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Date: 16 January 2017

Socioeconomic status, NEPSY II attention/executive functioning performance, and South African grade ones

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Abstract

The outcomes of neuropsychological tests carried out in local contexts, with individuals who do not match the normative sample of the tests being used, can be influenced by a number of sociodemographic factors. A major related concern is that children, who are healthy and cognitively well in one context, might appear cognitively impaired on a western developed test because of these disparities in the sociodemographic and cultural contexts of the normative sample and that of the child being tested. The aim of this research project was to collect and compare South African data for 7-year-old English-speaking children from low and high SES backgrounds on the attention/executive function domain of the NEPSY II battery (including Animal Sorting, Inhibition, Clocks, and Design Fluency subtests). A further aim was to compare the local data to the US normative data for the aforementioned subtests. A total of 35 children were recruited: 16 from a low SES school (WP group) and 19 from a high SES school (EP group). We collected sociodemographic, IQ and the NEPSY II data. There were significant between-group differences on race, sex, and SES measures. The groups also differed significantly on the IQ measure employed (WASI II), across all indices and subtests; and on all but 3 outcome scores (two completion time scores and on the Clocks subtest) of the NEPSY II subtests with the WP group performing more poorly than the EP group. Results also indicated that the outcomes of the children from the high SES school were more closely aligned with the western normative data. The findings of the study demonstrate the significance of SES and other related demographic factors on neuropsychological test outcomes, particularly when comparing individuals from non-western backgrounds to western norms. Hence, the need for tests that are adapted for and validated locally is reiterated.

Literature Review

There were several concerns regarding the use of internationally developed neuropsychological assessment tools in local contexts in terms of their sensitivity cross culturally and to sociodemographic factors, and the work on these topics is extensive (Uzzell, 2013; Ferret et al., 2014; Brickman, Cabo & Manly, 2006: Manly, 2008). In most cases, norms for neuropsychological tests originate from white, English-speaking, middle class individuals that have moderate to high education levels (Ardila, Rosselli & Puente, 2005). The outcomes of neuropsychological tests carried out in local contexts, with individuals who do not match the normative sample, can be influenced by confounding sociodemographic factors and by using inappropriate normative data (Ferrett, Thomas, Tapert, Carey, Conradie, Cuzen & Fein, 2014). In local terms, this issue poses a threat to the validity of assessing South African children with tests developed in westernized contexts. One core concern, for example, is that children, who are healthy and cognitively well in one context, might appear cognitively impaired on a western developed test because of the disparities between the sociodemographic and cultural contexts of the normative sample and that of the child being tested (Ferret et al., 2014). Hence, research exploring these factors that impact on the use of international tests in a local context of South Africa, the development of cross cultural understanding in terms of neuropsychological assessments, and, consequently, the need for tests that are adapted for and validated in this context, are necessary (Ardila, 2005). This is extremely important especially when doing testing on a population in a country like South Africa which has 11 national languages, a constant changing social structure, and profound socioeconomic and educational disparities (Foxcroft, 2005). These factors all influence how an individual will perform and will be discussed in this review.

Factors that impact of the use of international tests in a local context of South Africa

Several researchers highlight a number of factors that may negatively impact the viability and suitability of use of westernized tests in local contexts. Some of the main factors include, but are not limited to culture, language, education, and socio-economic status.

Culture

Culture strongly influences how people think, feel and act; therefore it is likely to impact on how the person will perform cognitively. Uzella, Ardila and Ponto (2013) stated that due to the fact that humans have different cultural environments, and that this factor influences how we had organised our cognitive abilities in our brain, this will in essence lead to different outcomes in neuropsychological testing. Such disparities in outcomes are especially common when comparing outcomes of individuals from non-westernised cultures to normative data emanating from westernised cultures.

Different cultural environments are associated with different developmental patterns of ability (cognitive processes used to perform certain tasks adequately). Regarding cultural values, one culture may find value and worthiness in learning certain things while the next culture does not and vice versa (Ardila, 2005). However, tests employ strategies and various elements that are not shared amongst all cultures; developing a test in this respect (i.e., culture- free tests) is almost impossible (Greenfield, 1997). Regarding neuropsychological tests, this is a reason why certain individuals score extremely high on certain subtests and extremely low on others with different task demands.

For example, when one considers tests that target speed of information processing, researchers often observe slower performances in neuropsychological testing by South Africans compared to the US norms on speeded tasks (Ardila et al., 2013). Rosselli and Ardila (2003) state that having a faster performance is more of a valued culture for individuals from western cultures (perhaps as a function of more individualist competitive approaches), but this may not be so in other cultures.

There are three other dominant factors to consider that may impact on neuropsychological testing and which are often intertwined with culture: language, level of education, and socioeconomic status (SES). Higher achievement or status in these factors will allow an individual to perform better than those who have lower achievement or are ranked lower on these factors.

Language

Numerous studies have been conducted demonstrating the effect that language has on neuropsychological tests results (Jacobs et al., 1997; Carstairs., 2006; Boroditsky, 2009; Knowles, 2010; Boroditsky, 2011). Carstairs and her colleagues (2006) concluded that general verbal abilities assessed in neuropsychological tests are heavily affected by proficiency in the language of administration and of the normative sample. Some problems identified in this area of research include that there may not be equivalent words in some African languages for some words from the English language, or, on verbal fluency tests (stating words beginning with a particular letter), for example, there may not be an equivalent number of words in isiXhosa or Afrikaans, as there is for a particular letter in English (Kendall et al., 2015), and vice versa. Testing individuals in languages other than their first may therefore disadvantage them and may lead to inadequate results (Carstairs et al., 2006;

Van Wyhe, 2009; Jacobs et al., 1997). South African normative data on tests administered in official languages other than English, are however lacking.

Language plays an important role in neuropsychological testing as the base language of administration of most tests is English. This is a problem as even though English is one of the three most spoken languages in the world, only 15% of the world's population can speak it (Ardila, 2005). South Africa is a multilingual country with 11 official languages. This should be of great concern for researchers conducting neuropsychological tests in a country such as this as a number of individuals therefore require testing in languages other than English. Further, even when individuals are able to understand English, the level of language used in administration is usually formal and inaccessible to those who may have limited education (Ardila, 2005).

Quantity and quality of education

The results of numerous research articles suggest that low levels and quality of education can affect neuropsychological test performance when using westernized tests (Manly et al., 2004; Crowe et al., 2013; Ferrett et al., 2014). Research shows that good quality and quantity of education can produce optimally developed cognition, skills, memory and a good attention span, all of which influence test performance (Crowe et al., 2013). Further, schools provide and expose individuals to content that is frequently used in cognitive tests (Ardila, 2007).

A recent study conducted by Ferrett and colleagues (2014) provided positive evidence that quality education was the greatest influencing factor on test performance. English- and Afrikaans-speaking adolescents from Cape Town aged 12 to 15 were assessed on the Grooved Pegboard Test, the Children's Colour Trails Test, and the World Health Organisation's version of the Auditory Verbal Learning Test (AVLT). Adolescents with advantaged education showed better outcomes in these tests as compared to those with disadvantaged education. Therefore, the degree and quality of formal education attained by the individual is a major factor that may set individuals apart and impact their testing ability (Greenfield, 1997). Both level and quality of education is however often closely tied to one's SES.

Socio-economic status (SES)

Researchers propose that individuals of lower socioeconomic class have poorer nutrition and health care access, which in turn may influence brain development and functioning. This may consequently impact on the way that those individuals perform on neuropsychological tests (Brickman, Cabo & Manly, 2006). In low- and middle-income countries (LAMICs) like South Africa, health care concerns associated with malnutrition, infectious diseases such as meningitis and HIV/AIDS, exposure to alcohol and drugs, head injuries, and endocrine ailments are rife, and these may in turn in many cases, affect cognitive functioning which in turn may impact test performance (Olness, 2003).

One's SES has a large impact on language and executive functioning as it will determine the quality and quantity of the level of education one receives thereby influencing neuropsychological testing. High SES is associated with better performances on neuropsychological tests than low SES (Olness, 2003). Given this disparity and the fact that normative data from neuropsychological tests primarily stem from high income countries (HICs), this might explain why individuals from LAMICs, and especially those from lower SES backgrounds, might perform poorly when measured against western norms. Hence, research has shown that the environment and experiences of one's childhood in different SES settings are in part responsible for the different neurocognitive outcomes for children, at least as measured by western-based neuropsychological tests. If one looks at South Africa, there is a cumulative effect of inferior quality in testing because of the fact that there is an ongoing socioeconomic deprivation and due to the differing sociodemographic profiles, there are large differences in performance (Foxcroft & Roodt 2005).

Development or adaptation of neuropsychological tests for local contexts

There have therefore been attempts in the history of neuropsychological testing to try to develop culture free or culture fair measures (Rosselli & Ardila, 2003; Ardila 2005). There is a suggestion that the effects of culture might be controlled if verbal tests are eliminated and only nonverbal tests were used because that would then eliminate the language barrier and the effects thereof in neuropsychological testing. However, Rosselli and Ardila (2003) argue that non-verbal tests sometimes causes larger differences in performance than verbal tests as non-verbal tests often require specific strategies and cognitive styles characteristic of middle-class western cultures, which forms the minority in South Africa. An example of this is the use of pictorial representations; where researchers have found marked differences in the perception of pictures by individuals from different cultures; therefore both these types of testing, i.e., verbal and nonverbal, can be culturally biased. This is concerning, given South Africa's multicultural, multilingual and socioeconomically diverse context, which all impact on neuropsychological testing (Manly, 2008). Hence tests adapted to the local context are needed.

Neuropsychological test adaptations in South Africa

There have previously been attempts to adapt neuropsychological tests for use in South Africa (Watts & Tollman, 1980; Mosdell, Balchin & Ameen, 2010; Bornman et al., 2010). In the study conducted by Mosdell and colleagues on two aphasia-related tests, participants were assessed with the original tests, then with the adapted test, i.e., to the South African context. The results indicated that participants appeared to fair better on the adapted version of the test (Mosdell, Balchin & Ameen, 2010).

The results of studies of South Africans that participated in three (World Health Organisation) WHO endorsed neuropsychological tests is also a good example of the significant roles education and socioeconomic status play in determining such test results. Results showed that for South Africans that had a higher assimilation to westernised culture, which includes higher education, good level of English and greater exposure to urbanisation, their outcome scores tend to be more compatible with the norms from samples in England and the USA (Cave & Grieve, 2009). However, Cave and Grieve (2009) argue that statistics for South Africa indicate that the individuals with those characteristics only make up the minority in South Africa. This is a problem because people that are healthy but who have lower educational achievement, SES, and command of the English language, might obtain scores that compared to those same non-local norms, might fall into a range interpreted by clinicians as being indicative of impaired functioning (Cave & Grieve, 2009).

There is a dearth of literature on pediatric neuropsychological tests and/or adaptations thereof published in South Africa. In the larger African context, Mulenga, Ahonen and Aro (2001) administered A Developmental Neuropsychological Assessment (NEPSY) to a sample of 25, 9-year-old and 20, 11-year-old children, from urban Zambia, including both the core and expanded tests of that battery. The results showed that the scores of children in that urban sample were comparable to the normative USA sample without much adaptation (Mulenga, Ahonen & Aro, 2001). The use of an urban, English-proficient sample is however noted here.

In summary, there is general consensus that many neuropsychological measures do not have acceptable diagnostic accuracy when used with individuals who do not conform to the demographic profile of the normative sample. This issue raises many ethical questions in the use thereof in local contexts especially in South Africa, given the multiple cultures and languages in this context. Although some adaptation and normative studies have been conducted, more research in this area is needed. Studies within South Africa are encouraged in terms of adapting internationally developed neuropsychological assessments to suit local contexts and providing relevant norms, as opposed to developing new test batteries for South African children, given the costs thereof.

This need for locally-relevant norms forms the rationale for our study. Although the study is on a much smaller scale to a typical normative study, it serves as a start to collecting local data on the attention/ executive domain of the NEPSY II, previously investigated in the African, but not yet South African context.

Aims and Hypotheses

The aim of this research project was to collect and compare South African (SA) data for 7-year-old English-speaking children from low and high SES backgrounds on the attention/executive function domain of the NEPSY II battery. Our objective is to compare this data to the original US normative data for the NEPSY II in an effort to contribute to the larger general need for establishing local norms for international test batteries used in South Africa.

We hypothesized that

i) Learners from low-SES SA backgrounds will score lower than learners from high-SES SA backgrounds and US norms, and that

ii) Learners from high SES SA backgrounds will score more equivalent to US norms.

Methods

Design and Setting

Our study design was quantitative, cross-sectional and descriptive, comparing low and high SES SA English-speaking learners to each other as well as to western normative data on the attention /executive function domain of the NEPSY II battery.

The research was conducted at two urban schools in the Cape Town area, one located in a low-SES setting and one in a high-SES setting. Parameters (e.g., annual school fees and pupil-teacher ratio) described by Van der Berg and Burger (2002) was used to determine the SES of chosen schools. They investigated the educational performance of learners in Western Cape schools in relation to SES. Testing was carried out in quiet rooms at the relevant schools.

Participants

Our initial aim was to recruit 80, 7-year-old children: 40 from a low-SES school and 40 from a high-SES school. We selected schools through convenience sampling, on the basis of pre-existing relationships with schools and through personal contacts.

Inclusion criteria was that learners were 7 years old (or were turning 7 years old in the year that the assessment was done if more participants were needed), that they were fluent in English, that they provided assent (see Appendix A), that their parent/caregiver/s provided informed consent for their participation in the study (See appendix B). In terms of our exclusion criteria, learners with previous formal diagnoses of ADHD, epilepsy, learning disability, head injury, or other previously diagnosed neurodevelopmental or neurological illness were not be eligible to participate in the study. We also excluded learners who were repeating the grade (for those who entered school at 6 years). We obtained all this information from parents and from the class teacher. Our exclusion criteria were necessary to ensure that the data was based on cognitively healthy South African children, without which it would be challenging to draw an adequate comparison between the normative data and our data set (Benito-León et al., 2016).

Measures

The set of forms sent to parents included the informed consent form (Appendix B), a demographic questionnaire and asset index (Appendix C) and a developmental questionnaire (Appendix D). We also included an information sheet for parents briefly outlining the study and inviting their child’s participation (Appendix E). The developmental and demographic questionnaires are described briefly below.

Developmental questionnaire. This questionnaire was used to investigate the developmental history of the child in relation to pregnancy, developmental milestones, previous neurological and/or neurodevelopmental diagnoses, and head injuries. It was a shortened form of the developmental questionnaire used at the pediatric neuropsychology clinic at the Red Cross War Memorial Children’s hospital.

Demographic questionnaire. This questionnaire captured the demographic information of the parent or caregiver; it included the parents’ education, occupation, income, and details about the environment in which they live. This questionnaire also included a more traditional asset index which included living aspects such as whether their household has running water or a flushing toilet and whether the family has access to bank accounts or credit cards. Using this measure, asset ownership was divided into three groups, based on the total asset score: 0-5 (low asset ownership), 6-12 (medium asset ownership), and 13-17 (high asset ownership) (Myer , Ehrlich & Susser 2008) .

Below are descriptions of the tests administered to the learners who participated in the current study. Besides the attention/executive functioning subtests of the NEPSY II, we also included a measure of IQ, the Wechsler Abbreviated Scale of Intelligence, second edition (WASI-II; Wechsler 2011) as significant differences in IQ could be a major confound to the NEPSY II outcome scores. Each of these tests and the relevant subtests are described below.

NEPSY II subtests. We present a description of the subtests from the NEPSY II that we administered in the current study, in Table 1.

Table 1. NEPSY II subtests: attention/executive functioning domain

Domain	Subtest	Description
Attention and executive functioning	Animal Sorting	In this subtest the child was given 6 minutes to sort 8 cards into two self-initiated categories. This subtest does not require any form of reading.
	Clocks	In this subtest the child sketched an image of a clock and then placed the arms (of the clock) where ever the examiner indicated.
	Design fluency	This subtest required the child to develop many possible designs by connecting up to five dots, which was either presented as structured or unstructured arrays.
	Inhibition	In this subtest the child was presented either with black or white shapes or arrows. There were 3 conditions: Naming, Inhibition, and Switching. In Naming, they either identified the shape or the direction of the arrow. In Inhibition, they switch the names around – circle for square or up for down, and vice versa. In Switching, they only switch the names of the white shapes or the direction of the white arrows.

Note. The Statue subtest, which forms part of the attention/executive functioning domain, is designed for children aged 3-6 and was therefore excluded from the assessment battery. We did not have access to the Auditory Attention and Response Set subtest, as the auditory file was unavailable. Also, the Animal Sorting and Clocks subtests, and Inhibition Switching component, can only be administered to children 7 years and older.

Regarding psychometric properties, both construct and content validity has been reported, with coefficients ranging from.62 to .89. It has been used in cross-cultural research (Brooks, Sherman, & Iverson, 2010; Mulenga, Ahonen, & Aro, 2001), including local studies (Hoare et al., 2012).

WASI II. The Wechsler Abbreviated Scale of Intelligence, second edition, is the updated version of the WASI and is used to measure the general intellectual functioning of individuals aged 6-89. This assessment battery can be used to swiftly and adequately measure general intelligence, especially when it is not feasible to administrator a full IQ battery (WASI-II; Wechsler 2011). It consists of four subtests namely Vocabulary and Similarities which together measure Verbal IQ, and Block Design and Matrix Reasoning which together measure Performance IQ.

For the Vocabulary subtest, participants are required to provide the meanings of increasingly difficult words. Of the 42 items, the first four are presented as pictures and the rest are read orally and accompanied by the written words for those old enough to read. For the Similarities subtest, participants are asked to explain how two words are similar. The first three items are presented as two rows of pictures and participants are asked to identify which picture from the top row goes best with those displayed in the bottom row. For the Block design subtest, participants are required to construct up to 13 designs using 9 red- and white-coloured blocks within a given amount of time, first as modelled by the examiner and then from images in a stimulus book. Finally, for the Matrix reasoning subtest, participants are required to complete a 4- or 9-piece matrix (34 items in total) by choosing a missing piece of the matrix from five options at the bottom on the page.

In terms of psychometric properties, the WASI test battery is both reliable and valid. Test-retest reliability coefficients for the verbal and performance IQ scores generally range from .92 to .95. and from .81 to .97 for the four subtests in terms of pediatric studies specifically (Stano, 2004; Wechsler, 1999). It is regularly used in local research (e.g., Ferrett, Carey, Thomas, Tapert, & Fein, 2010; Schrieff-Elson, Thomas, Dollman, Rohlwink & Figaji, 2015).

Procedure

Once ethical approval for the project was obtained, we contacted the selected schools, one from a low- and one from a high-SES setting, and set up meetings with the school principals. Schools that have English-speaking classes were selected. After the principals agreed to participation, we had requested all 7-year-old learners' names in their English grade 1 classes. We then sent an information letter (Appendix E), the demographic questionnaire and asset index (Appendix C), developmental questionnaire (Appendix D) and an informed consent form (Appendix B) to each child's parent / caregiver. From those sets of forms that were returned and included children who meet the inclusion criteria, we randomly selected 40 English-speaking learners at each school. Testing commenced at the schools at times convenient for the class teacher, learner and school. There was an assent form for learners (see Appendix A), which the test administrator read through with the learner prior to testing. For the learners who did not want to participate, testing was ceased at this point. Testing was conducted over two sessions for each child, one session for the NEPSY II subtests and one session for the WASI II. After each learner completed testing and the materials were collected the student was thanked for participating in the research and received a small token of thanks.

Statistical analyses

Demographic and general intelligence data. We start by presenting descriptive statistics for the demographic data for our participants. Before we ran between-groups comparisons, we used Levene's test of homogeneity and the Shapiro-Wilk test for normality to assess whether parametric assumptions are upheld. For continuous variables, we used one-way ANOVAS to analyse the general intellectual functioning data obtained from the WASI II if parametric assumptions were upheld and the non-parametric equivalent, Mann Whitney U tests, when these were violated. Here our independent variable was SES, and our dependent variables the PIQ, VIQ and full scale IQ scores. For categorical variables, we used Chi-square tests or Fisher's exact test when the more than 50% of the cell counts were less than 5.

NEPSY II data. We also compared the continuous NEPSY II subtest outcome scores for our participants using one-way ANOVAs, if parametric assumptions were upheld, and nonparametric Mann Whitney U tests, if these assumptions were violated. Here again our independent variable was SES, but our dependent variables were the NEPSY II subtest outcome scores. As with the WASI data, for categorical variables, we used Chi-square tests or Fisher's exact test when the more than 50% of the cell counts were less than 5.

Finally, we compared the NEPSY II subtest performances of our participants to the normative data (through qualitative clinical descriptions) provided in the test manual and present these comparisons, descriptively.

We used the *r*-statistic as a measure of effect size because it allowed for the computation of effect sizes for nonparametric data analyses. Values of .10 represent small,, .30, medium and .50, large effect sizes (Field, 2009).

Ethical considerations

The current study adhered to the ethical guidelines for research with human subjects outlined by the UCT Health Professions Council of South Africa. Ethical approval for the study was sought from both the Human Research Ethics Committees of the UCT Department of Psychology and the Western Cape Education department. Approval documents for both of these ethical bodies are included as Appendices F and G, respectively.

We requested informed consent from parents / caregivers (See Appendix A). The informed consent document outlined the following: the purpose of the study, what was expected of participants, and that the confidentiality of both the children and parents would be upheld. The consent form had also notified participants of their voluntary participation and their right to withdraw from the study at any point without penalties or negative consequences. If any incidental findings on the neuropsychological testing were detected, children and their parents were referred to the paediatric neuropsychology clinic at the Red Cross War Memorial Children's Hospital. We are in the process of providing the schools and parents with feedback on the outcomes of the study, once analyses are completed and the thesis is finalized.

Results

The total number of participants for the study was 35, with 16 in the WP group and 19 in the EP group. Figures 1 and 2 show the participant selection process for the WP and EP groups, respectively.

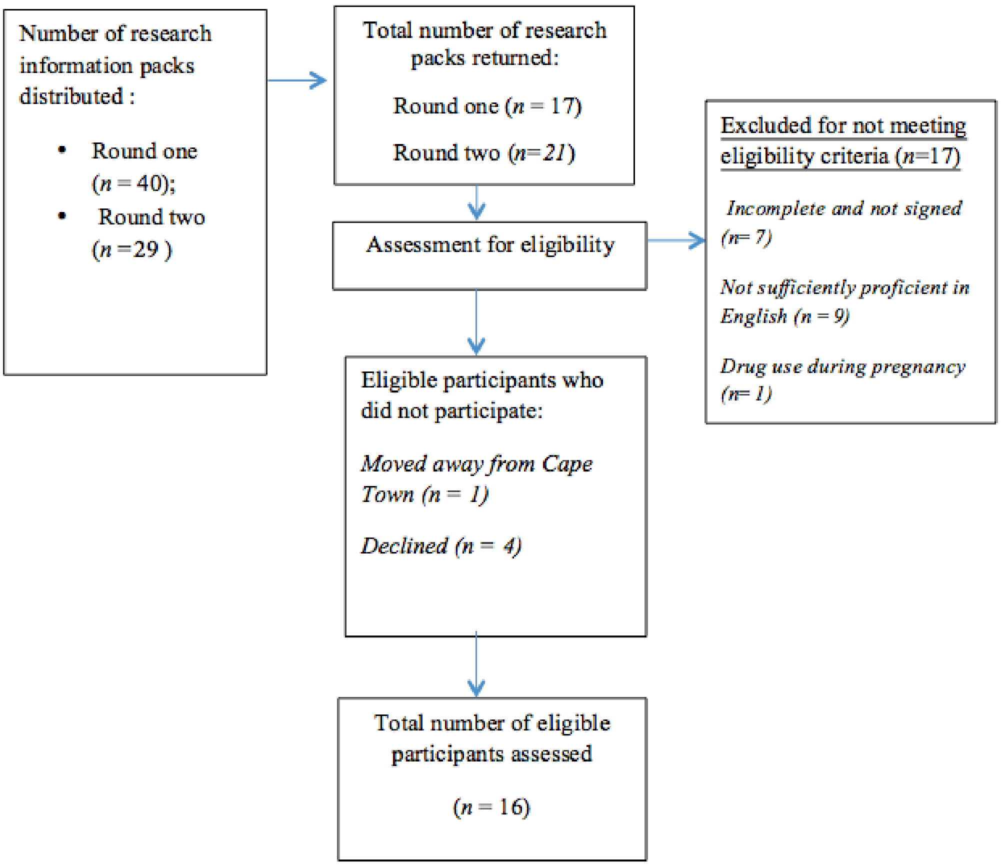

Figure 1. Participant selection process for WP. Flowchart depicting the process for selecting participants and also the number of participants at each stage of selection.

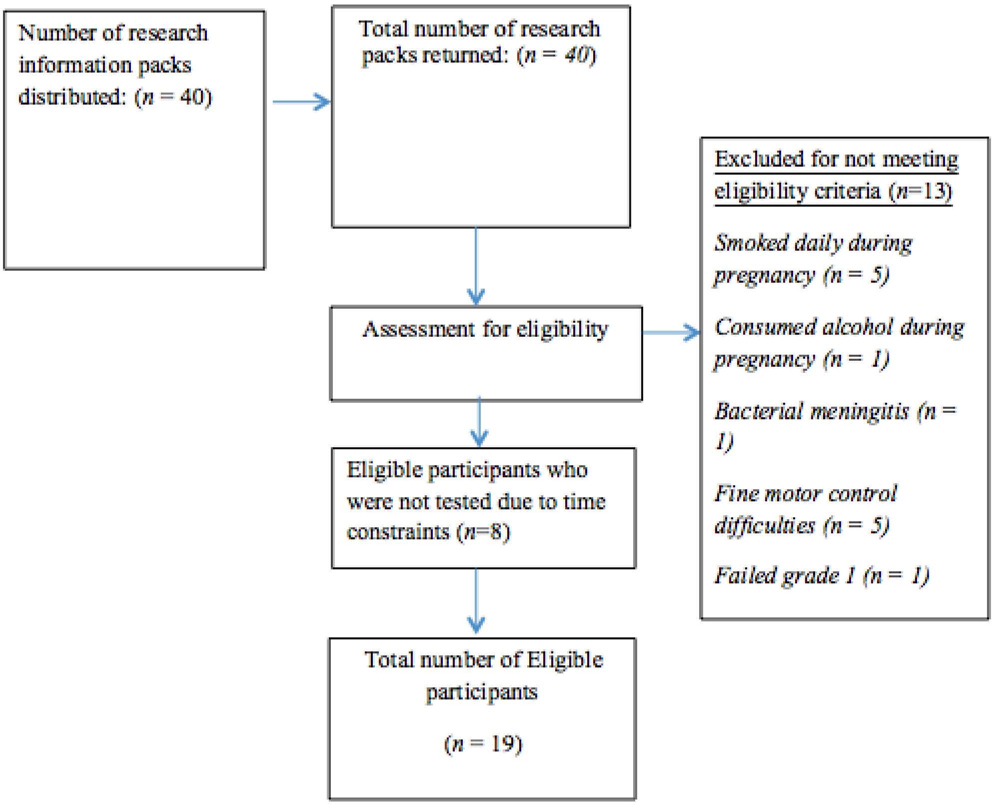

Figure 2. Participant selection process for EP. Flowchart depicting the process for selecting participants and also the number of participants at each stage of selection.

Table 2 shows the demographics of the study sample. Almost 69% of the WP sample was boys and 84% of the EP sample was girls. The groups therefore differed significantly in terms of sex. The mean ages at assessment for the two groups were similar, approximately 7 years for both groups. The range in terms of age for WP was 80-97 months and for EP, 84-92 months. The WP group included 4 children who were turning 7 in the year of testing. All participants were in grade 1. Regarding race, (n = 16) were mixed race, (n = 15) were White, and (n=4) were Black African. The distribution in terms of race differed significantly across the two study groups. Regarding home language, all participants who participated in the study could converse fluently in English. Two participants reported that they spoke both English and isiXhosa. There were no significant between-group differences in terms of the age at assessment and home language (see Table 2).

Table 2: Demographic Characteristics of the Sample (N = 35): WP vs. EP

Variable	Group		
	WP (*n* = 16)	EP (*n* = 19)	*p*
Sex			
Male: female	11: 5	3: 16	.002[a]
Age at assessment	88 (5.81)	88.26(3.03)	.724
Race			.000
Black African	3	1	
Mixed race	13	3	
White	0	15	
Home language			.202[a]
English	14	19	
English and isiXhosa	2	0	

Note. For *Age at assessment*, data are presented in months as means with standard deviations in parentheses. [a]Fisher's exact test was used as more than 50% of scores had expected counts of less than5.

Table 3 shows the SES and asset index data for the WP and EP groups in the sample. There were significant between-group differences for the following SES measures: household income per year, parental employment with regard to only the mother, and the asset index. There were no significant between-group differences for parental education and parental employment with regard to the father (see Table 3).

Table 3. Socioeconomic Status and Asset Index Data (N = 35): WP vs. EP

Variable	Group EP_High_SES (*n* = 19)	 WP_Low_SES (*n* = 16)	*P*
Household income per year [a]			.004
0			
1 - 5 000	0	3	
5 001 - 25 000	4	4	
25 001 - 100 000	2	5	
100 001 +	12	1	
Unknown/ incomplete	1	3	
Parental education (father: mother)			.065; .068
0 years	0: 0	: 0	
1-6 years	0: 0	1: 0	
7 years	0: 0	0:0	
8-11 years	1: 0	4: 4	
12 years	9: 10	3: 5	
13 years +	6: 8	2: 4	
Unknown/incomplete	3: 1	6: 3	
Parental employment (father: mother)			.092; .029
Higher executives, major professionals	4: 0	2: 1	
Business managers of medium businesses,	2: 5	0: 0	
Administrative personnel, managers,	8: 7	1: 2	
Clerical and sales, technicians, small	0: 1	1: 0	
Skilled manual (with training)	2: 0	3: 2	
Semi-skilled	1: 0	0: 2	
Unskilled, unemployed	0: 0	2: 2	
Homemaker	0: 3	0: 2	
Student, no occupation	0: 0	0: 0	
Unknown/incomplete	2: 3	7: 5	
Material and financial resources (Asset			.014[b]
0-5 assets (low)	0	0	
6-12 assets (medium)	1	6	
13-17 assets (high)	18	8	
Unknown/Incomplete		2	

Note. [a]Presented in South African Rands (ZAR). [b] Fisher's exact test was used as more than 50% of scores had expected counts of less than 5.

Tables 4 and 5 present the results of the between-group comparisons on measures of IQ and the NEPSY subtests, respectively. Assumptions of normality and/or homogeneity were violated for all most of the outcome variables across the two test batteries (including VIQ, PIQ, FSIQ-4, FSIQ-2, Vocabulary, Matrix reasoning, Similarities, Animal Sorting, INN CT, Inhibition total error, Inhibition Naming Combined scaled score, Inhibition Inhibition combined scaled score, Inhibition Switching combined scaled score, and Design Fluency). We therefore used Mann-Whitney *U* tests for the analyses.

As Table 4 shows, there were significant between-group differences on all of the IQ components and subtests: VIQ, PIQ, FSIQ, Block design, Vocabulary, Matrix reasoning and Similarities, with large effect sizes. In all cases, the EP group performed better than the WP group (see Table 4)

As Table 5 shows, there were significant between-group differences on all but three of the NEPSY II subtest outcome scores, Clocks, and Inhibition/Inhibition and Inhibition/Switching Completion Time scores (all of which had small effect sizes). In all other cases (Animal Sorting, Inhibition/Naming Completion Time, Inhibition Total Errors, Combined Scaled Scores for Inhibition Naming, Inhibition and Switching, and Design Fluency) the EP group performed better (significantly higher tests scores) than the WP group, with medium to large effect sizes (see Table 5).

Table 4: IQ Variables and Neuropsychological Composites: Between-group Comparisons for WP vs. EP (*N* = 35)

	WP (n = 16)				EP				Test statistics		
	n	Range	*M* (*SD*)	*Qualitative description*[1]	*n*	Range	*M* (*SD*)	*Qualitative description*[1]	*U*	*p*	*r*
General Intellectual Functioning											
VIQ	16	66-99	80.19 (9.65)	Low average	19	76-110	95.00 (7.90)	Average	21.5	<.001**	0,63
PIQ	16	81-101	90.25(6.75)	Average	19	81-123	107.21 (12.17)	Average	39.5	<.001**	0,63
FSIQ	16	72-98	83.44 (7.35)	Low average	19	84-116	101.26 (9.33)	Average	40.0	<.001**	0,73
Block Design	16	7-13	9.1(1.81)	Average	19	7-15	11.89 (2.26)	Average	39.0	<.001**	0,57
Vocabulary	16	1-12	6.19 (3.02)	Low average	19	5-12	9.11 (1.52)	Average	50.0	.001*	0,50
Matrix Reasoning	16	5-10	7.56 (1.79)	Low average	19	6-15	10.95 (2.57)	Average	63.5	<.001**	0,58
Similarities	16	3-8	6.37 (1.46)	Low average	19	6-12	8.84 (1.64)	Average	51.0	<.001**	0,64

Note. VIQ= Verbal IQ, PIQ= Performance IQ and FSIQ= Full Scale IQ. [1]Qualitive descriptions of the test outcome scores. For VIQ, mean rank for WP=11.08 and for EP= 23.89, for PIQ, mean rank of the WP = 10.97 and EP = 23.92; for FSIQ, mean rank for WP= 9.84 and EP= 24.87; For Block Design, mean rank for WP=11.69 and for EP= 23.3, for Vocabulary the mean rank for WP= 12.47 and for EP= 22.66, for Matrix Reasoning the mean rank for WP= 11.63 and for EP= 23.37, for Similarities the mean rank for WP= 10.94 and for EP 23.95. The *r* value presented here is an estimate of effect size. $*p < 0.01$. $**p < 0.001$.

Table 5: IQ Variables and Neuropsychological Composites: Between-group Comparisons for WP vs. EP (N = 35)

	WP				EP				Test statistics		
	n	Range	*M* (*SD*)	*Qualitative description*	*N*	Range	*M* (*SD*)	*Qualitative description*	*U*	*p*	*r*
Animal sorting	12	5-10	7.75 (1.87)	Low average	19	6-15	9.84 (2.67)	Average	63.0	.018*	-0,35
Clocks	12	1-11	6.92 (2.61)	Low average	19	4-15	8.74(3.21)	Average	80.5	.0.88	-0,23
INN CT	16	4-13	8.50 (2.58)	Average	19	6-14	10.37 (1.89)	Average	89.5	.017*	-0,36
INI CT	16	6-16	10.50 (2.92)	Average	19	10-13	11.05 (0.97)	Average	119.5	.140	-0,19
INS CT	11	5-15	9.00 (3.29)	Average	19	8-14	10.16 (1.43)	Average	84.0	.190	-0,15
Inhibition total error	16	1-15	6.75 (3.68)	Low average	19	8-19	11.16 (2.911)	Average	37.5	< .001**	-0,65
Inhibition Naming Combined SS	16	4-15	8.50 (3.25)	Average	19	6-15	13.00 (2.11)	High average	51.0	< .001**	-0,57
Inhibition Inhibition Combined SS	16	4-15	8.88 (3.32)	Average	19	6-14	11.26(2.60)	Average	86.0	.013*	-0,37
Inhibition Switching Combined SS	11	5-11	7.82 (1.88)	Low average	19	7-14	11.21(2.55)	Average	32.0	<.001**	-0,54
Design Fluency	16	5-14	9.06 (2.8)	Average	19	6-14	11.00 (2.19)	Average	88.5	.017	-0,36

Note. For Animal Sorting, Clocks and Inhibition Switching, the four 6-year-old children in the sample could not complete these tests. One additional child could not complete the Inhibition – Switching subtest as too many errors were made on the practice trial. INN CT = Inhibition Naming Completion Time; INI CT = Inhibition Inhibition Completion Time ; INS CT= Inhibition Switching Completion Time. [1]Qualitive descriptions of the test outcome scores. For Animal Sorting mean rank for WP = 11.55 and for EP = 17.79; for Clocks, mean rank for WP = 12.86 and for EP = 17.03; for INN CT mean rank for WP= 10.18 and for EP= 18.58, for INI CT mean rank for WP =14.18 and for EP= 16.26, for INS CT the mean rank for WP = 13.64 and for EP= 16.58, for Inhibition total error the mean rank for WP=9.41 and for EP =19.03, for Inhibition Naming Combined scaled score the mean rank for WP=7.09 and for EP = 20.37, for Inhibition Inhibition combined scaled score the mean rank for WP = 9.73 and for EP = 18.84,for Inhibition Switching combined scaled score the mean rank for WP= 8.91 and for EP = 19.32 ,for Design Fluency the mean rank for WP = 9.91 and for EP =18.74 The *r* value presented here is an estimate of effect size. *$p < 0.05$. ** $p < 0.001$.

Table 6 shows the percentage ranks for the total of number of errors for Naming, Inhibition and Switching components of the Inhibition subtest of the NEPSY II. All of the scores were significantly different with *p*-values of < 0.001, 0.004 and 0.006 for the errors for the Naming, Inhibition and Switching components respectively, using Fisher's exact test.

Table 6: Percentile ranks for total errors across Inhibition components for WP vs EP (N=35)

	WP			EP		
	Naming	Inhibition	Switching	Naming	Inhibition	Switching
< 2	1	1	1	0	0	0
2-5	1	3	0	0	0	0
6-10	1	2	1	0	2	0
11-25	3	3	5	1	0	3
25-50	4	3	2	0	4	3
51-75	5	1	0	6	6	5
>75	1	3	2	12	7	8

Discussion

Summary of Results and Hypothesis Testing

The current study focused on a comparison between grade one learners from 2 schools on the attention/executive functioning domain of the NEPSY II, one situated within a low SES context and the other, in a middle to high SES environment. The disparities between the SES backgrounds of these learners were confirmed by significant differences in SES-related variables reported in this study, including household income per year and the asset index. These variables confirmed that the higher SES EP learners had greater access to material and financial resources than the lower SES WP learners over and above the school-related information regarding SES. All learners were able to converse in English (some learners were in fact excluded on the basis that teachers noted that they were not sufficiently fluent in English) and in grade 1, across the two schools and there were no significant between-group differences in age. There were, however, significant differences in sex and race of the two groups, with significantly more girls and White students in the EP group and significantly more mixed race and boys in the WP group.

There were two hypotheses put forward for the current study. The first was that learners from low-SES SA background would score lower than learners from high-SES SA background and US norms, and second, that learners from high SES SA backgrounds would score more equivalently to US norms. Both hypotheses were confirmed not only on the test of interest, the NEPSY II subtests, but also on the test of general intellectual functioning, administered in order to control for the effects of IQ on the NEPSY II test outcomes.

Summary of results: Comparison of EP and WP groups on neuropsychological outcomes

Regarding the WASI II data, the groups differed significantly on the VIQ, PIQ, FSIQ indices as well as the Block Design, Vocabulary, Matrix Reasoning and Similarities subtests. In each case, the WP participants performed more poorly than EP participants.

Regarding the NEPSY II results, the groups differed significantly on all but 3 outcome scores, two completion time scores on the Inhibition subtest and on the Clocks subtest. In each case where significant differences were found, children from the WP group performed more poorly than children from the EP school. For two of the significant results, both groups performed in the average range, but at different ends of that range in terms of scoring.

Summary of results: Comparisons of EP and WP groups to western norms

The results for the WP group show that these learners' mean scores were lower than average when compared to those reported in the test norm banks for more than half of test scores, whereas all of the mean scores for the EP group (notwithstanding that some individual participants scored lower than expected on the tests) were in the average range (with one outcome score in the high average range).

We discuss these findings below.

Differences in neuropsychological test outcomes between the EP and WP groups

The between-group differences in general intellectual and attention/executive test outcome scores for the low (WP) and middle-high (EP) SES groups outcomes are consistent with literature describing the expected disparities on conducting neuropsychological tests on participants from different SES contexts (Ferrett et al., 2014). Research has shown that the environmental and experiential differences in childhood as a function of SES are associated with disparate neurocognitive outcomes for children, as least as measured by western-based neuropsychological tests. South Africa is particularly vulnerable to such effects, given the different SES landscapes. Ongoing socioeconomic deprivation as a function of differing sociodemographic profiles can result in cumulative effects such that there are large differences in test performance (Foxcroft & Roodt 2005). Researchers ascribe different mechanisms related to SES to such outcomes. For example, individuals in low- and middle-income settings are disproportionately affected by public health issues such as poor nutrition and healthcare, exposure to alcohol and drugs, and head injuries, all of which can impact on brain development and cognitive functioning, and consequently, test performance (Brickman, Cabo & Manly, 2006; Olness, 2003).

Regarding the IQ subtests, research has shown that children from low SES backgrounds score on average lower on intelligence tests than their high SES peers, in fact this difference in IQ triples by the time the child reaches 16 (Bradley and Corwyn, 2002, Schoon et al., 2012, Strenze, 2007). Hence the findings in the current study are not unexpected.

Regarding the attention/executive functioning subtests administered, these findings are consistent with previous research demonstrating that healthy individuals from low socioeconomic status (SES) backgrounds are at risk for deficits in this domain (Hackman & Farah, 2009; Sarsour et al., 2011).

The WP group performed more poorly than the EP group in basic conceptual formulation, category sorting and shifting between these (Animal Sorting), in terms of errors on all of the inhibition components (Naming, Inhibition, Switching). The errors on the Inhibition subtest across the different components suggest not only inhibitory and switching difficulties for the WP group, but also attentional and self-monitoring problems. Although results were significantly different for Design Fluency (nonverbal generativity) and completion time on the Naming component of the Inhibition subtest, these scores were all in the average range. In fact both the WP and EP groups performed in the average range in terms of completion time for all components of the Inhibition subtest, which is inconsistent with the finding that researchers often observe slower performances in neuropsychological testing by South Africans compared to the US norms on speeded tasks (Ardila et al., 2007). This outcome of course depends on the culture of the individuals one is comparing, i.e., having a faster performance is more of a valued culture for individuals from western cultures but this may not be so in other cultures (Rosselli and Ardila, 2003). Given South Africa's diversity in terms of culture, valuing speed over accuracy may be more presented in cultural groups not represented in our sample, which is also limited in size and representation. Finally, the groups did not differ significantly in terms of planning, organization and visuospatial construction (Clocks). Although the results are in the predicted direction, the effect size is small. This result is consistent with the Block Design scores on the WASI II.

In sum the WP groups seemed to struggle with tasks related to attention, inhibition and switching, and basic conceptualization and categorization. The latter two areas of difficulty (basic conceptualization and categorization) seem consistent with the findings on the verbal language subtests of the WASI II, Vocabulary and Similarities.

Comparison of neuropsychological test outcomes: EP and WP groups and US norms

Our comparative results here confirm reports that the outcomes of neuropsychological tests carried out in local contexts, with individuals who do not match the normative sample, can be influenced by confounding sociodemographic factors and hence, by using inappropriate normative data (Ferret et al., 2014). Such disparities in outcomes are especially common when comparing outcomes of individuals from low SES non-westernised cultures to normative data emanating from westernised cultures. In most cases, norms for neuropsychological tests originate from white, English-speaking, middle class individuals that have moderate to high education levels (Ardila, Rosselli & Puente, 2004), hence the disparities.

Research shows that for South Africans that have a higher assimilation to westernised culture (EP leaners in the case of the current study), which includes higher education, good level of English and greater exposure to urbanisation, their outcome scores tend to be more compatible with the norms from samples in England and the USA (Cave & Grieve, 2009). Our results are commensurate with this finding. There therefore appears to be a consensus among researchers that many neuropsychological measures do not have acceptable diagnostic accuracy when used with individuals who do not conform to the demographic profile of the normative sample.

Besides the differences in the test scores reported, these disparities were evident when testing was conducted with the WP participants where, in terms of our qualitative experience with testing, certain subtests in both the NEPSY II and WASI-II appeared more challenging to them compared to EP learners. There were many more queries and questions from participants from the WP school suggesting unfamiliarity with the subtests, which created a sense of uncertainty with particular subtests (e.g. Animal Sorting and Vocabulary). Comparatively, the participants from the EP school appeared more familiar with the testing process and tasks (with some describing doing similar types of activities with their parents for fun).

This observation is not inconsistent with the literature that individuals from high SES backgrounds seem to mirror the customs of the west more often than individuals from low SES communities - which inevitably results (and is evident) in participants performing far better than children from low SES communities and more comparable to norms generated in the west (Cave & Grieve, 2009). In most cases, norms for neuropsychological tests originate from white, English-speaking, middle class individuals that have moderate to high education levels (Ardila, Rosselli & Puente, 2004), a sample more closely matched with the EP group.

In sum, the two groups from low and middle-to-high SES backgrounds differed significantly on a number of neuropsychological test outcomes. We know that the groups differed in terms of SES, however, they differed on other demographic variables too. In line with our literature review, we discuss the possible role of each of the following actors below: culture, language, and quality and quantity of education and the role that some of these factors, in addition to SES, might play in terms of outcomes.

Culture

Although we did not explicitly investigate culture as a variable in our study, we included other demographic variables (e.g., race), which has shown be associated with culture. The race with which one identifies is both related to and dependent on culture (Worell, 2015). The groups in the current study differed significantly in terms of race with most of the WP sample being of mixed race and most of the EP sample being white.

Literature suggests that cultural values impact on how we organise our cognitive abilities in our brain; one culture may find value and worthiness in learning certain things while the next culture does not and vice versa (Ardila, 2007). Hence given the between group differences, race, and possibly culture, by implication, is likely to be confound SES in terms of understanding the differences in outcomes for the two groups.

Language

Although no significant difference in language was reported for the WP and EP groups, with all learners being able to converse in English and only 2 reported speaking both English and isiXhosa at WP, it was clear, at least qualitatively that some learners from the lower SES school had less of a command of the English language, even though they were able to converse in English. Although most parents from WP indicated their child’s home language was English, there were obvious differences in the two study groups’ grasp of the language and ability to therefore comprehend the test instructions. For example, the majority of children from WP struggled to comprehend the rules of the task for Animal Sorting, whereas most of children from EP understood, almost immediately, what was required of them. It became apparent during testing that a number of children at WP were not familiar with some basic English words and also used a mix of English and Afrikaans slang (kombuis Afrikaans). A few participants were also excluded from the study at WP as a result of the teacher noting that the child was not properly conversant in English at the WP school. Thus we feel that this factor should still be kept in mind in terms of understanding the outcomes, even though between group differences are not statically significant.

Quantity and quality of Education

Given that all of the children in the study were in grade 1, the quantity of education was consistent throughout and is therefore not a factor. However, given the differences in SES between the two study groups, differences in the quality of education for the two groups is an unsurprising factor. Schools in low-SES communities (in this instance WP) are often constrained in terms of resources, both in terms of well-qualified teachers (as there can be a movement of these teachers to better resourced settings), and in terms of physical resources. Schools in these settings are associated with poor academic outcomes (Aikens & Barbarin, 2008; Muijs, Harris, Chapman, Stoll, & Russ, 2004).

Research consistently shows that low levels and quality of education can affect neuropsychological test performance particularly when using western-based tests such that those with poorer quality of education perform more poorly on western based tests than those with a higher quality of education (Manly et al., 2004; Crowe et al., 2013; Ferrett et al., 2014). In the literature regarding quality education, it is evident that quality education impacts substantially on cognitive development, skills and an adequate attention span (Crowe et al., 2013) and consequently, test performance (Ferrett, et al., 2014).

Although we did not explicitly measure this factor, it is clear as can be seen by the data that differences in SES could serve as a proxy for the difference quality of education, which in turn impacts on test outcome scores. Hence, differences in quality of education are likely to contribute to the significant test outcomes reported in this study.

Sex

Besides the other demographic factors, results also showed that the study groups differed significantly in terms of sex. The role of sex in cognitive outcomes is an age old debate. Although some previous studies describe sex differences in psychological and neuropsychological test performance (e.g., Baker, Ho, Reynolds, 1994; Halpern, 2004), other more recent studies show that these sex differences are small and possibly negligible (Ardila, Rosselli, Matute, and Inozemtseva, 2011; Furnham and Budhani, 2002). Hence sex differences are not likely to act as a major confound to the test outcomes in the current study.

Study limitations and future directions

The first and most obvious limitation to the study is the sample size. Given certain procedural difficulties which impacted the start date for data collection, and some challenges at the WP school in getting parents to return the signed consent forms, we were able only able to collect data for the 35 participants reported on in this study. We collected data up until the final day permitted by the WCED, i.e., the last day if the third term. In future studies we will focus our efforts in ways to encourage and boost parent response. We may also include more schools and set more time and resources for testing.

A second limitation was that the learners who were only turning 7 in that year could not complete some subtests, because these subtests were designed for children 7 years and older. Given the challenges with recruitment at WP, we needed to include these grade 1 learners to boost the sample size.

Third, we did not run an Analysis of Covariance (ANCOVA) in order to assess the impact of confounding demographic variables on the between-group neuropsychological outcomes. Given the scope of this thesis and associated constraints, bearing in mind that nonparametric tests were used, we were not able to run a nonparametric ANCOVA. We will endeavor in future studies to statically control for these potential confounds to our results One method to meet this end would be to collect a much larger sample, which will possibly satisfy the necessary assumptions for parametric testing or to research non-parametric ANCOVA methods.

A further future direction will be to try to assess learners in the language of their choice. We note that all participants who were included in this study were conversant in English. However, by expanding the study one might want to focus on test translations and adaptions, such that learners could have the choice as to their preferred language of testing.

Conclusion

Albeit in on a limited scale, the research study presented here highlights the importance of considering the role of SES and other related demographic factors on neuropsychological test outcomes, particularly when comparing individuals from non-western backgrounds to western norms. Research exploring these factors that impact on the use of international tests in a local context of South Africa, the development of cross cultural understanding in terms of neuropsychological assessments, and, consequently, the need for tests that are adapted for and validated in this context, are necessary (Ardila et al., 2007). The development of locally relevant norms is extremely important especially when doing testing on a population in a country like South Africa and its multicultural population, a constant changing social structure, and profound socioeconomic and educational disparities (Foxcroft, 2005).

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APPENDIX A
Assent Form for Participants

We are doing a study with 7-year-old children, who speak English, from two schools in Cape Town to see how they do on some tasks.

You are going to be asked to play some games and do some puzzles. The person who is going to ask you the questions has told you that you can stop if you are feeling tired and need to take a break, and that nobody else will be told your answers to the questions.

Signing this paper means that you want to be in the study. If you don't want to be in the study, you don't have to sign the paper. No one will be angry if you don't sign this paper, and no one will be angry if you change your mind later and want to stop.

You can ask any questions that you have about the study. If you have a question later that you didn't think of now, you can call me on (relevant number to be inserted) or ask me next time.

________________________________ ______________

Signature of Child Date

________________________________ ______________

Signature of Researcher Date

Name of Participant ("Study Subject")

____

APPENDIX B
Parent/Guardian's Informed Consent Form

UNIVERSITY OF CAPE TOWN
DEPARTMENT OF PSYCHOLOGY

Informed Consent to Allow Participation in Research and Authorization for Collection, Use, and Disclosure of Cognitive Performance and Other Personal Data

You are being asked to allow your child to take part in a research study. This form provides you with information about the study and seeks your authorization for the collection, use and disclosure of your child's cognitive performance data, as well as other information necessary for the study. The Principal Investigator (the person in charge of this research) or a representative of the Principal Investigator will also describe this study to your child and answer all of their questions. Your child's participation is entirely voluntary. Before you decide whether or not they can take part, read the information below and ask questions about anything you do not understand. By refusing participation in this study you and your child will not be penalized or lose any benefits to which you would otherwise be entitled.

1. **Title of Research Study**

Comparing performance of 7-year-old, English-speaking, low and high SES South African learners on the attention and executive function domain of the NEPSY II

2.
Principal Investigator and Telephone Number(s)

Leigh Schrieff-Elson., Ph.D.
Senior Lecturer
Department of Psychology
University of Cape Town
021 650 3708

Imtiyaaz Hendricks
Honours student
Department of Psychology
University of Cape Town
3304247@myuwc.ac.za

Nina Steenkamp
Honours student
Department of Psychology
University of Cape Town
ninasteenkamp1@gmail.com

3. **What is the purpose of this research study?** The aim of the research project is to collect South African (SA) data for 7- year-old English- speaking children from different social environments on the attention/executive function domain of the NEPSY II: A developmental

neuropsychological assessment, battery. Our objective is to compare this data to the original US normative data. The results of the study will be used as normative data for future research in a South African context.

4. **What will be done if your child takes part in this research study?**
In this study a series of cognitive tests will be administered. The tests measure certain aspects of your child's attention and thinking skills.

5. **If you choose to allow your child to participate in this study, how long will they be Involved in the research?**
The experiment consists of two sessions. Both sessions should last between 60 and 90 minutes each. If at any time during the sessions your child finds any of the procedures uncomfortable, they will be free to stop participating without penalty.

6. **How many people are expected to participate in the research?**
80

7. **What are the possible discomforts and risks?**
There are no known risks associated with participation in this study. A possible discomfort your child may experience is slight fatigue. If they become tired during any of the tests, they can take a break. They will be allowed to take breaks whenever they want to. At the conclusion of the study procedures, we will describe how each of the participants did in testing in a short report and the results can be fully explained to parents, should they require it.

If you wish to discuss the information above or any discomforts you may experience, you may ask questions now or call the Principal Investigator listed on the front page of this form.

8. **What are the possible benefits to your child?**
Your child's cognitive performance will be measured on the domains of general intelligence, attention and executive function, and feedback will be available. This is, however, a research study and therefore the data obtained will only be used for research purposes and not on a clinical basis. Feedback will therefore only indicate a general range of performance of the population that participated in the study. Further enquiries regarding participants' cognitive functioning should be referred to a clinician.

9. **What are the possible benefits to others?**
Information from this study will improve our understanding of how different social environments affect cognitive functioning in children. The results of the study will also be used as norms for future research in a South African context.

10. If you choose to allow your child to take part in this research study, will it cost you anything?

Allowing your child to participate in this study will not cost you anything. The research will be conducted at the school your child is currently attending.

11. Can your child withdraw from this research study?

You are free to withdraw your consent and to stop you child participating in this research study at any time. If you do withdraw your consent, there will be no penalty.
If you have any questions regarding the rights of a research subject, you may phone Rosalind Adams in the Psychology Department at 021-650-3417.

12. If your child withdraws, can information about your child still be used and/or collected?

Information already collected may be used.

13. Once personal and performance information is collected, how will it be kept secret (confidential) in order to protect you and your child's privacy?

Information collected will be stored in locked filing cabinets or in computers with security passwords. Only certain people have the right to review these research records. These people include the researchers for this study and certain University of Cape Town officials. Your child's research records will not be released without your permission unless required by law or a court order.

14. What information about your child may be collected, used and shared with others?

The information gathered from your child will be demographic information and records of his/her performance on cognitive tests. If you agree that your child can be in this research study, it is possible that some of the information collected might be copied into a "limited data set" to be used for other research purposes. If so, the limited data set may only include information that does not directly identify you or your child. For example, the limited data set cannot include your or your child's name, address, telephone number, ID number, or any other photographs, numbers, codes, or so forth that link you or your child to the information in the limited data set.

The results of the research will be presented as part of an Honours research project for the University of Cape Town. Also, the results may be submitted for publication in a peer-reviewed journal. In both instances neither you nor your child will be identified in any way.

15. What should you tell your child?

You may wish to discuss the study with your child to find out determine whether he/she feels comfortable taking part. Your child should know that he/she can choose not to participate in the study. Your child should also know that if he/she does choose to participate, he/she can withdraw at any time during the study with no negative consequences.

16. How will the researcher(s) benefit from your child being in the study?

In general, presenting research results helps the career of a scientist. Therefore, the Principal Investigator and others attached to this research project may benefit if the results of this study are presented at scientific meetings or in scientific journals.

17. Signatures

As a representative of this study, I have explained to the parent/guardian of the participant the purpose, the procedures, the possible benefits, and the risks of this research study; and how the participant's performance and other data will be collected, used, and shared with others:

____ ______________________
Signature of Person Obtaining Consent and Authorization Date

You have been informed about this study's purpose, procedures, possible benefits, and risks; and how your child's performance and other data will be collected, used and shared with others. You have received a copy of this form. You have been given the opportunity to ask questions before you sign, and you have been told that you can ask other questions at any time.

You voluntarily consent to allow your child to participate in this study. You hereby authorize the collection, use and sharing of your child's performance and other data. By signing this form, you are not waiving any of your legal rights.

____ ______________________
Signature of Person Consenting and Authorizing Date

____ ______________________
Name of Child Age

Please indicate below if you would like to be notified of future research projects conducted by our research group:
______________ (initial) Yes, I would like to be added to your research participation pool and be notified of research projects in which I or my child might participate in the future.

Method of contact:

Phone number: ____________________________

E-mail address: ____________________________

Mailing address: __________________________________

____

____

APPENDIX C

Parent Information Questionnaire and Asset Index

PARENT QUESTIONNAIRE AND ASSET INDEX

GENERAL INFORMATION

Full name (Parent):	
Telephone:	Work: ( ) Home: ( ) Cell:
Home Language:	
Full name (Child):	
Gender:	M F
Date of Birth:	
Grade:	

HOUSEHOLD INCOME: (Please circle appropriate number)

Household income per year:	1. R0 2. R1 – R5 000 3. R5001 – R25 000 4. R25 000 – R100 000 5. R100 001+

PARENTAL EDUCATION: (Please circle appropriate number)

	Biological mother	Biological father	Guardian
Highest level of education reached? Mark one response for each person as follows:			
1. 0 years (No Grades / Standards) = No formal education (never went to school)	1.	1.	1.
2. 1-6 years (Grades 1-6 / Sub A-Std 4) = Less than primary education (didn't complete primary school)	2.	2.	2.

3. 7 years (Grade 7 / Std 5) = Primary education (completed primary school)	3.	3.	3.
4. 8-11 years (Grades 8-11 / Stds 6-9) = Some secondary education (didn't complete high school)	4.	4.	4.
5. 12 years (Grade 12 / Std 10) = Secondary education (completed senior school)	5.	5.	5.
6. 13+ years = Tertiary education (completed university / technikon / college)	6.	6.	6.
7. Don't know	7.	7.	7.

PARENTAL EMPLOYMENT: (Please circle appropriate number)

Hollingstead categories:	Biological mother	Biological father	Guardian
1. Higher executives, major professionals, owners of large businesses)	1.	1.	1.
2. Business managers of medium sized businesses, lesser professions (e.g. nurses, opticians, pharmacists, social workers, teachers)	2.	2.	2.
3. Administrative personnel, managers, minor professionals, owners / proprietors of small businesses (e.g. bakery, car dealership, engraving business, plumbing business, florist, decorator, actor, reporter, travel agent)	3.	3.	3.
4. Clerical and sales, technicians, small businesses (e.g. bank teller, bookkeeper, clerk, draftsperson, timekeeper, secretary)	4.	4.	4.
5. Skilled manual – usually having had training (e.g. baker, barber, chef, electrician, fireman, machinist, mechanic, painter, welder, police, plumber, electrician)	5.	5.	5.
6. Semi-skilled (e.g. hospital aide, painter, bartender, bus driver, cook, garage guard, checker, waiter, machine operator)	6.	6.	6.
7. Unskilled (e.g. attendant, janitor, construction helper, unspedified labour, porter, unemployed)	7.	7.	7.

8. Homemaker 9. Student, disabled, no occupation	8. 9.	8. 9.	8. 9.

MATERIAL AND FINANCIAL RESOURCES (ASSET INDEX): (Please circle appropriate number)

Which of the following items, in working order, does your household have?

Items	Yes	No
1. A refrigerator or freezer	1.	1.
2. A vacuum cleaner or polisher	2.	2.
3. A television	3.	3.
4. A hi-fi or music center (radio excluded)	4.	4.
5. A microwave oven	5.	5.
6. A washing machine	6.	6.
7. A video cassette recorder or dvd player	7.	7.

Which of the following do you have in your home?

Items	Yes	No
1. Running water	1.	1.
2. A domestic servant	2.	2.
3. At least one car	3.	3.

4. A flush toilet	4.	4.
5. A built-in kitchen sink	5.	5.
6. An electric stove or hotplate	6.	6.
7. A working telephone	7.	7.

Do you personally do any of the following?

Items	Yes	No
1. Shop at supermarkets	1.	1.
2. Use any financial services such as a bank account, ATM card or credit card	2.	2.
3. Have an account or credit card at a retail store	3.	3.

APPENDIX D
Developmental history questionnaire

Child's Name: ______________________________ Date of Birth: ___________________ Age: _________

PREGNANCY AND BIRTH

Were there any complications during the *pregnancy*?

Did you take any medicine during pregnancy? Prescribed or over the counter?

Did you smoke cigarettes while you were pregnant? How many?

How much did you drink when you were pregnant?

Anything else, like dagga? Any drugs?

Was the birth on time?

Was it a natural birth or via C-section/Caesarian? Was labor induced?

Were there any complications during the birth?

What was your baby's birthweight? __________

Were there any complications in the *newborn period*?

DEVELOPMENT

At what age did your child:

sit unaided? ____________________
crawl or 'scoot' on his bottom? ____________________
walk without help? ____________________
dress and undress without help? ____________________
button own clothes? ____________________
tie shoe laces? ____________________
start babbling/baby talk ____________________
say their first word? ____________________
use 2 words together? ____________________
talk in sentences? ____________________
write own name? ____________________

Was your child slow to walk, or run? Did s/he have any problems with co-ordination or fine motor control?

At what age was your child *dry by day*? ____________________
At what age was your child *dry by night*? ____________________

Were there any early *separations* from you? (when and for how long)

Please list any *illnesses* and problems with *hearing* or *vision* that your child has/had.

Has your child ever been referred to a *Psychologist/Psychiatry* service?

Have there been any *emotionally difficult* experiences for your child?

Does your child have any neurological or neurodevelopmental disorder (such as Attention Deficit Hyperactivity Disorder or Epilepsy)?

Has your child sustained any head injury?

If yes, did he/she lose consciousness and for how long?

Did your child attend crèche? (what ages)

How old was your child in Grade R? What year was that?

MEDICATIONS

Is your child currently receiving any *medication*?

Please feel free to mention anything else you would like to bring to our attention.

Completed by: ___________________________ Date: __________ Signed: _______________

APPENDIX E

Letter to Parents

Date

Dear parent / guardian,

We, Imtiyaaz Hendricks and Nina Steenkamp, are currently completing our Honours degrees at the University of Cape Town. We would like to invite your child to participate in our research study.

The main purpose of this research is to is to collect South African (SA) data for 7- year-old English-speaking children from low and high socio economic status backgrounds on the attention and executive function domain of the NEPSY II: A developmental neuropsychological assessment, battery. Executive functions refer to functions such as planning, organization and controlling our responses. The results of the study will be used as normative data for future research in a South African context. In other words, we would like to know how healthy South African children perform on these tests so that we have data against which we can compare the data for children from clinical samples.

If you allow your child to participate in this research, neuropsychological tests (i.e., tests of attention and executive functioning) will be carried out with your child, in two sessions of 60-90mins. You, as the parent/caregiver, will also be asked to complete two forms so that the investigator can know more about your child's background and development.

The study will not cost you anything and will be conducted at the school.

The consent form attached, gives you more details about this study. If you would like your child to participate in this study, please sign and return that form. **Please also provide your contact details so that we can get in touch with you.**

Thank you for taking the time to read this letter.

Regards,

Imtiyaaz Hendricks and Nina Steenkamp

APPENDIX F

Psychology Department Ethics Approval Form

UNIVERSITY OF CAPE TOWN

Department of Psychology
Research Ethics Committee
Rondebosch, 7701
Tel: 27 21 6504607 Fax: 27 21 6504104
E-mail: Lauren.Wild@uct.ac.za

21 July 2016

REFERENCE NUMBER: PSY2016-STNNIN004

Researcher Name: Nina Steenkamp and Imtiyaaz Hendricks
Researcher Address: Department of Psychology, University of Cape Town

Dear Ms Steenkamp and Mr Hendricks

PROJECT TITLE: Comparing performance of 7-year-old, English-speaking, low and high SES South African learners on the attention and executive function domain of the NEPSY II.

Thank you for your submission to the Department of Psychology Research Ethics Committee.

It is a pleasure to inform you that the Committee has **granted approval** for you to conduct the study.

Please note that the ongoing ethical conduct of the study remains the responsibility of the principal investigator.

Please quote your REFERENCE NUMBER in all your correspondence.

Yours sincerely

Associate Professor Lauren Wild
Acting Chair, Department of Psychology Research Ethics Committee

Appendix G

Western Cape Educational Departmental Ethics Approval Form

Western Cape Government
Education

Directorate: Research

Audrey.wyngaard@westerncape.gov.za
tel: +27 021 467 9272
Fax: 0865902282
Private Bag x9114, Cape Town, 8000
wced.wcape.gov.za

REFERENCE: 20160726 – 2673
ENQUIRIES: Dr A T Wyngaard

Ms Nina Steenkamp and Imtiyaaz Hendricks
Department of Psychology UCT
Rondebosch
7701

Dear Ms Nina Steenkamp and Imtiyaaz Hendricks

RESEARCH PROPOSAL: COMPARING PERFORMANCE OF 7-YEAR-OLD, ENGLISH-SPEAKING, LOW AND HIGH SES SOUTH AFRICAN LEARNERS ON THE ATTENTION AND EXECUTIVE FUNCTION DOMAIN OF THE NEPSY II

Your application to conduct the above-mentioned research in schools in the Western Cape has been approved subject to the following conditions:

1. Principals, educators and learners are under no obligation to assist you in your investigation.
2. Principals, educators, learners and schools should not be identifiable in any way from the results of the investigation.
3. You make all the arrangements concerning your investigation.
4. Educators' programmes are not to be interrupted.
5. The Study is to be conducted from **27 July 2016 till 30 September 2016**
6. No research can be conducted during the fourth term as schools are preparing and finalizing syllabi for examinations (October to December).
7. Should you wish to extend the period of your survey, please contact Dr A.T Wyngaard at the contact numbers above quoting the reference number?
8. A photocopy of this letter is submitted to the principal where the intended research is to be conducted.
9. Your research will be limited to the list of schools as forwarded to the Western Cape Education Department.
10. A brief summary of the content, findings and recommendations is provided to the Director: Research Services.
11. The Department receives a copy of the completed report/dissertation/thesis addressed to:

    The Director: Research Services
    Western Cape Education Department
    Private Bag X9114
    CAPE TOWN
    8000

We wish you success in your research.

Kind regards.
Signed: Dr Audrey T Wyngaard
Directorate: Research
DATE: 27 July 2016

APPENDIX H

WAS II Qualitative Descriptions

Composite Score	Classification
130 and above	Very Superior
120-129	Superior
110-119	High Average
90-109	Average
80-89	Low Average
70-79	Borderline
69 and below	Extremely Low