interactions between home language of the patient/examinee, the language in which that individual has received his/her education, and the language of test administration) in neuropsychological assessment in South Africa.

BACKGROUND

South Africa is a culturally and racially diverse nation, marred by historic inequities that manifest themselves today in extreme individual differences in socioeconomic status (SES) and education. The country is also linguistically diverse, with eleven official languages. According to the 2001 government census (Statistics South Africa, 2001), in the Western Cape the three major language groups are Afrikaans, isiXhosa, and English, respectively: 55.3% of the population in that province reported Afrikaans as their home language; 23.7% Xhosa; and 19.3 % English. Despite these figures, English is the primary language used in education in the Western Cape and in South Africa as a whole (WCED, 2009).

In clinical neuropsychological practice, as in education, many people are tested in a language different from their home language. This situation arises because almost all popular and commonly-used neuropsychological tests were developed in English-speaking countries such as the United States and the United Kingdom. Therefore, people who do not have

English as a home language, but who are assessed in English, are at an immediate disadvantage.[1]

For instance, Carstairs, Myors, Shores, and Fogarty (2006) compared neuropsychological test performance of three groups of Australian participants (*N* = 116): those from a non-English- speaking cultural background who first spoke a language other than English as a child, those from a non-English- speaking cultural background who first spoke English as a child, and those from an English-speaking background. All participants were tested in English. The researchers found that individuals from non-English-speaking backgrounds performed more poorly on verbal subtests; they ascribed this relatively poor performance to the individuals' lack of proficiency in English rather than to cultural differences. They therefore concluded that proficiency in the language of test administration impacts on assessments of general verbal ability on verbal subtests. These findings raise questions about the current clinical practices of assessing individuals from non-English-speaking backgrounds in English.

The disadvantage experienced by the individuals from non-English-speaking backgrounds might be decreased if the individual's language of educational instruction is English, however. To illustrate this point, Shuttleworth-Edwards et al. (2004) compared test performance on an English administration of the Wechsler Adult Intelligence Scale – Third Revision (WAIS-III; Wechsler 1997) of a sample of South African white English first-language and black African first-language speakers (*N* = 68, age range 19-30 years). Crucially, all participants had English as a medium of educational instruction. The results suggested that white and black participants with educational backgrounds of similar quality performed at a level comparable to the US standardization sample. Similarly, Bethlehem, de Picciotto, and Watt (2006) demonstrated, using a small South African bilingual English-Zulu speaking sample (*N* = 35), that individuals who were tested in English and who had English as a medium of instruction performed slightly better on verbal fluency tests than those who were tested in Zulu and had English as a medium of instruction. These data suggest that even

[1]Of interest here, however, is that even South African individuals with English as their home language may not, because of cultural and idiomatic differences, perform as well as UK- and US-based normative groups on tests developed in those countries. For instance, Wallis and Birt (2003), testing a South African sample (*N* = 131), found that both native English speakers and non-native English speakers struggled to create synonyms for words used on a popular multiple-choice personality questionnaire (the Sixteen Factor Personality Questionnaire (16PF); Cattell, 1995), even though that questionnaire is advertised as being suitable for individuals with a 5th-grade reading level.

if home language and medium of instruction are not the same, the best language for the individual to be tested in is that in which he/she has received formal education.

Sixty percent of children in South Africa attend Afrikaans single-medium schools (Giliomee, 2005). Thus, psychologists cannot blindly proceed to only administer tests in English; they need to make suitable provisions for, for example, the 60% of children referred to above. Of course, most South African clinical neuropsychologists do not unhesitatingly and unthinkingly apply English language, Western-developed and -normed tests to their clients/patients. In practice, various methods and strategies can be used to overcome the language-based difficulties often encountered in assessment sessions. For instance, if an English-speaking neuropsychologist is faced with an Afrikaans-speaking client, there are various options available to that psychologist. One option is to test the individual in English, make a note that the individual's home language is in fact Afrikaans, and accordingly adjust test interpretations. This, of course, is not necessarily fair to the client, for numerous reasons. For instance, the validity of the test administration might be compromised because the test was not designed to be administered to individuals without a certain level of English-language proficiency; additionally, the interpretive adjustments made by the clinician will not necessarily be empirically based and so there is the risk of under-diagnosis of a pathological condition.

A second option in this case, and one that is frequently employed by South African neuropsychologists, is to employ an interpreter to sit in on the test session in order to translate test instructions and stimuli into Afrikaans. This approach presents numerous interpretive problems, however, particularly when the interpreter has no previous familiarity with the test instructions, or has little neuropsychological or psychometric testing experience. Another potential source of difficulty is when the examiner's language is the interpreter's second or third language. If any of these circumstances arise, the result may be inadequate or biased examination (Lezak, Howieson, & Loring, 2004). Naturally, one way to circumvent the potential problems outlined above is to properly train the interpreter, ensuring that he/she is familiar with the test instruments. Unfortunately, such training and familiarization is time-consuming and expensive, and as such is very rarely possible to implement in the clinical practice setting.

A third option in this case is for the neuropsychologist to translate the English instrument him/herself, and to then conduct the assessment in Afrikaans. Apart from the fact that this raises the same ethical issues as would be present for any of the other options (viz., if the psychologist does not have a firm grounding in the language of the client, it is best to refer the client to someone who is), direct translation of tests is problematic because of idiomatic issues in different languages and the potential cultural inappropriateness and/or irrelevance of particular test items for different ethnic groups (Mitrushina, Boone, Razani, & D'Elia, 2005). Moreover, there is some concern that even well translated instruments must re-establish construct validity in their new guise (Nell, 2000; Wallis, 2004).

A fourth option in this case is thus to devise an entirely new set of psychometrically sound Afrikaans-based tests. Of course, this option costs much more than simply innovation and imagination on the part of the psychologist, and therefore is not something that an individual in clinical practice could undertake on his/her own. Although there are some South African-developed, -standardized, and -normed intelligence and personality tests (e.g., Cattell, 1995; Du Toit, 1994; Robinson 1989), none of these can be called neuropsychological tests. There are South African neuropsychological test batteries (e.g., Roos et al., 2009), all of which consist of translated and culturally adapted forms of tests developed in Western countries; however, the normative data for those South African batteries are limited, and they have not addressed the concern, mentioned above, about re-establishing construct validity.

A fifth (and probably the most radical) option in this case, then, is to eliminate language-based testing altogether and use non-verbal tests with demonstrations and pictures. The widely held belief that non-verbal tests are free from cultural and racial bias has been debunked, however (Perez-Arce & Puente, 1996; Roselli & Ardila, 2003). For instance, Knoetze, Bass, and Steele (2005) showed that Xhosa-speaking individuals performed significantly more poorly than their English-speaking counterparts on the Ravens Coloured Progressive Matrices (RCPM; Raven, Court' & Raven, 1990) test, a widely-used nonverbal assessment of reasoning ability that is often used as a model of culture-free intelligence testing. Knoetze and colleagues speculated that the relatively poor RCPM performance they saw by Xhosa-speaking individuals might be due to the children's inability to think analogically since this kind of thinking is required to interpret non-verbal stimuli.

Clearly, then, the role of language in neuropsychological assessment in South Africa is a complex problem not only because of the variety of languages spoken in the country, but also because of the difficulties associated with interpreting, translating, and adapting tests. This problem is compounded by the political history of the languages involved. Current language use in South Africa is mainly a reflection of the apartheid system's segregation policies,[2] which manifest in a number of ways today. One of these ways is the status that one language (English) enjoys above the others. The impact of this fact on neuropsychological practice, particularly in the domain of child assessment, is that many parents prefer that their children be tested in English despite that not being the child's home language or medium of instruction. One parent recently explained to me that, "I want my son to be tested in English because in this country it is the better language and he has to become familiar with the idea that he will need to be good at English in order to find a job someday". Although parents may have the best of intentions, the choice of English as the language of test administration may actually do a disservice to their children, seeing as children may not perform at their best if they lack proficiency in the language of test administration (Balfour, 1999; Heugh, 2002; Tung, Lam, & Tsang, 1997).

One way to improve proficiency in any language, of course, is to have it as the medium of academic instruction. As noted above, in neuropsychological assessment, matching the language of test administration to the language of academic instruction, regardless of home language, may be particularly important: Children may learn and use various terms at school that are not directly translatable into their home language, or that are required in the academic context but not at home. In other words, language use is context-dependent for multilingual individuals, and it is much more likely that the formal language learned and used in academic contexts will be much more beneficial to neuropsychological test performance than the relatively informal language used in social contexts and at home. Therefore, it seems logical that if individuals are to perform at their best on neuropsychological tests then they should be tested in the language in which they received their formal education.

[2]When reviewing the statistics for matriculation results between 1955 and 1997, one of the strange anomalies of the apartheid educational system is evident. During apartheid, Bantu education was surprisingly successful in that it saw many African first-language speakers actually matriculate. The matriculation pass rate for African first-language pupils showed a significant decline over the period 1976-1997' however (Heugh, 2002). An explanation for this anomaly is that Bantu education was introduced in 1953, which meant that pupils had 8 years of mother-tongue instruction, and the teaching and learning of English and Afrikaans as subjects taught by teachers who were proficient in these languages. It was only in the 9th year of education that African-language speaking pupils were expected to make the switch from mother-tongue instruction to exclusively English and Afrikaans. Despite the poor curriculum Bantu education offered, it 'succeeded' in some ways because instruction and knowledge was being reinforced in a language that pupils were not only familiar with but could comprehend. This argument is supported by October (2002), who demonstrated that Grade 12 African-language speaking learners would perform badly in their final examinations because the medium of instruction and assessment was not in their mother tongue.

In a slightly different vein, a reasonably large body of literature suggests that congruency of home language and medium of instruction enhances students' academic performance (see, e.g., Brock-Utne, 2007; Howie, Scherman, & Venter, 2008; Mchazime, 2001; Snayers & Du Plessis, 2006; Webb, 2006). To illustrate this point, Esterhuyse, Beukes, and Louwrens (2007) conducted a study with a South African sample of Grade 2 learners ($N = 138$), aged 7-8 years. They found that learners instructed in their mother tongue significantly outperformed those instructed in their second language on a measure of intelligence and academic performance. Based on these data, they suggested that medium of instruction is crucial in the development of general mental ability because language and intelligence are interdependent cognitive domains. Similarly, Cattell (2006) examined the performance of first-year university students in a course focused on development of the language of argument and critical thinking. Crucially, students had the choice of taking the course in either English or Afrikaans; naturally, those with a home language of English preferred to take the course in English, and those with a home language of Afrikaans preferred the course in Afrikaans. Results showed that the latter students performed relatively well compared to previous first years who only had the option of English-based instruction even though their home language was Afrikaans. The author attributed this improved level of performance to the ability of the learners to construct meaning from course instructions because they were given in a language in which they were proficient (i.e., their home language).

RATIONALE FOR RESEARCH

Even though South Africa has a multilingual population, clinical and research neuropsychologists often do not fully meet the linguistic needs of the individuals they assess. Even though tests have been (formally and informally) translated and adapted to try and deal with these shortcomings, the issue of assessing individuals with home languages or languages of academic instruction that are not English remains problematic and neglected.

It is still unclear to what extent the relationship between home language, language of academic instruction, and language of test administration affects individual performance on neuropsychological assessment. Language may be the most important mediator of neuropsychological test performance, particularly when the language of test administration is not the home language of the examinee (Nell, 1999).Thus, by focusing on the relationship between home language, school language, test language and neuropsychological test performance this study aimed to add relevant information to aid clinicians and researchers alike.

SPECIFIC AIMS AND HYPOTHESES

This study is part of a 3year longitudinal study, that aims to establish a comprehensive, multi-purpose neuropsychological test battery for reliable use in South African clinical and research settings. The primary objective of the present study was to explore under which language-variant conditions (matching language of test administration with home language or with language of academic instruction) one might derive optimal performance on neuropsychological tests.

The study tested the following hypotheses:

(i) individuals with the same home language, medium of academic instruction and language of test administration will perform better than those individuals with mismatches between home language, medium of instruction and language of test administration;

(ii) individuals with the same medium of academic instruction and language of test administration will perform better than those individuals with a language of test administration that is different from their medium of academic instruction, even if participants in those two groups have the same home language.

METHOD

Research Design and Setting

Data were collected from learners at various primary and high schools and one tertiary institution in Cape Town. The inclusion of a range of schools ensured that diverse levels of socioeconomic status were represented in the sample, ensuring its generalizability to the wider South African population.

A synchronic cross-sequential design was used, comparing three groups based on a non-randomized sampling criterion: one “same” language group and two “different” language groups. Assignment of participants into these groups was based on various combinations of home language, medium of instruction, and language of test administration. The first “different” group consisted of Afrikaans home language participants with an English medium of instruction tested in English (Group AEE). The second “different” group consisted of

Afrikaans home language participants with an English medium of instruction tested in Afrikaans (Group AEA). The "same" group consisted of Afrikaans-speaking participants with Afrikaans as a medium of instruction tested in Afrikaans (Group AAA).

Participants

The final selection of learners was based on a screening interview for psychological disorders: Learners suffering from various forms of psychological and psychiatric pathology have been excluded. The screening interview used was with Kiddie-Schedule for Affective Disorders and Schizophrenia - Present and Life-time Version (Kaufman et al., 1997). A variety of medical questions were also used to establish that the potential participant did not suffer from any medical condition affecting their mental or motor abilities. Furthermore, only individuals able to understand and speak either Afrikaans or English were included.
A sample of 44 participants (age range: 7-23 years) was recruited. There were equal numbers of males and females in each group (see Table 1).

Consent to collect data within various schools was obtained from the Western Cape Education Department and from the University of Cape Town. Approval for all study procedures was granted by the Research Ethics Committee of the University of Stellenbosch Medical School.

Materials

Test battery

The neuropsychological tests that was used in this study are all well-standardized and commonly-used instruments that have been translated and adapted for use in South Africa (see Table 2) (Ferrett et al., 2009).

WASI: General intellectual functioning was measured by using the Wechsler Abbreviated Scale of Intelligence (*WASI;* Wechsler, 1999). This intelligence test has been normed and standardized for use in persons from the age of 6 to 89 years. It is based on the original Wechsler model of intelligence, which conceptualizes intelligence as being captured by the traditional verbal and performance index-split (Strauss, Sherman, & Spreen, 2006).

Table 1

Demographic Characteristics of the Current Sample

Variable	Group AEE (*n* = 15)	Group AEA (*n* = 13)	Group AAA (*n* = 15)	*F* / χ^2	*df*	*p*	ESE[a]
Age (years)	15.89 (4.46)	17.77 (3.00)	15.68 (4.40)	1.02	2, 41	.37	0.13
Sex (F:M)	12:3	10:3	12:4	0.11	2	.95	0.05
Level of education (years)	8.93 (4.11)	10.85	8.69	1.26	2, 41	.29	0.32
Quality of education	4.58 (0.52)	4.5 (0.53)	4.36 (0.50)	0.65	2, 33	.53	0.28
Parents' Annual Income Level				6.52	8	.058	0.37
R0 – 10,000	0	1	3				
R10 – 20,000	0	1	2				
R20 – 40,000	2	1	2				
R40 – 60,000	0	0	0				
R60 – 100,000	2	0	2				
> R100,000	4	1	2				

Note. Quality of education was from the WCED economic status scale for school ratings: 0- 'not classified'; 1- lowest economic bracket; 2- second lowest economic bracket; 3- middle economic bracket; 4- second highest economic bracket; 5- highest economic bracket

Effect size was estimated by ω^2 for ANOVAs and by Cramer's V for chi-square analyses

The *Similarities* and *Vocabulary* subtests make up the WASI Verbal IQ index. The first of these subtests requires participants to identify how two concepts are similar; the second requires participants both to describe the meaning of a word. The *Block Design* and *Matrix Reasoning* subtests make up the WASI Performance IQ index. The first of these subtests requires participants to copy modeled geometric patterns using coloured blocks; the second requires participants to select the correct piece of a missing picture from a series of options.

Boston Naming Test: The Boston Naming Test (BNT; Kaplan Goodglass, & Weintraub, 1976) is a measure of confrontation naming. Participants are required to look at a series of line drawings and name the pictured object. Later items are more difficult than earlier ones because they are less frequently encountered in everyday life and because, therefore, the words to name them occur less frequently in the language of testing. This type of picture-naming vocabulary test is useful in the examination of children with learning disabilities and in the evaluation of brain-injured adults (e.g., those with dysnomia).

Controlled Oral Word Association Test: The purpose of this test is to evaluate the spontaneous production of words under restricted conditions (Benton, Hamshier, & Sivan, 1994). The *phonemic verbal fluency* task requires participants to generate, within a 1-minute time limit, as many words as they can think of that begin with a prescribed letter. The *semantic verbal fluency* task requires participants to name, within a 1-minute limit, as many items or objects that belong in a particular category (e.g., animals).

Biographical and socioeconomic deprivation questionnaire: Participants were required to complete this questionnaire, which asks for information about their age, sex, race, home language, education, and health. In addition, questions such as how many people share a home and if a telephone, running water and electricity are available were included to help determine levels of socioeconomic status.

Marin Acculturation Scale (MAS): This instrument is a 12-item scale developed and previously used with Latino samples in the United States (Marin, Sabogal, Marin, Otero-Sabogal, & Perez-Stable, 1987). The original version of the scale, which has a test-retest reliability of 0.92, was translated into Afrikaans and was administered to measure degree of bilingualism and preferred language status (see Appendix A).

Procedure

Suitable participants were given assent forms to complete and consent forms to give their parents to complete. These forms were returned and completed prior to commitment to participate in the study. Testing was conducted at the school or tertiary institution that the participant attends.

After potential participants were recruited and consent/assent forms have been read or signed, individual screening with Kiddie-SADS - Present and Life-time Version (Kaufman et al., 1997) was conducted.

On the day of testing, the examiners once again ensured that participants understand the purpose of the study and their role in it. They were also be reminded about confidentiality and that they may withdraw at any time during the study. Examiners allowed for any questions participants may have. Only then were they able to proceed with the administration of the 90 minutes neuropsychological battery. The order of test administration was as follows: MAS, BNT, WASI Vocabulary, phonemic verbal fluency, WASI Block Design, WASI similarities, Phonemic verbal fluency, Matrix Reasoning and semantic letter fluency.

The external supervisor (H.F.) managed the administration of the neuropsychological tests by four trained examiners. All test administrators received test manuals in Afrikaans and English, and closely follow the instructions for administration given in the manuals. For the verbal fluency tasks, tape recorders were used to capture responses; these were transcribed later.

Statistical Analysis

Analyses of the collected data were conducted using the Statistica8 software package (StatSoft, Inc., 2007), and commenced with detailed analyses of descriptive statistics characterizing the performance of individuals on the neuropsychological tests listed above. Descriptive statistics also allowed for a closer look at the sample’s characteristics in terms of years of education level, quality of education, gender, SES and age. Descriptive statistics and correlation matrices were performed for initial analysis of the data

Subsequently, inferential statistical analysis, taking the form of between-group comparisons, commenced. The assumptions of parametric statistical tests (e.g., normal distribution of data, homogeneity of variance) were checked for all variables of interest. In each case, the assumptions were upheld, and so between-group comparisons proceeded using analysis of variance (ANOVA).

As the research is based on previous theoretical findings, an analysis of further interest a hierarchical multiple regression to explore which demographic variables predicted performance on the neuropsychological test battery. The results of this regression were analysed and the significant predictor variables identified. The significant predictor variables were those with significant *F*-values and those that explained most strongly the variance in the model as shown by their high R^2 values. These predictors formed the final regression model; diagnostic tests were run on that model. Finally, analysis of the residuals was performed to detect the presence of outliers.

RESULTS

Between-Group Comparisons of Neuropsychological Test Performance

Hypothesis 1 is that Group AAA will outperform Groups AEA and Groups AEE on the measures of interest. Hypothesis 2 is that Group AEE will outperform Group AEA. With regard to the assumptions underlying parametric statistical tests, Levene's test for homogeneity of variance was not significant and the data were normally distributed for the dependent variables. Therefore, a one-way ANOVA with planned contrasts was conducted to examine the hypotheses. The coefficients for the planned contrasts are shown in Table 2.

Table 2
Contrast Coefficients

	Group		
Contrast Number	AEE	AEA	AAA
1	0	-1	1
2	1	0	-1
3	-1	1	0

The results of the ANOVA, along with relevant descriptive statistics, are reported in Table 3. The results in the Table indicate that there were only statically significant between-group differences on two dependent measures: WASI Vocabulary and WASI Matrix Reasoning. *A priori* planned comparisons revealed that there was a significant difference between Groups AEA and AAA and between Groups AEE and AAA on the WASI Vocabulary, $t(40) = 2.06$, $p = .046$, and $t(40) = 2.87$, p = .007. Examining the means for this dependent variable alerts us to the fact that these statistically significant differences are in the opposite direction from that predicted.

With regard to WASI Matrix Reasoning, *a priori* planned comparisons detected statistically significant differences between Groups AEA and AAA, $t(41) = 3.60$, p = .034, and between Groups AEE and AAA, *t*(41) = 2.97, *p* =.006. Again, these results were in the opposite direction to that predicted.

Interestingly, there were several dependent variables on which the omnibus *F* test was not statistically significant but *a priori* planned comparisons were. These dependent variables included: WASI Similarities, where there was a statistically significant difference between Groups AEA and AAA, *t*(40) = 2.20, p = .003; WASI Block Design, where there was a statistically significant difference between groups AEA and AAA, *t*(41)= 2.45, p = .002; semantic fluency, where there was a statistically significant difference between Groups AEE and AAA, *t*(41) = 2.24, p = .003. All of these results were in the opposite direction to that predicted.

Overall, these results are surprising and are contrary to what was predicted. With regard to Hypothesis 1, participants in Group AAA (the “same language” group) did not outperform those in the two “different language” groups (Groups AEA and AEE); in fact, on average they performed more poorly that participants in the other two groups. With regard to Hypothesis 2, participants in Group AEE did not outperform Group AEA; instead, the participants in those two groups performed equally well.

To explore these questions of interest from a slightly different perspective, I conducted a linear correlation to determine to what extent group condition influenced neuropsychological test performance (as estimated by a composite performance variable whose derivation is described below). The analysis indicated that a definite but small negative relationship exists ($r^2 = -0.27$) and it was not statistically significant ($p = 0.07$). The magnitude of this relationship is low, with less than 8% of the variance explained by it ($r = 0.075$). These results are once again contradictory to the hypotheses. A possible reason for this is that the sample size in this study was quite small. As these results tend toward significance it may be that with a larger sample size one may in fact discover a significant relationship between these group conditions and neuropsychological test performance.

Demographic Predictors of Neuropsychological Test Performance

As noted earlier, because the research is at least partly based on previous theoretical findings, I used a hierarchical multiple regression analysis in an attempt to model, in the current sample, the relationship between sex, age, quality of education and level of education as indicators of neuropsychological test performance. Following convention for this method, known predictors (established from former research, such as that by Bethlehem, Picciotto, & Watt, 2003), were entered into the model in order of their importance in predicting the

Table 3

Results of Between-Group Comparisons on the Neuropsychological Outcome Variables

Test	Group AEE (n = 15)	Group AEA (n = 13)	Group AAA (n = 15)	F	p	ESE (ω^2)
WASI						
Vocabulary	126.91 (27.98)	118.33 (36.82)	93.06 (32.33)	4.41[a]	0.02*	0.37
Similarities	121.13 (28.32)	127.81 (36.28)	98.59 (39.76)	2.74[a]	0.07	0.30
Block Design	35.00 (18.73)	45.77 (18.73)	29.50 (36.18)	3.06	0.06	0.30
Matrix Reasoning	22.53 (6.93)	24.69 (7.57)	14.75 (7.65)	7.49	0.002**	0.48
Boston Naming Test	13.07 (2.89)	12.23 (3.37)	12.00(2.44)	0.57	0.57	0.45
Phonemic Fluency	68.20 (20.70)	71.54 (19.06)	59.00(16.02)	1.81	0.17	0.19
Semantic Fluency	51.93 (14.57)	50.54 (15.98)	41.37 (8.30)	2.94	0.06	0.28

Note. In columns 2, 3, and 4, means are presented with standard deviations in parentheses.

[a] $df_{\text{within}} = 40$; all other $df_{\text{within}} = 41$

*p < .05; **p < .01

outcome. Thus, the predictor variables were (in order of entry into the model): age, SES (as estimated by level of annual parental income), quality of education and sex. The criterion variable was a composite score of the overall test performance; this composite score was created by adding the participants' scores on the WASI subtests, the verbal fluency tests, and the Boston Naming Test. At this stage, I excluded level of education from the hierarchical regression as it was highly correlated with age, $r = 0.99$.

Table 4 shows the final regression model, including age and SES the predictors. These predictor variables were retained for this model as they demonstrated statistically significant *F*-values and explained most strongly the variance at various stages of the hierarchical model (as shown by their high R^2 values). As can be seen, the final model was statistically significant, $F(2, 40) = 23.29$, $p < 0.001$, $R^2 = .70$.

A full set of diagnostic tests were run on that final model. Table B2 and Figures B1 and B2 graphically illustrate aspects of these diagnostic tests (see Appendix B). Briefly, analysis of the partial correlations suggested that the predictors contributed a substantial amount of unique variance. However, the tolerance levels were high, suggesting no problems with multicollinearity in the data, and the R^2 values were low, suggesting that there is a relatively small amount of shared variance between the variables. Analysis of the residuals showed that the data were normally distributed and that there did not seem to be any serious outliers that required attention.

In summary, the final regression model was, from a statistical significance perspective, a good fit for the observed data, suggesting that the model as a whole is a good predictor of neuropsychological test performance. These predictors produce a good model of overall test performance as the predictors account for a great deal of the variance in the model.

Table 4

Regression Model: Predictors of Neuropsychological Test Performance in the Current Sample

	B	*SE B*	*β*
Constant			3.15
Age	0.81	0.12	12.40
SES	0.36	0.12	10.28

Note. $R^2 = 0.70$; $p < 0.001$

DISCUSSION

This study aimed to investigate language considerations in neuropsychological assessments. My primary aim was to explore under which conditions (being tested in their home language, being tested in their medium of academic instruction, etc.) participants would be able to provide optimal performance on a battery of neuropsychological tests. This broad aim was explored by investigating two more specific hypotheses, each of which are discussed below.

The first specific hypothesis was that individuals with the same home language, medium of instruction and language of test administration would perform better than those individuals with mismatches between home language, medium of instruction and language of test administration. Contrary to predictions, individuals from the "same language" group (Group AAA) performed more poorly on all tests in comparison to individuals from the "different languages" groups. (Groups AEA and AEE). This failure to confirm the hypothesis may be due to various reasons.

Firstly, the participants in Group AAA were from a lower socioeconomic status than the participants in the other groups. The effects of SES on cognitive and neuropsychological test performance are well documented (see, e.g., (Ardila, 1995; Bjorklund & Weiss, 1985; Bowey, 1995; Magnuson & Duncan, 2006; Walker, Petrill, & Plomin, 2005). In the South African context, where great disparities exist in terms of individual access to economic resources, SES must always be considered in the interpretation of neuropsychological test performance; the regression model presented at the end of the Results section provides empirical evidence for this need. With reference to the current sample and their performance on the neuropsychological test battery, the implication is that even though certain individuals (those in Group AAA) were placed in the best language conditions, SES (especially in the South African context) still remains a confounding variable of assessment that has to carefully considered by researchers and clinicians.

Secondly, the current results should be interpreted with caution, as there was anecdotal evidence of quite substantial individual variation in Afrikaans proficiency within the "same language" group (Group AAA). This fact is important to note, but unfortunately cannot be explored in any more depth as we did not employ a robust measure of first- and second-language proficiency in this study.

Lastly, the participants in Group AAA are characterized as monolingual, whereas those in Groups AEE and Group AEA are classified as bilingual. Recent literature has indicated that there are cognitive advantages experienced by bilinguals (Bialystok1999 &Bialystok, Craik, Klein, Viswanathan, 2004). For example, the study by Bialystok (1998) that aimed to compare begree of bilingualism to metalinguistic awareness, which was described as the ability to solve problems that required analysis and control hypothesized that bilingual individuals would outperform all monolinguals on metalinguistic tasks, which requires high levels of control of processing. In addition that those individuals who are well balanced bilinguals would outperform partial bilinguals. All of the results were consistent with the hypothesis.

This may have contributed to the performance of groups AEE and AEA.

The second hypothesis was that individuals with the same medium of instruction and language of test administration would perform better than those individuals with a language of test administration that is different from their medium of instruction, even if participants in those two groups have the same home language. Although these results were not statistically significant, there were obvious issues to note. One was that participants in Groups AEE and AEA performed almost equally well on all the tests. This pattern of data concurs with previous literature that congruency between home language and medium of instruction enhances test performance (Mchazime, 2001 & Webb, 2006), and that compatibility between home language and test language would result in favourable outcomes (Carstairs et al, 2006). Bethlehem et al. (2003) also found that when test language is the same as medium of instruction, individuals perform better on neuropsychological tests; they attribute this better performance to the fact that particular vocabulary is formally learnt and practiced in English.

Finally, I investigated the influence of a set of demographic variables (sex, level of education, quality of education, SES and age) on neuropsychological performance. Results from the hierarchical regression indicate that age and SES were significant predictors of test performance across the three groups. Based on previous literature it is not surprising that these variables were found to be significant predictors of neuropsychological test performance. For example, Shuttleworth-Edwards, Kemp et al. (2004) argue that poor quality of education is associated with lowering of both Verbal and Performance IQ on the Wechsler Adult Intelligence Scale – Third Revision (WAIS-III; Wechsler, 1997).

Age, by itself, is commonly understood as one of the main predictors of cognitive performance (Heaton, Grant & Matthews,).

The correlation analysis for the neuropsychological test performance and group condition indicated contradictory data to the hypotheses it might be important to note that the sample size may have acted against the acquisition of the significance that was expected in line with previous literature.

These findings have both clinical and theoretical implications.

Firstly, the lack of statistically significant differences between Groups AEE and AEA suggest that clinicians and researchers may in fact choose to test patients/clients in either the home language *or* the medium of instruction, or simply leave it to the client to decide. Secondly, because this study suggests that test language may be the clients' home language or medium of instruction (which is usually English), there appears to be less of a need to incur the cost of interpreters/translators in the clinical setting where a population such as that from which the current sample was drawn predominates. Lastly, results indicate that clinicians need to be aware of the complex issues around testing of bilingual and multilingual individuals, especially in the diverse context of South Africa.

In conclusion, Future research directions could include repeating this study using a larger sample size. The procedure and methods reported here are satisfactory and serve as a preliminary venture upon which to build a larger project. In addition, including isiXhosa speaking participants and examining the differences experienced by these groups featuring these individuals may further broaden our understanding of the relationship between home language, language of instruction, and test language.

Acknowledgements

I would like to acknowledge my supervisors, Dr. Kevin Thomas and Helen Ferrett for their valuable input, advice and encouragement. I have been inspired by their dedication and passion for research.

I would like to thank Ms. Beranice and Patsy Thompson for their much appreciated assistance in data collection and recruitment.

Finally, I would like to extend my gratitude to the National Research Foundation for making this research initiative possible.

REFERENCES

Anderson, S. J. (2001). On the importance of collecting local neuropsychological normative data. *South African Journal of Psychology, 31*, 29 – 34.

Anthonissen, C. (2006). On determining what counts while counting: aspects of language testing where diversity is the standard. *Per Linguam, 22*, 39-54.

Ardila, A. (1995). Directions of research in cross-cultural neuropsychology. *Journal of Clinical and Experimental Neuropsychology, 77,* 143-150.

Allegri, R. F., Mangone, C. A., Fernandez, V. A., Rymberg, S., Taragano, F. E., & Baumann, D. (1997). Spanish Boston Naming Test norms. *Clinical Neuropsychologist, 11*, 416.

Balfour, R. J. (1999). Naming the father: re-examining the role of English as a medium of instruction in South Africa. *Changing English, 6,* 103-112.

Benton, A. L., Hamsher, K., & Sivan, A. B. (1994). *Multilingual aphasia examination. (3rd ed.).* Iowa City, IA: AJA Associates.

Bethlehem, D., de Picciotto., J., & Watt, N. (2003). Assessment of verbal fluency in bilingual Zulu-English speakers. *South African Journal of Psychology*, *33*(4), 236-240.

Biggs, J. B. (1990). Effects of language medium of instruction on approaches to learning. *Educational Research Journal, 5,* 18-28.

Bjorklund, D. F., & Weiss, S. C. (1985). Influence of socioeconomic status on children's classification and free recall. *Journal of Educational Psychology, 77,* 119-128.

Bowey, J. A. (1995). Socioeconomic status differences in preschool phonological sensitivity and first-grade reading achievement. *Journal of Educational Psychology, 87,* 476-487.

Brock-Utne, B. (2007). Language of instruction and student performance: new insights from research in Tanzania and South Africa. *International Review of Education, 53,* 509-530.

Broom, Y. (2004). Reading English in multilingual South African primary schools*. Bilingual Education in Bilingualism, 7,* 506-526.

Carstairs, J. R., Myors, B., Shores, E. A., & Fogarty, G. (2006). Influence of language background on tests of cognitive abilities: Australian data. *Australian Psychologist, 41*, 48-54.

Cattell, K. (2006). Developing the language of argument: a bilingual approach. *Southern African Linguistics and Applied Language Studies, 24*, 143-150.

Cattell, R. B. (1995). Personality structure and the new fifth edition of the 16PF. *Educational & Psychological Measurement, 55,* 926-937.

Du Toit, H.A. (1994). Standardizing the Senior South African Individual Scale (SSAIS) (non-verbal) for the hearing disabled.In R.van Eeden, M. Robinson & A.B. Posthuma (Eds.), *Studies on South African Intelligence Scales* (pp. 109-122). Pretoria, South Africa: Human Sciences Research Council.

Eiselen, R. (2002). The role of language proficiency in predicting first semester results at university. *International Studies in Educational Administration, 30*, 35-42.

Ferrett, H., Dowling, T., Conrade, S., Kidd, M., Carey, P., & Thomas, K. (2009, August). Comparing the utility of South African adaptations of the Wechsler Abbreviated Scale of Intelligence, the Controlled Oral Word Association Test and the Boston Naming Test for English, Afrikaans and Xhosa-speaking 8-25-year-olds in the Western Cape Province. In K. G. F Thomas & C. G. Tredoux (Chairs), *Applied cognitive science and experimental neuropsychology in South Africa III*. Symposium to be conducted at the 15th Annual Congress of the Psychological Society of South Africa, Cape Town

Garratt, L. C., & Kelly, T. P. (2008). To what extent does bilingualism affect children's performance on the NEPSY? *Child Neuropsychology, 14*, 71-81.

Giliomee, H. (2005). 'n Algemeen geldende basis vir Afrikaans? *Tydskrif vir Geesteswetenskappe, 45,* 276-282.

Heugh, K. (2002). The case against bilingual and multilingual education in South Africa. *PRAESA-Occasional Paper*, *6,* 1-42.

Howie, S., Scherman, V., & Venter, E. (2008). The gap between advantaged and disadvantaged studies in schools. *Educational Research and Evaluation, 14*, 29-46.

Kamin, L. J. (2006). African IQ and mental retardation. *South African Journal of Psychology, 36,* 1-9.

Kaplan, E., Goodglass, H., & Weintraub, S. (1976). *Boston naming test. experimental edition*. Boston: Aphasia Research Center, Boston University.

Kaufman, J., Birmaher, B., Brent, D., Rao, U., Flynn, C., Moreci, P., Williamson, D., & Ryan, N. (1997). Schedule for Affective Disorders and Schizophrenia for School-Age-Children-Present and Lifetime Version (K-SADS-PL): intial and reliability validity data. *Journal of the American the Academic of Child and Adolescent Psychiatry, 36*, 980-988.

Knoetze, J., Bass, N., & Steele, G. (2005). The Raven's Coloured Progressive Matrices: Pilot norms for isiXhosa-speaking primary school learners in peri-urban Eastern Cape. *South African Journal of Psychology, 35,* 175-194.

Lezak, M., Howieson, D., & Loring, D. (2004). *Neuropsychological assessment* (*4th ed*.). New York: Oxford University Press.

Magnuson, K. A., & Duncan, G. J. (2006). The role of family socioeconomic resources in the black-white test score gap among young children. *Developmental Review, 26,* 365-399.

Marin, G., Sabogal, F., Marin, B.V. , Otero-Sabogal, R., & Perez-Stable, E. (1987). Development of a short acculturation scale for Hispanics. *Hispanics Journal of Behavriuol Sciences, 9,* 183-205.

Mchazime, H. S. (2001). *Effects of English as a medium of instruction on pupils' academic achievement in social studies in primary schools in Malawi*. Unpublished doctorial dissertation, University of South Africa.

Mitrushina, M., Boone, K., Razani, J., & D'Elia, L. (2005). *Handbook of normative data for neuropsychological assessment* (*2nd ed.*). New York: Oxford University Press.

Nell, V. (1999). Standardising the WAIS-III and the WMS-III for South Africa: Legislative, psychometric, and policy issues. *South African Journal of Psychology, 29*, 128-137.

Nell, V. (2000). *Cross-cultural neuropsychological assessment: theory and practice.* New Jersey: Lawrence Erlbaum Associates.

Perez-Arce, P., & Puente, A. (1996). Neuropsychological assessment of ethnic minorities. In R. J. Sbordone, & C. J. Long (Eds.), *Ecological validity of neuropsychological tests* (pp.283-300). Delray Beach: GR Press.

Raven, J. C., Court, J. H. and Raven, J. C. (1990). *Manual for Raven's Progressive Matrices and Vocabulary Scales – Section 2: Coloured Progressive Matrices*. Oxford: Oxford Psychologists Press.

Robinson, M. (1994). Distinguishing learning – disabled pupils with reading problems form ordinary pupils on the basis of the junior South African individuals scales (JSAIS). In R. van Eeden, M. Robinson & A.B. Posthuma (Eds.). *Studies on South African Intelligence Scales* (pp. 14-37). Pretoria, South Africa: Human Sciences Research Council.

Roos, A., Calata, J.L., Maritz, S.J., Kidd, M., Daniels, W. M. U., & Hugo, F. J., (2009). Normative data for the Tygerberg cognitve battery and mini-mental status examination in a South African population. *Science Direct*, 1-8.

Roselli, M., & Ardila, A. (2003). The impact of culture and education on non-verbal neuropsychological measurements: A critical review. *Brain and Cognition, 52,* 326-333.

Shuttleworth-Edwards, A., Kemp, R. D., Rust, A. L., Muirhead, J.G. L., Hartman, N.P., &
Radloff, S. E. (2004). Cross-cultural effects on IQ test performance: A review and preliminary normative indications on WAIS-III test performance. *Journal of Clinical and Experimental Neuropsychology, 26,* 903-920.

Snayers, J. H., & Du Plessis, L. T. (2006). Moedertaalonderrig en tweetaalige onderwys-perspektiewe op die voertaalvraagstuk in Suid-Afrikaanse skole. *Tydskrif vir Geesteswetenskappe, 46*, 51-61.

StatSoft, Inc. (2007). *STATISTICA, Version 8*. Tulsa, OK: Author.

Statistics South Africa. (2001). *Census in brief*. Pretoria: Statistics South Africa.

Strauss, E., Sherman, E. M. S., & Spreen, O. (2006). *A compendium of neuropsychological tests: Administration, norms, and commentary (3rd ed.)*. New York: Oxford University Press.

Tung, P., Lam, R., & Tsang, W. K. (1997). English as a medium of instruction in post-1997 Hong Kong: what students, teachers and parents think. *Journal of Pragmatics, 28,* 441-459.

October, M. (2000). *Medium of instruction and its effect on matriculation examination results for 2000 in the Western Cape secondary schools: a study of examination results in relation to home language and language of medium*. Unpublished master's thesis, University of Cape Town.

Van Ommen, C. (2005). Putting the PC in IQ: Images in the Wechsler Adult Intelligence Scale – third edition (WAIS-III). *South African Journal of Psychology, 35,* 532-554.

Webb, V. (2006). Perspektiewe op moedertaal onderrig. *Tydskrif vir Geesteswetenskappe*, *46,* 37-47.

Walker, S. O., Petrill, S. A., & Plomin, R. (2005). A genetically sensitive investigation of the effects of the school environment and socio-economic status on academic achievement in seven-year-olds. *Educational Psychology, 25,* 55-73.

Wallis, T. (2004). Psychological tests do not measure what they claim to measure: A re-evaluation of the concept of construct validity. *South African Journal of Psychology, 34,* 101-112.

Wechsler, D. (1997). *The Wechsler Adult Intelligence Scale- 3 Edition: Technical manual*. San Antonio: The Psychological Corporation.

Wechsler, D. (1999). *Wechsler Abbreviated Scale of Intelligence Manual*. San Antonio, TX: The Psychological Corporation.

Western Cape education department online. (2009). Curriculum development. Retrieved 18/05/09, from http://wced.wcape.gov.za

APPENDIX A

Marin Acculturation Scale

English Version

For items 1-8, please indicate which language you prefer in each of the situations described. For items 9-12, please indicate which social grouping you prefer in each of the situations described.

Do you think you are: English-speaking ☐ Bilingual ☐ Multilingual ☐

A = Afrikaans, X = Xhosa, E = English	Only A/X	More A/X than E	Both equally	More E than A/X	Only E
1. In general, what language(s) do you read and speak?	1	2	3	4	5
2. What was the language (s) you used as a child?	1	2	3	4	5
3. What language(s) do you usually speak at home?	1	2	3	4	5
4. In which language(s) do you usually think?	1	2	3	4	5
5. What language(s) do you usually speak with your friends?	1	2	3	4	5
6. In what language(s) are the TV programs you usually watch?	1	2	3	4	5
7. In what language(s) are the radio programs you usually listen to?	1	2	3	4	5
8. In general language(s) are the movies, TV and radio programs you prefer to watch and listen to?	1	2	3	4	5
A = Afrikaans, X = Xhosa, E = English	All A/X	More A/X	About half	More E	All E

		than E	and half	than A/X	
9. Your close friends are?	1	2	3	4	5
10. You prefer going to social gatherings/parties at which people are?	1	2	3	4	5
11. The persons you visit or who visit you are?	1	2	3	4	5
12. If you could choose your children's friends to would prefer them to be?	1	2	3	4	5

Afrikaans version

Vir items 1-8, verwys asseblief watter taal jy verkies. Vir items 9-12, verwys asseblief watter sosiale groep jy verkies in die omstandighede wat beskryf is.

Dink jy dat jy is: Afrikaans ☐ Tweetalig ☐ Veeltalig ☐

A = Afrikaans, X = Xhosa, E = English	Slegs A/X	Meer A/X as E	Albei ewe	Meer E as A/X	Slegs E
1. In die algemeen watter taal/e gebruik jy om te lees en skryf?	1	2	3	4	5
2. Watter taal/e het jy gebruik as kind?	1	2	3	4	5
3. Normaalweg watter taal/e praat jy by die huis?	1	2	3	4	5
4. In watter taal/e dink jy gewoontlik?	1	2	3	4	5
5. Watter taal/e praat jy gewoontlik met jou vriende?	1	2	3	4	5
6. In watter taal/e is die T.V programe wat jy gewoontlik na kyk?	1	2	3	4	5
7. In watter taal/e is die radio programe wat jy gewoontlink na luister?	1	2	3	4	5
8. In die algemeen in watter taal/e verkies jy om flieke, T.V en radio programe te kyk en luister?	1	2	3	4	5

A = Afrikaans, X = Xhosa, E = English	Almal A/X	Meer A/X as E	Omtrent half en half	Meer E as A/X	Almal E
9. Die vriende na aan jou is?	1	2	3	4	5
10. Jy verkies om sosiale funksies/partyjies bywoon waar mense?	1	2	3	4	5
11. Die persone wat vir jou besoek is?	1	2	3	4	5

12. As jy jou kinders se maatjies kon kies, jy so verkies dat hulle?	1	2	3	4	5

APPENDIX B

Table B1

Diagnostic data- redundancy coefficients

	Beta in	Partial Cor.	Semi- Partial Cor.	Tolerance	R- Squared
Age	12.39	0.82	0.80	0.98	0.019
SES	10.28	0.55	0.36	0.98	0.019

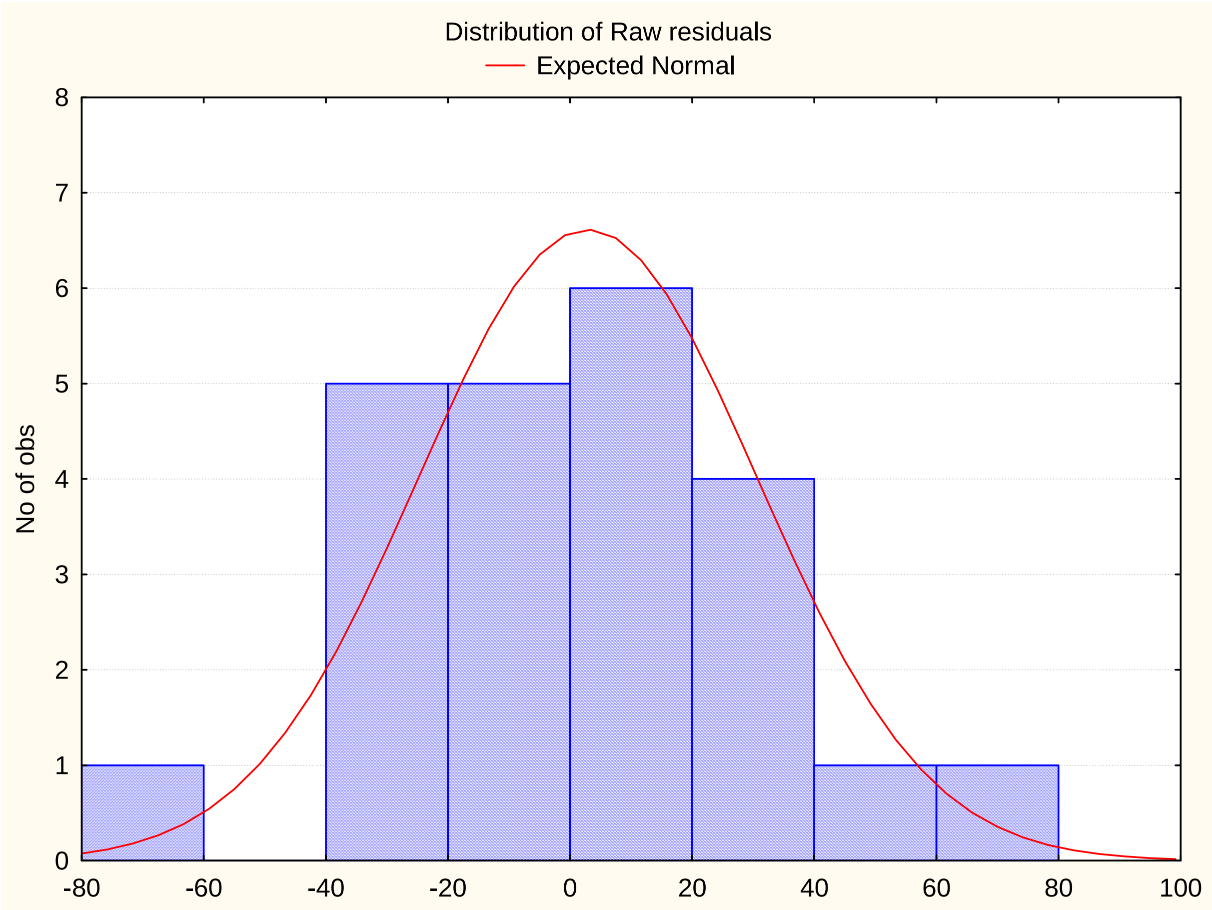

Figure B1. Distribution of raw residuals for final regression model

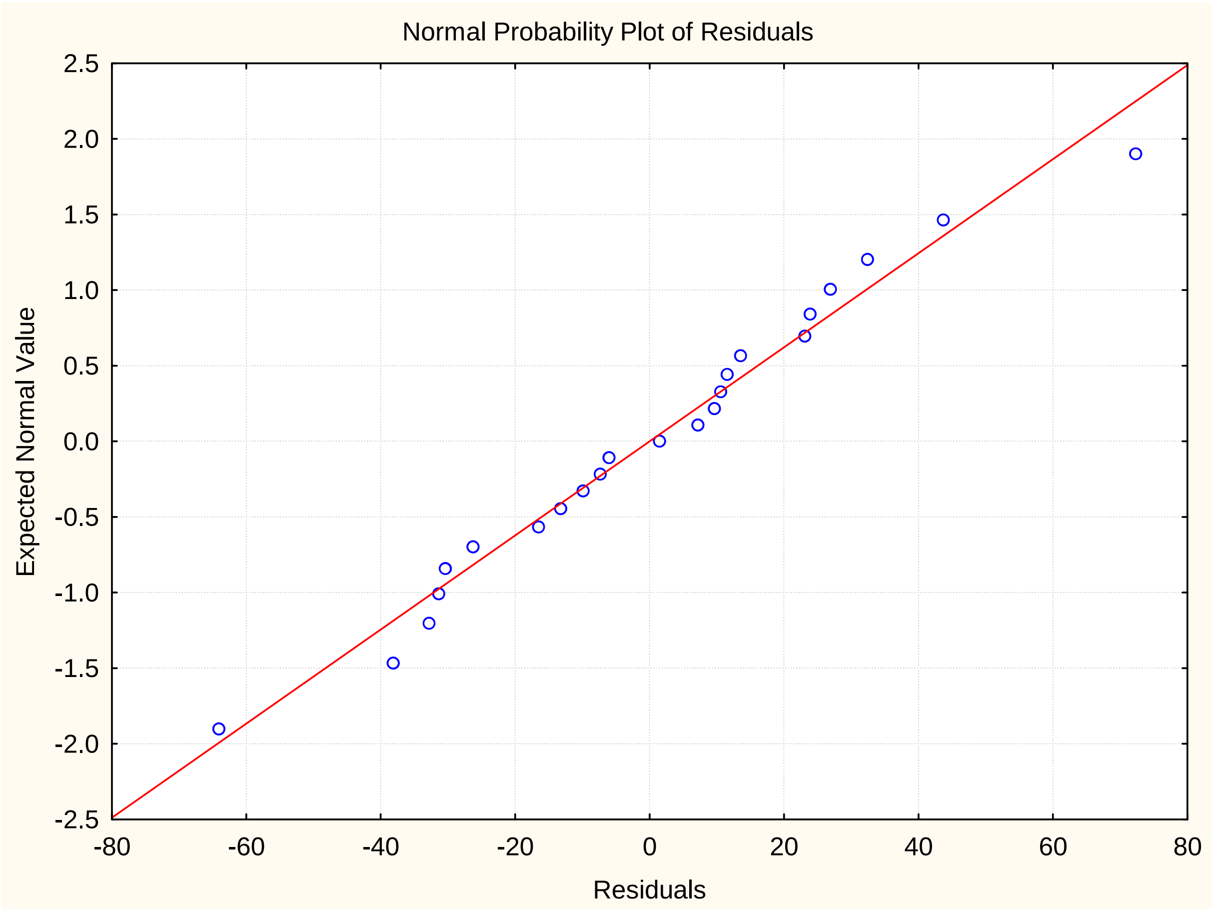

Figure B2. Normal probability plot of residuals for final regression model