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Predictors of Academic Achievement in Multilingual Learners

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1. Introduction

1.1 Abstract

This research considered factors that predict academic achievement in Grade 8 and 9 learners. The learners in this study were categorised primarily based on their first language. As a researcher in South Africa one is not faced with a division between monolinguals and bilinguals, but rather is forced to classify language users based on their 'home' or 'first' language. Thus learners whose first language was English fell into the first-language (L1) group, while learners whose first language was not English fell into the second-language (L2) group

Academic achievement was defined in this study as the marks obtained by learners in their school subjects. This method of assessing students and learners is both pervasive and essential in the determination of academic potential, and the subsequent determination of future employment and educational opportunities.

The results of these school achievement tests were compared with results obtained from the Differential Aptitude Test Form S (DAT-S) English Version. The DAT-S is an assessment instrument used to determine academic potential. This test was developed in South Africa, and normed against Afrikaans and English speaking students (Vosloo, Coetzee & Claassen, 2000). The test was chosen for use in this study because *"the kind of information obtained from the differential aptitude tests can … facilitate judgements regarding potential success in the course of a career"* (Vosloo, Coetzee & Claassen, 2000 p. 1).

The results of this comparison were used to examine factors that determine success in an academic sphere, and which underlying proficiencies as predicted by the DAT-S may have contributed to this success.

1.2 Language and South Africa

The Constitution of the Republic of South Africa, 1996 (Act 108 of 1996), recognises 11 official languages. These languages are Afrikaans, English, IsiNdebele, IsiXhosa, IsiZulu, Sepedi, Sesotho, Setswana, SiSwati, Tshivenda, and Xitsonga. According to the national census (Statistics South Africa, 2001), IsiZulu is the most widely spoken language, with 10.7 million people or 23.8% of the population claiming this as their home or first language. The second most prolific language is IsiXhosa, with 7.9 million people or 17.6% of the population claiming this as their mother tongue. In contrast, English is only the sixth most common home language, with only 3.7 million people or 8.2% of the population brought up speaking English as their first language. Despite these demographic trends, the majority of schools in South Africa use English as their primary language of instruction (Kane-Berman, 2004).

Clearly, in a country with an estimated 44.8 million people (Statistics South Africa, 2001) where only 3.7 million of those people speak English as a first language, the decision to use English as the primary language of instruction is based on considerations other than the linguistic background of the population. It is anomalous to discover a situation in which the overwhelmingly dominant language of instruction differs from the home language of the majority of the population. A history of the language instruction policies of South Africa is beyond the scope of this research, however, a brief overview of this historical background is required to explain this phenomenon.

The Union Act of 1910 saw the amalgamation of the former Boer republics with the Cape Colony and Natal. This Act also saw the statutory recognition of Afrikaans as a joint official language with English (Lanham, 1996). Economic power resided primarily with the English language, but Afrikaners began entering the job market and there was a concomitant rise in English-Dutch bilingualism. There was however, a growing hostility towards the dominance of English among certain sectors of the Afrikaner population, and there was a rapid spread of the concept of *taalstryd* (language struggle). Lanham (1996, p. 22) notes that *'language loyalty became the biggest social division in white South African society'*. During this time however, the use of English within black South Africa was steadily increasing. There was growing access to state and mission schools for blacks, and as cities expanded with the increase of urbanisation there were increased opportunities for interaction with English speakers. The black urban population was increasing rapidly, and since English was often the language of the workplace, blacks use of English was growing at a similar rate.

As the Afrikaner nationalist movement grew in power, education was increasingly perceived as *'a weapon through which to advance Afrikaans and reduce the influence of English in South Africa'* (Banda, 2000, p. 53). It was on this linguistic battleground then, that the black population was to suffer some of the greatest casualties. The Bantu Education Act of 1953 saw the implementation of enforced mother tongue instruction (MTI) for blacks, with a systematic reduction of the role of English in black education. This removal of the English language was supplemented with an increased emphasis placed on Afrikaans instruction. MTI was to continue until secondary school, at which point blacks were to learn through both English and Afrikaans as media of instruction (Branford, 1996). These measures were enforced despite strong opposition from both white and black communities.

Banda (2000, p. 53) notes that *'the Afrikaner nationalist government went on a deliberate campaign uprooting white English mother-tongue teachers from Bantu education, thereby denying black children authentic models of English and well trained, experienced teachers'.* This linguistic segregation was also coupled with large scale social segregation, so that blacks were limited not only in their educational opportunities, but their freedom of movement and association was also heavily curtailed. This effectively denied blacks access not only to education, but restricted their opportunities to interact with proficient English speakers at almost every level. Lanham (1996, p. 27) has stated that:

> *Social segregation, the removal of white teachers from classrooms including mission schools, and the denial of entry to so-called white English universities, confined the black child's encounter with English to the classroom with teachers, themselves products of deprived learning experiences with little gained in knowledge of teaching methods or competence in English from training colleges, which had suffered the same way as schools.*

There was little funding for Bantu education and less interest in its eventual success, and thus the system ended in utter failure. Banda (2000) contends that the collapse of Bantu education is partly responsible for the current situation in which blacks seem to associate mother tongue education with mediocrity and failure. The opposition and anger surrounding the forced Afrikaans medium of instruction in black schools culminated in the Soweto riots of 1976. Pluddeman (1996 cf. Banda, 2000) reports that black parents overwhelmingly prefer their children to be educated in English rather than Afrikaans.

After the transition to democracy in 1994, the new government began working on a fresh curriculum. The initial draft of this curriculum was released in 1997 (Manganyi, 1997), and was named Curriculum 2005. It was envisioned that this new curriculum would be fully implemented by 2005, and it had several stated goals to redress the imbalances of the past. The users guide released by the Department of Education (Manganyi, 1997, p.2) stated that:

> *The primary task of educational policy makers is the establishment of a just and equitable education and training system which is relevant, of high quality and is accessible to all learners, irrespective of race, colour, gender, age, religion, ability or language. A priority for both national and provincial education departments is, therefore, the creation of a transformative, democratic, open learning system, fostering in all its users, a strong commitment to lifelong learning and development.*

Thus language and language competence were at the forefront of policy-makers minds in the creation of the new curriculum. The curriculum was based on the principles of Outcomes Based Education as envisioned in the White Paper on Education and Training of 1995 (Department of Education, 1995).

Current language policy within education is intended to be a form of additive bilingualism. Since the primary language of instruction for the vast majority of schools in South Africa is English however, and the structure of the learning experience is very similar to an English immersion programme, it is not clear that subtractive bilingualism is not taking place. A discussion of additive and subtractive bilingualism is undertaken in a later chapter of this report.

Language policy in South Africa is somewhat contradictory in its approach, as the South African School Act of 1996 clearly demands that a learners mother tongue should be primary throughout their education. The second or third languages are intended only to supplement a child’s education which is carried out in their L1. It is somewhat anomalous then that the vast majority of education in South Africa is conducted in English (Kane-Berman, 2006). There are myriad reasons for this phenomenon, the most basic being the lack of textbooks and teaching aids in the official languages. This is a situation which is difficult if not impossible to remedy, given the number of official languages in South Africa. The task of translation of all textbooks (which currently remain exclusively in English or Afrikaans) is not only prohibitively expensive, but is also one that would take an uncomfortably long time to accomplish. Thus far no efforts have been made to begin a large scale translation enterprise, and the focus seems to be more on the promotion of English proficiency within the school system.

The lack of true mother tongue instruction in South Africa is also premised on the attitudes of blacks towards their own indigenous languages (Banda, 2000). It has been demonstrated by several researchers (Smit, 1996; De Klerk, 1996; Banda, 2000) that blacks are adamant that their children will be educated in English. There is also an apparent perception within the black community that indigenous languages are of low status. This seems to be premised primarily on two factors, the first of which being the continuing legacy of apartheid in which indigenous languages were regarded both popularly and legislatively as inferior. The second factor is the undeniable usefulness of English globally and as a business tool. With the pervasive nature of English as the global language of business, proficiency in this language is of marked economic benefit.

The above discussion highlights several key issues. The first is that bilingual or multilingual learners, depending on the type of bilingualism present, often perform differently on standardised tests when compared against their monolingual peers. Second, these measured differences can have a dramatic effect on the L2 speaker’s life if tests used to determine potential make systematic errors in measurement based on language preference. Finally, South Africa is a country with a multiplicity of languages and a history of discrimination that has skewed the language profile of the population. Given all these factors, it seems that there is an urgent need to determine whether bias exists in current assessment instruments, and further to determine the usefulness of such instruments in the multilingual South African context. This identified need has given rise to the research presented in this report.

1.3 Language Proficiency

The acquisition of proficiency in language is a topic that has been extensively researched (Sternberg, 1999), and the overall theme of the debate was that of a nature/nurture division. Skinner (1957) argued that language was merely another aspect of learned behaviour, while Chomsky (1959; 1972) repudiated this idea and pointed to the infinite number of sentences and ideas that could be spontaneously expressed in language. Chomsky maintained that our understanding of language was constrained not so much by what we had already heard and learned, but by the operation of an innate Language Acquisition Device. The depth of the theoretical argument is not relevant to the current report, but suffice it to say that the nature/nurture division has been largely synthesised so that it is widely recognised today that both aspects play a part in language acquisition. Jusczyk (1997) has termed the process ‘innately guided learning’, which sums up the position that language is a learned skill while maintaining the assertion that the ability to learn language is innate.

Cummins (1979) has noted that there are broadly two types of language skills, basic interpersonal communicative skills (BICS) and cognitive academic language proficiency (CALP). This distinction was first suggested by the work of Skutnabb-Kangas and Toukomaa (1976) who noted that immigrant children in Sweden often appeared to educators to be fluent in both Finnish and Swedish but still showed levels of verbal academic performance in both languages considerably below grade/age expectations. Since the children were able to communicate in Swedish with a near native-like proficiency, the researchers were surprised that their performance on academic tasks in that language was significantly reduced.

This problem was tackled by Cummins (1979; 2000a; 2001a) when he noted that spoken language and communication is rich in contextual clues, while most academic tasks are significantly context reduced. Furthermore most verbal interactions are cognitively undemanding, while academic tasks require a high degree of concentration and understanding. It became clear using this framework of spoken language (context rich/cognitively undemanding) and academic language (context reduced/cognitively demanding) that different linguistic skills were employed when language was used in these different contexts. It is essential to bear in mind the distinction between BICS and CALP when testing children from linguistically diverse backgrounds, as this may have a significant impact on their ability to perform well on academic tasks and tests. In a school or academic setting, the most commonly used method of assessment is standardised testing and in South Africa the language of assessment is most often English. In multilingual groups, where the L1 is not English, it is expected that reduced results in tested CALP will be found when L2 learners are compared to their monolingual peers.

The situation is complicated further by the fact that pupils have been shown to be able to easily transfer reading skills across languages, while they have great difficulties in learning to read in L2 (Hovens, 2002). Thus a child that is taught to read in his/her L1 is more easily able to transfer those reading skills across languages than a child who is taught to read in L2. A distinction must be made between merely reading a text and comprehending its meaning. While children with weak CALP may still be able to read a text with similar proficiency to an L1 learner, their comprehension of that text may be significantly reduced. Hovens (2002) found that with a solid grounding in L1 reading skills, when children began to read in their L2 they demonstrated significantly better comprehension than those who had begun their reading education in the L2. Thus transference of reading skills across languages is an attainable goal, while attempting to teach children to read in their weaker language is a far more difficult task.

1.4 Bilingualism and multilingualism

Bilingualism refers to the acquisition of a language other than the home language of the individual, while multilingualism is the state of having acquired more than one language in addition to the home or first language. Researchers have been investigating the effects of bilingualism and multilingualism for many years, and there are conflicting views surrounding the effects of language proficiency (Cummins, 2000).

Tucker (1997) notes that multilingualism is seen as a problem by some researchers but not by others. For example, Darcy (1953), in the early 1950s, reported that imperfect knowledge of the L2 among multilinguals caused L1 impedance whereas, some 20 years later, Lambert and Tucker (1972) reported on high levels of achievement of L2 at no cost to the L1. More recently, researchers have tried to understand the reasons for such contradictory findings. Studies that have shown negative effects are usually associated with students enrolled in immersion programmes, in which the sole language of instruction is the L2, that are surrounded by negative attitudes towards the L1 (McLaughlin, 1978). On the other hand, positive findings are usually related to majority language groups in immersion programmes in which the L1 still enjoys a high status (Swain & Cummins, 1979). It has been shown that positive attitudes towards L1 and L2 play a significant role in the academic achievement of multilingual children (Cummins, 1996). Stroud (2001, p339) has noted that *“there is evidence that one of the most important considerations in the success or failure of multilingual programmes is the extent to which marginal language communities participate in the design and implementation of their own language provisions”*.

Bilingualism is often treated as distinct from trilingualism or multilingualism, and Hoffman (2001) has suggested that the effects of bilingualism versus multilingualism are distinct from one another. She maintains that the addition of languages to an individual’s lexical repertoire changes their experience and interaction with their world, and that with each additional language gained, this language has a qualitative and quantitatively measurable effect on their behaviour and functioning. Some evidence that trilingualism differs from bilingualism is also offered by Cummins (2001), but in general he treats trilingualism or multilingualism in a similar way to bilingualism. The primary advantage of multilingualism, according to Cummins (2001), is that the language learner/user is exposed to a wider range of lexical registers, and this is assumed to accelerate their cognitive development and speed of lexical processing. Errasti (2003) has elaborated on the tri/multilingual advantage by showing that children who have mastered a second language are more easily able to acquire proficiency in a third. She also notes that children who were already biliterate developed a higher competence in a third language than those who had monolingual literacy alone.

Despite some evidence showing differences between tri/multilinguals and bilinguals, this study will treat bilinguals and multilinguals as a theoretically similar group. The majority of research carried out in the field of linguistic testing has conflated the ideas of bilingualism and multilingualism, primarily for the sake of convenience (Cummins, 2000). Given the multiplicity of official languages present in South Africa, it is a practical impossibility to distinguish between bilingualism and multilingualism.

Papapavlou (1999, p. 253) states that:

> *“To begin with, it is important to differentiate between ‘early or simultaneous bilingualism’ and ‘consecutive bilingualism’. The first kind refers to the child who*

has been in contact with more than one language from birth, whereas the second refers to the one who acquired the second language in early childhood, after the first language has been established."

Research indicates that simultaneous bilingualism generally leads to native-like proficiency in both the languages in question (Cummins, 2000). Bialystok (2001, p.4) notes that the idea that a multilingual language user has full fluency in two or more languages is somewhat naïve, and argues that researchers need to think in terms of the more pragmatic definition that the language users can *"function in each language according to given needs"*.

In South Africa the vast majority of the population would be classed as simultaneous bilinguals using the above definition, but this simultaneous bilingualism is of a special kind. The majority of black people in South Africa learn multiple languages in their communities, but these languages are often African languages, which are not the primary language of instruction in schools (being English or Afrikaans). Thus while black students are simultaneous bilinguals for several African languages, they are consecutive bilinguals when it comes to English or Afrikaans. In the study conducted by Papapavlou (1999), he found that academic abilities were enhanced by bilingualism. In his sample group however, there were primarily monolingual speakers, and few bilingual language users. Thus the bilinguals were presented with many proficient speakers on whom to model their own language usage. Cummins (2001, p.62) also notes this possibility when he states that:

"It is interesting to note that English L1 students who attend French-language schools in Montreal do develop fully native-like fluency in French because of the much wider range of target language registers they are exposed to (e.g. from peer interaction) in comparison to the restricted classroom registers in the French immersion context where exposure to French outside the classroom is usually minimal or non-existent."

This situation is not always possible for students in South Africa, who must often model their English or Afrikaans language usage on their teachers alone, who may have reduced competency in these languages to begin with (Banda, 2000).

In addition to the concepts of simultaneous versus consecutive bilingualism, the researcher in the field of language acquisition and testing needs to be aware of the distinction between ‘additive’ and ‘subtractive’ bilingualism. Broadly, additive bilingualism is defined as the acquisition of an additional lexical framework that is an adjunct to the already existing language (Cummins, 2000). Additive bilingualism takes place, as the name suggests, when the language learner adds another language to their repertoire which does not in any way detract from their proficiency in their first language. Evidence that this form of second language acquisition takes place was first provided by Peal and Lambert (1962) when they showed that the bilinguals in their study demonstrated greater mental flexibility and the ability to think more abstractly. They also argued that positive transfer between languages, wherein the use of one language enriched and supported the use of the second language, benefited overall intelligence.

Subtractive bilingualism refers to the learning of a second or additional language that has a detrimental effect on the language user’s performance in their first or previously acquired language (Cummins, 2000). Cummins (2000, 2001) argues that subtractive bilingualism generally occurs when the base language is perceived as a language of lower-status than that which is being acquired. Further, if a language learner is placed in an immersion context, in which they are taught exclusively in the L2, they are more likely to experience a subtractive bilingual progression.

Finally, the concepts of ‘balanced’ versus ‘unbalanced’ bilingualism need to be introduced before the discussion can move on to the use of these concepts in an educational setting. Balanced bilingualism (Bialystock, 2001) refers to the theoretical position in which a bilingual language user has the same or similar proficiency in both or all of their acquired languages. This is the ideal position, and is thus a theoretical entity alone, however, much research has been conducted showing that balanced bilinguals have an advantage over their monolingual peers (Bialystock, 1999; 2001; Cummins, 2000; 2001; McLeay, 2003).

Unbalanced bilingualism refers to the state in which a bilingual language user has not acquired equal proficiency in all of their languages (Cummins, 2000). This is the state in which most bilinguals find themselves, however it becomes problematic when there is a large degree of difference in proficiency between one language and another. There is evidence to suggest that unbalanced bilinguals must spend more time on tasks presented in their weaker language as they need to perform translation and code switching tasks that a monolingual does not (Chincotta & Underwood, 1996). It is becoming widely recognised that an unbalanced bilingual tested in their weaker language cannot complete the task in the same time as their monolingual counterpart, simply because of the increased time required for mental translation and manipulation (Cummins, 2000).

To summarise the above section then, the state of simultaneous additive and balanced bilingualism is the ideal situation for a bilingual speaker. At the other extreme, consecutive subtractive and unbalanced bilingualism is the least desirable position for a bilingual language user. Given this brief overview of the general theory of bilingualism, a broad discussion of educational testing in the context of bilingualism follows.

1.5 Educational testing

Educational testing uses nearly every type of available test in order to make decisions about learners. Anastasi (1988, p. 411) has noted that "*intelligence, special aptitude, multiple aptitude, and personality tests can be found in the repertory of the educational counsellor and the school psychologist*". These tests, along with the results of achievement tests are used by teachers on a daily basis to categorise and guide learners towards subject choices that are deemed appropriate.

Lezak (2000) has noted that observation is the foundation of all psychological assessment, and she argues that attempting to evaluate psychometric data without adequate observation leads to questionable validity. Unfortunately in large scale testing such as that which occurs in an educational environment, such observation is impossible for the educational psychologist to attempt, and they must rely on the data garnered through psychometric assessment. Since observation cannot be attempted, the psychologist or psychometrist interpreting the data will be largely unable to discern if unseen confounding variables or systematic errors in measurement have occurred. In the South African context this is especially relevant, and Nell (2000) has suggested that assessors in South Africa must be very sensitive to the language issues that skew the results of the assessment. He has noted that without information regarding the L1 of the assessed individual, test data becomes virtually uninterpretable. Further, if the testee's home language is different from the language in which the test is administered, only observation and intuition can give a fair picture of the subject’s true abilities.

Assessment of ability using standardised tests across linguistic groups is a traditionally difficult task (Norris, Brown & Hudson, 2002). The problem lies in the fact that a test used to assess ability is often primarily linguistically based, and thus the language used in the assessment is a large part of that which is being assessed. If a learner is tested in their second language (L2), it is likely that they will not have the same proficiency in L2 as their monolingual peers. Sandoval and Durán (1999, p.181) have noted that:

> *“One of the more complex challenges for psychologists is the reliable and valid assessment of skills of people from non-English backgrounds who might be limited in their English proficiency.”*

All tests originally normed on English L1 populations are to some extent measures of English proficiency (Sandoval & Durán, 1999). This is not normally a problem when the tests are administered to an English L1 population, since English proficiency in this population does not account for a significant amount of variance in the total score. When such a test is used on an English L2 population however, this is not the case. English proficiency within a non-native English population accounts for a large proportion of the variance in an English L1 normed test, so much so that any test in English administered to this group must be interpreted as measuring English proficiency in addition to the constructs it was designed to measure. This creates problems for the psychologist or psychometrist attempting to interpret norm-referenced scores, as there is no objective way of discerning the degree of variance that language proficiency, or lack thereof, is contributing to the final test scores.

Language is an integral part of culture, and as Cummins (2000) has noted, there is no such thing as a ‘culture-free’ test. Rather psychometrists and test developers in general have striven to create ‘culture-fair’ or ‘culture-reduced’ tests. Today it is widely recognised that every test is a product of it’s time and the culture in which it was developed. Thus no test can ever be free of content that is somewhat biased towards a certain culture or cultural group. This is especially true in the case of the assessment of linguistically diverse populations. Since every test must perforce be presented in a language, it is intuitively apparent that those testees who are less proficient in the language of presentation will perform at a lower level than their L1 counterparts. This position is also backed up by extensive research in the field (Cummins, 2000).

Venter (1993) has discussed how psychometric testing for the definition, diagnosis, and determination of severity of mental retardation is inadequate for professionals working in the field of mental handicap in South Africa. He asserts that when cross cultural testing is attempted, the use of English language norm referenced tests in this multicultural society poses several problems including the language issue, ecological validity, and inappropriate norms. Venter (1993) concludes that a clinical approach, preferably in a multidisciplinary framework, with intelligent interpretation of psychometric test results (the emphasis on functionality rather than numerically evaluated performance), should ensure a fair assessment of mentally handicapped children from those cultural groups for whom traditional test norms and standards are not suitable. While his discussion accurately reflects the current state of norm referenced tests, his conclusions are unfortunately not generalisable to a population that does not require, and indeed has no access to, focused clinical observation. A population of learners of even a single school is already too large for an accurate clinical picture to be constructed for each child, and the costs in terms of both time and finances are prohibitive. Thus norm-referenced tests of large populations are both inevitable and essential.

It is generally expected that tests which are administered in English, or at least rely on a degree of proficiency in this language, would yield lower scores for non-native English speakers. Further, it is likely that tests which rely primarily on non-linguistic constructs or proficiencies, would yield similar results across language groups. This is precisely the pattern that was observed in a study of neuropsychological test norms (MacFarlane, 2001), in which L1 and L2 subjects were tested on a range of standardised neuropsychological tests. The tests were categorised on the basis of their linguistic requirements, with certain tests being primarily language based, while others required little or no use of language to complete. For instance, tests like the Controlled Oral Word Association test (COWA), which requires subjects to generate as many words as possible in different categories (eg. Fruit, animals, etc.) were classified as language based tests. Conversely tests like the Rey-Osterreith Complex Figure test, which required the subjects to remember and reproduce an abstract design, were classed as non-language based. It was found that L2 subjects consistently performed at a lower level than their L1 peers on language based neuropsychological tests, while their performance on non-language based tests was indistinguishable from their L1 counterparts. The researcher (MacFarlane, 2001, p. 41) concluded that *"the results of this study indicate that one of the primary difficulties surrounding norm-referenced testing is that current norms disadvantage non-first language English speakers"*.

Cummins (2000) raises a number of issues around this point, specifically calling into question when it is appropriate to test multilingual children on the same tests as their monolingual peers, and furthermore how comparable these results might be. Bialystok (2001) has strongly argued that when conducting research on linguistically dissimilar groups, it is almost impossible to fully distinguish which differences are attributable to linguistic factors, and which to cognitive/socio-economic factors. Valdes and Figueroa (1994, p.87) have noted that:

> *"When a bilingual individual confronts a monolingual test, developed by monolingual individuals, and standardised and normed on a monolingual population, both the test-taker and the test are asked to do something that they cannot."*

Cummins (2001a) has further noted that most educators today agree that IQ and aptitude tests do not measure 'innate potential', but rather seek to measure 'academic potential'. This essentially refers to the idea that these sorts of tests are primarily attempting to predict how well a student will perform at academic tasks similar to those presented within the tests. These tests do not tap into the wider idea of intelligence per se, but rather focus on a more limited prediction of the ability to perform well on academic measures. Anastasi (1988, p 412) has stated simply that *"aptitude tests serve to predict subsequent performance"*. Thus a primary question about any of these tests must be, "How well do these tests predict the subsequent performance of the testees?"

Cummins (2001a) has highlighted the danger inherent in these tests of labelling a child 'low IQ'. This can adversely affect their academic progress because of the way labels tend to shape teachers expectations, among other possible prejudicial results. Given these dangers, Cummins sought to enquire about sources of bias in these tests, especially in the field of linguistic diversity. It has become increasingly clear that language is a vital consideration in the assessment of individuals, and recent research (Church, 2000; MacFarlane, 2001) has shown that there are often considerable differences between L1 English speakers and L2 subjects when tested using linguistically based tests. Cummins (2001a) has noted with concern that there is great reluctance on the part of psychologists and assessment professionals to admit that children with great divergence between their scores on linguistic and non-linguistic tests cannot be adequately assessed using these measures. The results of these tests are in effect uninterpretable. Given these concerns, it is essential to investigate how well these types of scores correlate for L2 learners tested with a widely used test.

There is inevitably great diversity between and within groups in terms of language proficiency, and the issue of accurate academic assessment becomes extremely complicated. Norris, Brown & Hudson (2002) attempted to test L2 learners on a task-based assessment instrument, and found that with decreasing levels of proficiency in L2, so there was a corresponding decrease in successful completion of given tasks. This would suggest that being tested in L2 will underestimate the abilities of the multilingual learner. It further points to a phenomenon wherein a linear relationship exists between tested linguistic proficiency and successful task completion. Thus a testee with the poorest command of the language in which they were tested, will also be expected to exhibit the least success in the completion of tasks given to them in that language.

Far from being a purely educational issue, there are thorny socio-cultural and political implications surrounding language instruction and assessment based on linguistic variables. Felix Banda (2000) has examined the legacy of the apartheid language policies, and notes that it seems that education conducted solely in English rather than L1 impedes learning, and leads to poor mastery of both English and L1. This is contrasted with Pluddemann’s (1996, cf Banda, 2000) research which shows that increasingly, black and coloured parents are demanding English medium of instruction for their children. Thus the majority of South Africans are educated in a subtractive multilingualism framework. With this in mind, it becomes clear how these issues affect assessment in South Africa. Large scale assessment is impracticable without written tests, however L2 learners are specifically disadvantaged by this form of testing.

When attempting to determine abilities or aptitudes using standardised tests, it is essential to recognise that within South Africa, language may be the most important variable to be taken into account. Depending on socio-economic status, those tested may be balanced multilinguals who have achieved more or less equal proficiency in all of their languages, non-balanced multilinguals, or the students may be primarily monolingual. It has been demonstrated that non-balanced multilinguals are markedly slower when attempting to switch between languages on both linguistic and numerical tasks (Meuter, Humphreys & Rumiati, 2002). Thus timed assessments may underestimate multilinguals abilities due to temporal constraints, beyond issues of increased item difficulty due to imperfect command of L1. Language of testing also has important implications for issues such as digit span, as Chincotta and Underwood (1996) discovered when they demonstrated that children have a longer digit span in their dominant language. Even spatial tasks have been shown to have a relationship to multilingualism and language dominance (McLeay, 2003).

Given the above discussion it does not seem unreasonable to assert that when any form of test is given in language, the most fundamental criterion for success is proficiency in that language. Thus this research aimed to investigate the central research question: How well does an aptitude test, such as the DAT-S, predict subsequent academic performance in L1 and L2 South African Grade 8 and Grade 9 learners? The hypotheses that guided this study were as follows:

1. There will be a difference in performance between the L1 and L2 groups.
2. The DAT-S will exhibit different predictive patterns for the L1 and L2 learners.
3. The performance of L1 and L2 learners in Grade 8 and 9 on the DAT-S can predict their future academic success.

2. Methods

2.1 Research Design

This research followed the pattern of a non-experimental ex-post-facto correlational research design. The variables used in this study included language, school results, and results obtained on the DAT-S. These results were obtained using archival data, and thus were outside the control of the researcher and were not able to be manipulated. The subjects were also grouped based on a language variable, and thus formed part of pre-existing groups, thus precluding randomisation into groups. These factors necessitated a non-experimental research design. Given the reduced power of non-experimental research, and the lack of randomisation which limited generalisability, the research was strengthened by the fact that it was a replication and expansion on a previous exploratory study (Vogt, 2004).

2.2 Subjects

The subjects in the study were selected through non-probabilistic convenience sampling methods, and they consisted of Grade 8 and Grade 9 learners from an English-medium secondary school in Gauteng. Thus it is not certain that the sample is representative of all Grade 8 and 9 learners in Gauteng English-medium secondary schools. All learners had previously attended English-medium primary schools in the catchment area of the secondary school where the research was conducted. The Grade 8 group consisted of 170 learners, 85 (50%) of whom were L1 speakers, and 85 (50%) L2 speakers. The Grade 9 group consisted of 155 learners, 72 (47%) of whom were L1 speakers, and 83 (53%) L2 speakers. Of the learners for whom English was their L2, their home languages varied and included Afrikaans, isiNdebele, Sepedi, Setswana, SiSwati, Sesotho, Tshivenda, isiXhosa, and isiZulu. In terms of ethical considerations, the names of the students were not available to the researcher, and reference numbers were employed to link the learners' individual marks. The data used was archival data supplied by the school, and consent to use this data was obtained both from the school itself and from the Gauteng Department of Education.

2.4 Materials

Two main categories of assessment instruments were used in this research, those being the examinations and assessment instruments used by the school which provided the overall marks for the students, and the Differential Aptitude Test Form S (DAT-S). The researcher had no control over the content or administration of the school assessment tests, and only had access to the overall marks that these tests provided.

The second instrument, the DAT-S, is a test administered routinely in South African schools. The DAT-S states that its function is to *"establish what study or occupational direction is the most suitable for the particular learner"* (Vosloo, Coetzee & Claassen, 2000, p. 36). Since such long term decisions are based on this type of test, it is essential that these tests prove to be valid and reliable for the population that they are used with.

The DAT-S is a standardised test constructed to assess various facets of intellectual functioning (Vosloo, Coetzee & Claassen, 2000). The test is aimed at assessing potential for success in terms of underlying ability or aptitudes. The norm group for this test was composed of first language English speakers for the English version of the test, and first language Afrikaans speakers for the Afrikaans version. The performance of learners whose first language is neither Afrikaans nor English has not been documented, and norms for this group are not currently available. Theory would suggest that learners who are tested in a language in which they have less than native-like proficiency would perform at a lower level than their monolingual peers. Since the majority of learners in South Africa are multilingual, and do not speak either Afrikaans or English as a first language, the appropriateness of using the DAT-S in this setting requires further investigation.

The battery is aimed at measuring specific intellectual abilities rather than general intellectual ability. This information is intended to be used to aid subject choice and guide the teachers and learners in determining an appropriate path for the learner to follow in their school career. The test is available in English and Afrikaans, and should only be used with children who have been taught exclusively in one of these languages for at least 5 years prior to testing. In this study only the English version of the test was investigated. The scores obtained on the DAT-S yield a derived score that is interpreted on a normalised nine-point standard scale, a stanine. The scores thus range between 1-9, and have been found to have a mean of 5 and a standard deviation of 1,96. The scores are easily interpretable, with a score of 1 being defined as very weak, a score of 2 or 3 as poor, 4-6 are defined as average, 7 and 8 as good, and a score of 9 is defined as very good. The table below indicates the percentage of the population that each stanine score represents on the normal curve:

Table 2.1: Description of stanine scale

Percentage Tests	Stanine	Description
Lowest 4%	1	Very poor
Next 7%	2	Poor
Next 12%	3	
Next 17%	4	Average
Middle 20%	5	
Next 17%	6	
Next 12%	7	Good
Next 7%	8	
Highest 4%	9	Very good

Adapted from Vosloo et al. 2000

The test battery consists of nine sub-tests that are described below:

2.4.1 Test 1 – Vocabulary

This test measures verbal comprehension, which is defined as knowledge of words and their meaning, as well as application of this knowledge in both spoken and written language. The test consists of 30 items. At each item a word is given, followed by five other words. The learner must indicate the word that has the same or nearly the same meaning as the given word. Since learners' abilities in tasks of verbal reasoning, reading comprehension, memory concerning verbal material, and most linguistically based tasks, cannot be adequately assessed if there is a language backlog, this test has been designed to identify such a backlog. In this case a language backlog refers to a learner not having achieved proficiency in the tested language that is comparable with their peers. If the learners score on the test translates into a stanine of 4 or below, then these learners cannot be adequately assessed using the DAT-S. These learners will however be included in the current analysis for two reasons. The first is that it is common practice for schools to take cognisance of the learner's results regardless of the 'stanine of 4' recommendation. It is also too expensive and time-consuming to then retest these pupils on the DAT-R which may be more appropriate. The second reason for the learners inclusion in the analysis is that these children may yield the most interesting results for the analysis, and it may be possible to isolate more easily which scores are most affected by linguistic difficulties.

2.4.2 Test 2 – Verbal Reasoning

This test consists of 25 items that require the learner to understand the verbal material presented, to process it logically, and to find a solution to a particular problem. It is assumed that the ability to determine relationships, to complete word analogies, to solve general problems requiring logical thought, combined with the individuals vocabulary and linguistic background, is a valid indication of an aspect of general reasoning. The authors (Vosloo, Coetzee & Claassen, 2000) maintain that this test measures mainly the ability that is normally measured by the verbal subtests of general intelligence tests. It is held that this test should give a satisfactory indication of the general level of cognitive functioning.

2.4.3 Test 3 – Non-Verbal Reasoning: Figures

The test consists of 25 items divided into two sections. In section 1 two figures that match one another in a particular way are presented. A third figure is given, and a fourth figure must be found to match the third figure in the same way as they first one matches the second. In section 2 each item consists of four figures that constitute a series. It must be determined what changes the figures have undergone, and on the basis of this information a fifth figure must be chosen to complete the series. This test measures the ability to solve problems of a logical nature in which words and numbers do not occur in the question.

2.4.4 Test 4 – Computations

The test consists of 25 items in which the calculations to be performed are either directly stated, or must be determined by the learner. Some of the questions are presented as straight arithmetical problems, while others are presented as word problems that the learner must solve. The questions require only the use of the four basic arithmetical operations (addition, subtraction, multiplication, and division), but it is possible that the linguistically based questions may contain a language bias. This test measures the ability to work quickly and efficiently with numbers, and does not necessarily have a connection with advanced mathematical competence or with complex mathematical reasoning.

2.4.5 Test 5 – Reading Comprehension

This test consists of 25 questions based on two reading passages. It is assumed that the learners ability to choose the right answers to questions about the prose passages is a valid indication of their level of reading comprehension. This test should also give a good indication of the general language ability of the learner.

2.4.6 Test 6 – Comparison

This test consists of 25 items consisting of symbol groups that are made up of numbers, letters, names or figures that must be compared with one another. The learner must indicate the symbol group that does not look the same as the other groups. This test aims to measure visual perceptual speed, which consists mainly of the quick and accurate perception of differences and similarities between visual configurations.

2.4.7 Test 7 – Spatial Visualisation 3D

This test consists of 25 items divided into three sections. In section 1 (eight items) a drawing is shown of two blocks that are placed against one another and hinged together. One block remains stationary while the other must be swung around mentally so that it presses against the first block. In section 2 (eight items) two or more solid objects of different shapes and sizes are shown on the left side. The figure that can be built with the given objects must be identified. In section 3 (nine items) a cube whose sides are marked in a certain way is shown on the left side, and on the right five cubes are shown that must be manipulated mentally to determine which one looks like the one on the left. This test aims to measure the three-dimensional spatial ability of the learner.

2.4.8 Test 8 – Mechanical Insight

This test consists of 25 items, some of which contain a drawing of a mechanical apparatus, others depicting a mechanical or physical principle. A question is asked about the drawing and the learner must choose the correct answer from five given options. This test assumes that the ability to make a correct visual representation of the result of the operation of a mechanical apparatus, or a physical principle depicted in a drawing, is a valid criterion for the measurement of mechanical insight.

2.4.9 Test 9 – Memory

This test comprises of a story presented in a number of paragraphs. The learner must memorise as many of the facts as possible in the paragraphs, so that they can answer questions about the story at a later stage. This test aims to measure the ability to memorise meaningful material. The scores on this test will also be subject to the learners familiarity with the language in which the test is presented.

2.5 Procedure

The results obtained on the school examinations were collected by the school, and were stored on their database. These results were complete for both the Grade 8 and Grade 9 classes, and reflected the marks obtained at the end of the academic year as well as mid-year. Both the mid-year and end-of-year results were deemed to be an essential part of the analysis, as it was possible that interesting patterns of results could be discerned as learners became more familiar with the required material throughout the course of the year. Thus improvements could not only be discerned, but conclusions could be drawn about the degree of improvement demonstrated both within and between language groups.

The DAT-S was administered and scored by a registered psychologist from the Human Progress Group CC as part of routine testing carried out by the school. This test is administered to all Grade 8 pupils at the beginning of the academic year, and the tests are discussed with the students as an aid to curriculum selection and carreer guidance. The results obtained were analysed and sent to the school. These results were then included in the school's database. The collection of the DAT-S scores involved several months of visits to the school in order to link these scores with the appropriate students.

The marks obtained on the learners' report cards were determined through the use of the school examinations, and these tests were formulated and administered by the relevant teachers across the range of subjects. At this level (Grades 8 and 9), all the learners were tested using the same examinations in their respective Grades, and wrote the same subjects. This allowed for easy comparison across the subject groups.

The results were collected from the school, and were entered into a spreadsheet using Microsoft Excel. The process of entering the data into the spreadsheet involved crossreferencing of student numbers with their results, and the elimination of students who had no scores listed for the DAT-S. The school, when contacted about those students who had no DAT-S scores, explained that since the DAT-S is a routine test administered at the beginning of the academic year. A small minority of students were either absent on the day of the test, or only joined the class at a later date. Since the specific intention of this study was a comparison of DAT-S and examination scores, subjects without such scores were removed from the analysis database.

Having completed the data entry, the dataset was extensively scanned to reveal any inconsistencies or inaccuracies that might have skewed the results. No data was imputed, and subjects with missing scores were either removed from the dataset if substantial holes were present in their data, or subjects with few missing values were included in the analysis of only specific variables for which their data existed. Since the dataset was adequately large, the removal of subjects with significant missing values should not have had an effect on skewing the results of the analysis. After the data cleaning process was complete, the Grade 8 class used in the analysis consisted of 170 learners, and the Grade 9 class of 155 learners. The slight disparity between the number of learners in the respective classes was not caused by the data cleaning process, but rather by natural attrition as learners move through the school system. There are typically fewer learners in higher grades than there are in lower grades, and the dataset before removal of subjects showed a similar ratio of learners between grades both before and after data cleaning. As a final step an outlier analysis was conducted on the dataset, and illogical outliers were scanned for. An illogical outlier in this case would have been, for example, a Grade 8 learner whose age was inappropriate, or a DAT-S score that exceeded 9 (an impossibility given the stanine system). Fortunately there were no outliers that presented inconsistencies, and thus no further learners needed to be removed from the dataset and no imputation was required.

When the groups were subdivided into their linguistic brackets, the Grade 8 class consisted of 85 L1 learners, and 85 L2 learners. Both groups were thus sufficiently large for parametric statistical methods to be used. The breakdown of the Grade 9 class was not as neat. For the L1 group, there was data available for DAT-S scores of only 69 learners. Further, there was only data available for 20 L1 learners on Test 9 (Memory). A similar pattern was present in the L2 group, with DAT-S scores being available for 80 L2 learners, and scores for Test 9 being present for only 25 learners. Thus while the groups are still sufficiently large for parametric comparisons on most measures, results for Test 9 in the Grade 9 group must be treated with caution. It is unclear why the results for Test 9 were largely unavailable for the Grade 9 group, and neither the school, nor the researcher responsible for data collection could furnish any further explanation.

2.6 Data Analysis

Theory suggests that there should be a difference in measured performance between the L1 and L2 learners, both in their school results and in the results obtained on the DAT-S. Thus the first step in the data analysis was undertaken to establish whether statistically significant differences in performance were indeed present between the L1 and L2 groups. Given the large size of the groups it was decided that 2-Independent-Sample T-Tests were appropriate for discovering whether such differences were present. These tests were run for each school result, and each DAT-S test, including the overall stanine result, to discover both if differences existed, and further which subjects or tested abilities significantly diverged from one another between language groups. Certain tests for the Grade 9 group failed Levine's test for equality of variance, and thus the results for the Satterthwaite T-tests were used in these instances.

Having established whether differences in performance existed between the language groups, Pearson correlations were calculated to establish the degree to which the school marks and the DAT-S scores correlated with one another. The presence and relative strength of these correlations would provide a strong indication of the strengths and weaknesses of the DAT-S in predicting performance between language groups. Further, the patterns of these correlations should allow for conclusions to be drawn regarding the systematic patterns of prediction of the DAT-S relating to different language groups. These results could be used as a basis for interpretation of the DAT-S which reduces linguistic bias. It should be possible to discern to what degree the DAT-S is capable of accurate prediction of L2 academic achievement, and to adjust test score interpretation accordingly. A more large scale application of this principle could eventually yield a basis for being able to compare scores across linguistic groups, wherein a stanine of 5 in a L2 learner, for instance, could be more accurately interpreted as equivalent to a stanine of 6 in a L1 learner. Since large scale rewriting of tests and retesting of students is an economic impossibility, a basis for valid interpretation of test results obtained from different linguistic groups must be found. This study contends that since rewriting of tests for all languages is an unworkable solution, reinterpretation of test results with linguistic context in mind is a valid solution to some of the problems inherent in cross-cultural/cross-linguistic testing.

The results were calculated using the SAS System Version 9.1 for Windows. The full results of all tests can be found in the Appendix and only the most pertinent findings are discussed below.

3. Results

Table 3.1 DAT-S Descriptive Statistics and T-Tests

Grade 8

Variable	Home lang	N	Mean	Std Dev	Home lang	N	Mean	Std Dev	T	P
Stanine	**1**	85	5.08	1.50	**2**	85	3.97	1.54	4.77	<.0001*
T1	**1**	85	4.92	1.66	**2**	85	3.33	1.83	5.92	<.0001*
T2	**1**	85	5.28	1.84	**2**	85	4.12	1.94	4.02	<.0001*
T3	**1**	85	5.24	1.84	**2**	85	4.51	2.08	2.42	0.0164**
T4	**1**	85	3.94	1.61	**2**	85	3.38	1.57	2.32	0.0218**
T5	**1**	85	5.51	2.18	**2**	85	3.78	2.08	5.29	<.0001*
T6	**1**	85	6.08	2.35	**2**	85	4.81	2.24	3.60	0.0004*
T7	**1**	85	5.55	1.94	**2**	85	4.60	1.76	3.35	0.001*
T8	**1**	85	4.66	1.92	**2**	85	3.67	1.59	3.65	0.0004*
T9	**1**	85	6.06	2.11	**2**	85	4.14	2.53	5.37	<.0001*

Grade 9

Variable	Home lang	N	Mean	Std Dev	Home lang	N	Mean	Std Dev	T	P
Stanine	**1**	71	4.95	1.64	**2**	82	3.94	1.32	4.23	<.0001*
T1	**1**	69	4.38	1.83	**2**	80	3.60	1.51	2.83	0.0053*
T2	**1**	69	5.20	1.88	**2**	80	4.13	1.70	3.68	0.0003*
T3	**1**	69	5.12	2.05	**2**	80	3.80	2.10	3.86	0.0002*
T4	**1**	69	4.17	2.11	**2**	80	3.69	1.67	1.57	0.118
T5	**1**	69	5.35	2.25	**2**	80	3.94	1.84	4.20	<.0001*
T6	**1**	69	5.84	2.32	**2**	80	5.00	2.29	2.22	0.028**
T7	**1**	69	5.46	1.97	**2**	80	4.71	1.90	2.37	0.0191**
T8	**1**	69	4.68	1.85	**2**	80	3.63	1.48	3.87	0.0002*
T9	**1**	20	4.50	2.76	**2**	25	3.92	2.40	0.75	0.4551

* Significance at the 0.01 level
** Significance at the 0.05 level

Note: **T1** – Vocabulary; **T2** – Verbal reasoning; **T3** – Non-verbal reasoning; **T4** – Computations; **T5** – Reading comprehension; **T6** – Comparison; **T7** – Spatial visualisation 3D; **T8** – Mechanical insight; **T9** – Memory.

The results presented in table 3.1 of the T-Tests for Grade 8 and 9 on the DAT-S revealed systematic significant differences between the L1 and L2 groups. The Grade 8 group showed significant differences between the language groups on every DAT-S subtest. An examination of the means shows that the L1 group had a significant advantage over the L2 group on every test. A comparable pattern emerged for the Grade 9 group, with the groups performing significantly differently on all DAT-S subtests other than T4 and T9. The lack of significance on the T9 subtest should be treated with caution, given the reduced number of observations for this subtest. The L1 group outperformed the L2 group on all measures other than on T9.

Table 3.2 School Subjects Descriptive Statistics and T-Tests

Grade 8

Variable	Home lang	N	Mean	Std Dev	Home lang	N	Mean	Std Dev	T	P
ML	1	85	50.39	13.03	2	85	41.48	13.5	4.38	<0.0001*
ML %	1	85	65.01	10.65	2	85	59.42	11.24	3.33	0.0011*
AC	1	85	66.55	11.14	2	85	63.79	10.81	1.64	0.1024
AC %	1	85	75.59	6.90	2	85	72.42	7.66	2.83	0.0052*
EMS	1	85	55.80	15.13	2	85	46.06	14.87	4.23	<0.0001*
EMS %	1	85	58.62	11.35	2	85	51.29	11.93	4.10	<0.0001*
HSS	1	85	55.04	12.46	2	85	46.17	15.31	4.14	<0.0001*
HSS %	1	85	60.46	9.97	2	85	52.87	12.54	4.37***	<0.0001*
LLC1	1	85	65.91	10.35	2	85	59.34	9.93	4.22	<0.0001*
LLC1 %	1	85	63.13	7.67	2	85	58.27	8.22	3.98	<0.0001*
LLC2	1	85	58.59	13.90	2	85	48.11	15.74	4.60	<0.0001*
LLC2 %	1	85	59.80	11.18	2	85	50.17	13.37	5.10	<0.0001*
LO	1	85	64.62	9.20	2	85	63.25	9.95	0.94	0.3502
LO %	1	85	74.31	5.26	2	85	73.66	6.82	0.69***	0.4895
NS	1	85	60.17	16.60	2	85	51.31	15.87	3.56	0.0005*
NS %	1	85	62.99	12.00	2	85	55.91	12.13	3.83	0.0002*
TECH	1	85	70.00	11.08	2	85	60.93	10.97	5.36	<0.0001*
TECH %	1	85	73.92	7.54	2	85	67.33	8.43	5.37	<0.0001*

Grade 9

Variable	Home lang	N	Mean	Std Dev	Home lang	N	Mean	Std Dev	T	P
ML	1	72	56.89	14.05	2	83	54.01	13.59	1.29	0.1977
ML %	1	72	61.86	14.90	2	83	58.94	12.21	1.34	0.1819
AC	1	72	62.49	17.37	2	83	62.77	14.58	-0.11	0.9117
AC %	1	72	64.28	11.07	2	83	64.94	8.85	-0.41	0.6798
EMS	1	72	47.06	18.78	2	83	43.92	17.33	1.08	0.2809
EMS %	1	72	52.39	15.27	2	83	51.05	12.36	0.60	0.5468
HSS	1	72	61.72	85.60	2	83	47.93	12.18	1.36***	0.1794
HSS %	1	72	55.83	12.71	2	83	50.65	11.30	2.69	0.008*
LLC1	1	72	63.43	10.36	2	83	61.96	9.51	0.92	0.3597
LLC1 %	1	72	62.72	9.03	2	83	63.29	7.14	-0.43***	0.6686
LLC2	1	72	56.40	14.53	2	83	47.80	13.51	3.82	0.0002*
LLC2 %	1	72	55.93	12.26	2	83	50.49	8.18	3.20***	0.0018*
LO	1	72	58.47	11.23	2	83	60.34	12.16	-0.99	0.3254
LO %	1	72	64.11	13.24	2	83	63.87	11.85	0.12	0.9039
NS	1	72	46.93	20.19	2	83	41.17	21.06	1.73	0.0853
NS %	1	72	53.44	13.05	2	83	52.07	12.19	0.68	0.4998
TECH	1	72	65.49	14.92	2	83	60.15	14.00	2.30	0.0229**
TECH %	1	72	63.97	10.79	2	83	58.69	9.40	3.26	0.0014*

* Significance at the 0.01 level
** Significance at the 0.05 level
*** Unequal variances used
% Indicates the year-end result. All marks are mid-year results unless indicated.

Note: **ML** – Mathematical Literacy; **AC** – Arts & Culture; **EMS** – Economic & Management science; **HSS** – Human & Social science; **LLC1** – Language, Literacy & Communication in English; **LLC2** – Language, Literacy & Communication in Afrikaans; **LO** – Life orientation; **NS** – Natural science; **TECH** – Technology

Table 3.2 shows the Grade 8 class L1 learners outperformed their L2 peers on every measure, and the majority of differences reached significance. The only tests that did not reach significance were the mid-year A&C marks, and the mid and year-end LO marks.

The pattern for the Grade 9 group differed substantially from that shown in the Grade 8 group. The L1 and L2 groups' scores diverged significantly on the year-end HSS subject; mid and year-end results on the LLC2 subject; and mid and year-end results on the TECH subject. Again where significant differences were observed, the L1 group outperformed the L2 group.

A reversal was observed on some measures when compared to the performance of the Grade 8 group. Throughout the year, the L2 students outperformed their L1 peers on A&C when the mean scores were examined. This same circumstance was present for the year-end result on the LLC1 subject, wherein the L2 learners outperformed the L1 group. Mid-year results for LO also showed the L2 learners outperforming their L1 counterparts.

Table 3.3 Grade 8 – Correlations – L1 Group

	Pearson Correlation Coefficients – 1st Language									
	Stanine	T1	T2	T3	T4	T5	T6	T7	T8	T9
AC	0.54	0.48	0.47	0.52	0.48	0.41	0.18	0.30	0.40	0.42
AC%	0.43	0.26	0.33	0.42	0.52	0.31	0.15	0.29	0.30	0.30
EMS	0.52	0.32	0.39	0.46	0.46	0.45	0.13	0.20	0.35	0.39
EMS%	0.50	0.34	0.40	0.44	0.53	0.39	0.22	0.21	0.38	0.42
HSS	0.58	0.46	0.47	0.49	0.53	0.48	0.13	0.25	0.45	0.50
HSS%	0.55	0.41	0.41	0.45	0.56	0.42	0.24	0.27	0.46	0.46
LLC1	0.37	0.37	0.30	0.25	0.46	0.31	0.05	0.33	0.26	0.41
LLC1%	0.51	0.48	0.43	0.42	0.60	0.45	0.19	0.35	0.44	0.48
LLC2	0.45	0.29	0.31	0.34	0.44	0.32	0.12	0.17	0.35	0.42
LLC2%	0.41	0.25	0.26	0.35	0.42	0.38	0.23	0.15	0.31	0.39
LO	0.11	0.27	0.11	-0.02	0.20	0.11	-0.18	0.05	0.08	0.27
LO%	0.17	0.22	0.13	0.07	0.22	0.18	-0.08	0.09	0.16	0.17
ML	0.62	0.49	0.47	0.54	0.67	0.46	0.31	0.23	0.40	0.48
ML%	0.62	0.32	0.45	0.58	0.61	0.40	0.27	0.37	0.44	0.30
NS	0.44	0.31	0.26	0.41	0.38	0.40	0.11	0.11	0.24	0.26
NS%	0.56	0.31	0.41	0.48	0.53	0.42	0.19	0.19	0.35	0.33
TECH	0.11	0.11	0.01	0.16	0.10	0.09	0.01	0.13	0.20	0.08
TECH%	0.11	0.08	0.09	0.14	0.17	0.12	0.05	0.11	0.15	0.10

% Indicates the year-end result. All marks are mid-year results unless indicated.

Note: **T1** – Vocabulary; **T2** – Verbal reasoning; **T3** – Non-verbal reasoning; **T4** – Computations; **T5** – Reading comprehension; **T6** – Comparison; **T7** – Spatial visualisation 3D; **T8** – Mechanical insight; **T9** – Memory; **ML** – Mathematical Literacy; **AC** – Arts & Culture; **EMS** – Economic & Management science; **HSS** – Human & Social science; **LLC1** – Language, Literacy & Communication in English; **LLC2 –** Language, Literacy & Communication in Afrikaans; **LO** – Life orientation; **NS** – Natural science; **TECH –** Technology

Table 3.3 shows that the stanine correlated moderately to strongly with most school subjects, exhibiting the highest predictive power for ML (r = 0.62). Neither the stanine nor any subtests showed even a weak correlation with TECH or TECH%, or with LO and LO%. T1 showed weak to moderate correlations with the majority of subjects, the best predictive power being for AC (r = 0.48); HSS (r = 0.46); LLC1% (r = 0.48); and ML (r= 0.49). T2 displayed weak to moderate correlations with the majority of school subjects. The strongest correlations for T2 were with AC (r = 0.47); HSS (r = 0.47); ML and ML% (r = 0.47; r% = 0.45). T3 showed moderate correlations with most measures, but was most strongly correlated with ML and ML% (r = 0.54; r% = 0.58). T4 exhibited the greatest predictive power for ML and ML% (r

= 0.67; *r*% = 0.61) A strong correlation with LLC1% (*r%* = 0.60) was also observed. T5 showed moderate correlations with HSS (*r* = 0.48); EMS (*r* = .45); and ML (*r* = 0.46). T6 and T7 did not correlate to a significant degree with any measures. T8 correlated most highly with HSS and HSS% (*r* = 0.45; *r*% = 0.46). T9 showed a moderate to strong correlation with HSS (*r* = 0.50); LLC1% (*r*% = 0.48); and ML (*r* = 0.48).

Table 3.4 Grade 8 – Correlations – L2 Group

Pearson Correlation Coefficients – 2nd Language										
	Stanine	**T1**	**T2**	**T3**	**T4**	**T5**	**T6**	**T7**	**T8**	**T9**
AC	0.63	0.40	0.51	0.46	0.51	0.49	0.43	0.37	0.31	0.60
AC%	0.62	0.39	0.51	0.46	0.38	0.57	0.40	0.35	0.54	0.57
EMS	0.71	0.55	0.63	0.53	0.52	0.57	0.34	0.52	0.47	0.55
EMS%	0.74	0.57	0.62	0.55	0.54	0.63	0.38	0.53	0.51	0.59
HSS	0.78	0.57	0.69	0.54	0.59	0.65	0.37	0.52	0.52	0.68
HSS%	0.79	0.57	0.70	0.57	0.54	0.70	0.39	0.56	0.59	0.68
LLC1	0.66	0.42	0.53	0.61	0.44	0.49	0.37	0.39	0.50	0.60
LLC1%	0.80	0.57	0.66	0.63	0.54	0.71	0.40	0.47	0.55	0.73
LLC2	0.53	0.36	0.51	0.43	0.27	0.47	0.33	0.48	0.38	0.58
LLC2%	0.71	0.48	0.67	0.53	0.44	0.63	0.36	0.48	0.49	0.72
LO	0.52	0.36	0.40	0.42	0.41	0.42	0.30	0.37	0.38	0.45
LO%	0.57	0.34	0.48	0.41	0.43	0.48	0.35	0.39	0.39	0.54
ML	0.74	0.53	0.57	0.57	0.64	0.54	0.33	0.51	0.49	0.56
ML%	0.75	0.49	0.63	0.55	0.56	0.63	0.41	0.49	0.57	0.61
NS	0.48	0.46	0.41	0.35	0.42	0.39	0.28	0.37	0.27	0.41
NS%	0.56	0.50	0.48	0.41	0.45	0.47	0.27	0.43	0.32	0.49
TECH	0.36	0.16	0.28	0.30	0.24	0.29	0.10	0.29	0.26	0.38
TECH%	0.61	0.34	0.57	0.41	0.47	0.48	0.18	0.54	0.47	0.51

% Indicates the year-end result All marks are mid-year results unless indicated.

Note: **T1** – Vocabulary; **T2** – Verbal reasoning; **T3** – Non-verbal reasoning; **T4** – Computations; **T5** – Reading comprehension; **T6** – Comparison; **T7** – Spatial visualisation 3D; **T8** – Mechanical insight; **T9** – Memory; **ML** – Mathematical Literacy; **AC** – Arts & Culture; **EMS** – Economic & Management science; **HSS** – Human & Social science; **LLC1** – Language, Literacy & Communication in English; **LLC2** – Language, Literacy & Communication in Afrikaans; **LO** – Life orientation; **NS** – Natural science; **TECH** – Technology

Table 3.4 indicates that overall the L2 group exhibited stronger correlations between the DAT-S and their academic results than their L1 counterparts. The stanine was moderately to highly correlations for all measures. T1 correlated highly with EMS% (r% = 0.57); HSS and HSS% (r = 0.57; r% = 0.57); and LLC1% (r% = 0.57). T2 showed moderate to very high correlations with most measures. The most significant result was for HSS and HSS% (r = 0.69; r% = 0.70). T3 was moderately to highly correlated with most measures, and most strongly associated with performance on LLC1 and LLC1% (r = 0.61; r% = 0.63). T4 displayed the most significant association with ML (r = 0.64) and HSS (r = 0.59). T5 was highly correlated with LLC1% (r% = 0.71) and HSS% (r% = 0.70). T6 showed weak to moderate correlations on all measures, but strongly predicted no single score. T7 also showed weak to moderate correlations with all measures, but was strongly associated with EMS and EMS% (*r* = 0.52; *r*% = 0.53); and HSS and HSS% (*r* = 0.52; *r*% = 0.56). T8 was associated most strongly with HSS% (*r*% = 0.59) and ML% (*r*% = 0.57). T9 was moderately to strongly correlated with all measures, and was the best overall predictor of L2 scores. The strongest association with T9 was demonstrated by LLC1% (*r*% = 0.73), closely followed by LLC2% (*r*% = 0.72).

Table 3.5 Grade 9 – Correlations – L1 Group

Pearson Correlation Coefficients – 1st Language										
	Stanine	**T1**	**T2**	**T3**	**T4**	**T5**	**T6**	**T7**	**T8**	**T9**
AC	0.30	0.13	0.36	0.14	0.23	0.29	0.22	0.10	0.08	0.41
AC%	0.36	0.23	0.46	0.16	0.18	0.32	0.26	0.24	0.20	0.37
EMS	0.59	0.45	0.53	0.39	0.39	0.52	0.14	0.32	0.40	0.36
EMS%	0.62	0.40	0.60	0.45	0.45	0.58	0.19	0.41	0.48	0.56
HSS	0.19	0.16	0.20	0.16	0.15	0.11	0.08	0.13	0.21	0.34
HSS%	0.58	0.42	0.63	0.34	0.34	0.68	0.13	0.25	0.48	0.40
LLC1	0.59	0.61	0.54	0.32	0.40	0.62	0.17	0.33	0.28	0.58
LLC1%	0.63	0.57	0.66	0.36	0.43	0.67	0.26	0.41	0.46	0.62
LLC2	0.37	0.28	0.37	0.27	0.34	0.25	0.24	0.17	0.28	0.39
LLC2%	0.48	0.45	0.48	0.35	0.39	0.46	0.24	0.24	0.34	0.60
LO	0.42	0.29	0.40	0.13	0.29	0.41	0.21	0.22	0.31	-0.08
LO%	0.46	0.41	0.52	0.25	0.30	0.44	0.13	0.20	0.31	0.15
ML	0.68	0.36	0.62	0.51	0.62	0.43	0.13	0.47	0.64	0.28
ML%	0.68	0.45	0.64	0.49	0.51	0.58	0.15	0.32	0.54	0.58
NS	0.51	0.41	0.47	0.32	0.36	0.46	0.10	0.19	0.37	0.14
NS%	0.54	0.46	0.54	0.41	0.39	0.57	0.09	0.31	0.44	0.35
TECH	0.39	0.11	0.27	0.34	0.23	0.35	0.14	0.24	0.26	0.45
TECH%	0.55	0.32	0.52	0.39	0.34	0.51	0.11	0.24	0.42	0.47

% Indicates the year-end result All marks are mid-year results unless indicated.

Note: **T1** – Vocabulary; **T2** – Verbal reasoning; **T3** – Non-verbal reasoning; **T4** – Computations; **T5** – Reading comprehension; **T6** – Comparison; **T7** – Spatial visualisation 3D; **T8** – Mechanical insight; **T9** – Memory; **ML** – Mathematical Literacy; **AC** – Arts & Culture; **EMS** – Economic & Management science; **HSS** – Human & Social science; **LLC1** – Language, Literacy & Communication in English; **LLC2** – Language, Literacy & Communication in Afrikaans; **LO** – Life orientation; **NS** – Natural science; **TECH** – Technology

Table 3.5 shows that the stanine moderately predicted all scores other than HSS (*r* = 0.19). The stanine was most strongly associated with ML and ML% (*r* = 0.68; *r*% = 0.68). T1 was strongly associated with changes in LLC1 and LLC1% (*r* = 0.61; *r*% = 0.57). T2 was a good predictor of LLC1% performance (*r* = 0.66), and was strongly associated with ML and ML% (*r* = 0.62; *r*% = 0.64). T3 showed weak to moderate correlations for most measures, but was most strongly associated with ML and ML% (*r* = 0.51; *r*% = 0.49). T4 was most strongly associated with ML and ML% (*r* = 0.62; *r*% = 0.51). T5 was a strong predictor of LLC1 and LLC1% performance (*r* = 0.62; *r*% = 0.67) and HSS% (*r*% = 0.68). T6 did not correlate with any measures. T7 did not correlate with any measures other than EMS% (*r*% = 0.41); LLC1% (*r*% = 0.41); and ML (*r* = 0.47). T8 was a strong predictor of ML and ML% (*r* = 0.64; *r*% = 0.54).

T9 was most strongly correlated with LLC1% (*r*% = 0.62) and LLC2% (*r*% = 0.60). Of interest was the fact that HSS was not correlated with any DAT-S scores, while HSS% showed some moderate to strong correlations with subtests.

Table 3.6 Grade 9 – Correlations – L2 Group

Pearson Correlation Coefficients – 2nd Language										
	Stanine	**T1**	**T2**	**T3**	**T4**	**T5**	**T6**	**T7**	**T8**	**T9**
AC	0.19	-0.09	-0.01	0.22	0.09	0.17	-0.10	0.10	0.00	-0.03
AC%	0.42	0.10	0.22	0.38	0.26	0.29	0.00	0.41	0.39	0.45
EMS	0.41	0.26	0.26	0.25	0.37	0.27	0.15	0.45	0.32	0.21
EMS%	0.58	0.40	0.39	0.38	0.48	0.44	0.09	0.52	0.49	0.55
HSS	0.49	0.30	0.28	0.25	0.49	0.36	0.16	0.43	0.35	0.44
HSS%	0.47	0.38	0.31	0.23	0.43	0.42	0.16	0.43	0.40	0.45
LLC1	0.45	0.47	0.37	0.14	0.27	0.51	0.07	0.47	0.45	0.51
LLC1%	0.61	0.59	0.38	0.34	0.44	0.66	0.00	0.46	0.54	0.82
LLC2	0.31	0.22	0.16	0.17	0.20	0.30	-0.06	0.40	0.18	0.15
LLC2%	0.52	0.38	0.36	0.30	0.35	0.45	0.00	0.57	0.52	0.68
LO	0.37	0.23	0.27	0.21	0.31	0.17	0.15	0.34	0.27	0.56
LO%	0.38	0.26	0.24	0.26	0.30	0.27	0.15	0.38	0.25	0.24
ML	0.58	0.36	0.41	0.38	0.45	0.41	0.05	0.54	0.52	0.50
ML%	0.45	0.29	0.30	0.30	0.40	0.29	0.04	0.47	0.40	0.43
NS	0.42	0.32	0.25	0.22	0.41	0.32	0.12	0.48	0.35	0.25
NS%	0.47	0.30	0.34	0.32	0.34	0.36	0.01	0.49	0.40	0.36
TECH	0.18	-0.02	0.06	0.15	0.17	0.07	0.04	0.26	0.09	0.05
TECH%	0.34	0.14	0.19	0.20	0.31	0.25	0.14	0.35	0.31	0.16

% Indicates the year-end result All marks are mid-year results unless indicated.

Note: **T1** – Vocabulary; **T2** – Verbal reasoning; **T3** – Non-verbal reasoning; **T4** – Computations; **T5** – Reading comprehension; **T6** – Comparison; **T7** – Spatial visualisation 3D; **T8** – Mechanical insight; **T9** – Memory; **ML** – Mathematical Literacy; **AC** – Arts & Culture; **EMS** – Economic & Management science; **HSS** – Human & Social science; **LLC1** – Language, Literacy & Communication in English; **LLC2** – Language, Literacy & Communication in Afrikaans; **LO** – Life orientation; **NS** – Natural science; **TECH** – Technology

Table 3.6 indicated that the stanine was moderately correlated with the majority of measures, and was strongly associated with LLC1% (*r*% = 0.61). T1 showed mostly weak correlations, but was strongly correlated with LLC1 and LLC1% (*r* = 0.47; *r*% = 0.59) T2 was generally weakly associated with school subject scores, the strongest association being shown with ML (*r* = 0.41). T3 was weakly to moderately associated with most measures, but displayed strong predictive power for none. T4 was most strongly correlated with HSS (*r* = 0.49) and EMS% (*r*% = 0.48). T5 proved to be a strong predictor for only LLC1 and LLC1% (*r* = 0.51; *r*% = 0.66). T6 did not correlate with any measures. T7 was a moderate predictor of most scores, and was most strongly associated with LLC2% (*r*% = 0.57); ML (*r* = 0.54); and EMS% (*r*% = 0.52). T8 showed moderate to strong correlations with LLC1 and LLC1% (*r* = 0.45;

r% = 0.54). T9 showed some very strong correlations, the most notable being with LLC1% (*r*% = 0.82) and LLC2% (*r*% = 0.68). Once again T9 proved to be a very strong predictor in L2 group. TECH, TECH%, and AC scores were not predicted by the DAT-S.

4. Discussion

This discussion will examine the main findings that arose out of the analysis presented in the preceding section. The Grade 8 and 9 classes will be discussed concurrently, and results will be analysed in terms of the overall stanine score and the individual school subjects. This research correlated the results of mid-year and year-end examinations of Grade 8 and 9 L1 and L2 learners with their results on the DAT-S. The intention was to show to what extent the DAT-S can effectively be used in the prediction of academic achievement in L2 learners. The hypotheses that guided this study were:

1. There will be a difference in performance between the L1 and L2 groups.
2. The DAT-S will exhibit different predictive patterns for the L1 and L2 learners.
3. The performance of L1 and L2 learners in Grade 8 and 9 on the DAT-S can predict their future academic success.

4.1 The stanine

The **stanine** is the overall score that is provided by the DAT-S, and can be converted into an IQ range. Since the **stanine** is a measure of the average performance level across aptitudes, it would be expected that this figure would correlate highly with most school subjects.

When the Grade 8 results were examined the groups proved to be significantly different in terms of their average **stanine** scores, and indeed were significantly different on every subtest of the DAT-S. Since the L1 and L2 groups were significantly different in terms of the majority of their school results (with the exception of Life Orientation and the mid-year scores for Arts & Culture), with the L2 group scoring lower on average than the L1 group, it would seem that language proficiency is the differential factor in both patterns of scores. This supports the first hypothesis proposed in this study: that the language groups would differ significantly in terms of their results. The second hypothesis, that the language groups would show differing patterns of scores on the DAT-S, is also supported by this data.

It is important to note that the mean score achieved by the L2 learners on **T1** (vocabulary) was less than 4 for both the Grade 8 and 9 groups. This violates the ‘stanine of 4’ criterion, showing that the majority of the learners in the L2 group were not proficient enough in English to be adequately assessed by the DAT-S. The recommended course of action in the Manual for the DAT-S (Vosloo, Coetzee & Claassen, 2001) would be to retest these learners on the DAT-R. The retesting process would prove to be costly and time consuming for the school, and it is not normally undertaken as a matter of course. It is important to note that for all stanine scores in the Grade 8 group, the stanine predicted performance more accurately in the L2 group. Thus it seems that the third hypothesis, that the DAT-S can still be used as a predictor for the L2 group, also has a degree of support from the evidence.

In the Grade 9 group, the differences between the groups were noticeably smaller than those apparent in the Grade 8 subjects, and many tests were no longer statistically significant. This argues for a situation in which the Grade 9 group has moved closer to achieving academic parity, despite the language differences. If this is the case, then it would seem that linguistic barriers diminish over time, given long term exposure and consequently an increased command of the language of instruction. Further, in the Grade 9 group, the differences between the language groups were not significant on all the DAT-S subtests. **T4** (computations) did not reach significance, which suggests that this skill, which should be the least reliant on proficiency in English, is fairly resilient to linguistic differences. This conclusion is supported by the work of Church (2000) and MacFarlane (2001), which showed that in University students, statistically significant differences were no longer apparent between language groups when non-verbal/non-linguistic measures were used. This was despite the non-linguistic tests being administered in English. Thus it seems that the students had acquired the BICS to understand what was required of them and accurately complete the tasks that did not require an academic use of the English language. However the students faltered when tests specifically called for more advanced CALP. **T9** (memory) was also not statistically different between the language groups, but given the reduced number of observations for this variable, this result should be treated with caution.

The majority of the children in the study had attended the school for several years, and both groups had thus been exposed to the same or similar learning environments in the school setting. While only the Grade 8 and Grade 9 groups were examined in this study, the majority of learners in both the L1 and L2 groups had attended the same school for their entire school career. Thus in terms of educational and formative environment (at least within the school setting) the language groups were reasonably homogeneous. The significant differences between L1 and L2 DAT-S scores, as well as academic results, strongly argued for a differentiating factor being responsible for these patterns of scores. Since the groups had been specifically subdivided based on a linguistic variable alone, it is likely that language proficiency was the factor that was most significant in the resultant divergent patterns.

4.2 Mathematical Literacy

In both Grade 8 language groups, **T4** (computations) contributed the greatest explanatory power in predicting **ML** results. This was a result that tied in directly with the stated goals of the DAT-S subtest, which aimed to *'measure the arithmetical ability of the learners'* (Vosloo, Coetzee, & Claassen, 2000, p.6). Of great interest, however, was the pattern observed in the L2 group on the year-end results. For this testing period, **T4** no longer had the most predictive strength for **ML**, and became subsidiary to **T2** (verbal reasoning), **T5** (reading comprehension), and **T9** (memory). This result must be interpreted in the context of the progressive nature of language usage throughout the school year. In general, mathematical questions posed at the beginning of an academic year will be of lesser numerical and linguistic complexity. As the year continues, complexity of both factors increases by a more or less proportional amount. For the L1 learners their mastery of the linguistic aspects seemed to have little impact on their **ML** scores, with computational ability being the most important factor in their success. L2 learners, however, had to employ many more learned skills than the L1 learners (for whom language comprehension is an automatic skill), in order to complete the same examinations. Thus the L2 learners had to exercise their verbal comprehension and manipulation skills, along with their memory skills, in order to complete a test that is ostensibly one of computational/mathematical ability alone.

The results for **ML** between the language groups were significantly different for the Grade 9 subjects, once again with the L2 group achieving lower results than their L1 counterparts. This pattern evaporated by year-end however, with both groups achieving comparable results. For the L1 group, the best individual predictors of achievement were **T8** (mechanical insight), **T2** (verbal reasoning), and **T4** (computations). By year end the pattern had remained similar, but **T5** (reading comprehension) emerged as one of the strongest predictors at this time. The L2 correlations were more diffuse, with moderate to strong explanatory power being exhibited by all DAT-S subtests other than **T1** (vocabulary) and **T3** (non-verbal reasoning). By year-end, this pattern had shifted, with **T7** and **T9** emerging as the strongest predictors, and moderate explanatory power remaining in the **T4**, **T6**, and **T8** variables. It is clear that the L2 group must still use a diverse range of cognitive strategies to complete academic tasks, but the evidence points to a degree of convergence on **ML** between the language groups.

These results confirm the three main hypotheses of this study and point to a situation in which the Grade 9 L2 group is approaching parity with their L1 counterparts. This finding was unexpected, but is confirmed by subsequent results.

4.3 Arts & Culture

The marks attained on the Grade 8 **AC** achievement tests were not significantly different between language groups mid-year, but the groups' performance had diverged significantly on the year-end results. No clear pattern emerged in the individual DAT-S scores, and medium strength correlations were present for a majority of the subtests. It is most likely that **AC** is a broad enough subject that it taps into multiple abilities and aptitudes to determine success. Clearly language proficiency is still an issue in succeeding at this subject, as evidenced by the divergence between the language groups at the end of the year, with the L2 group scoring slightly lower than their L1 counterparts on their final examinations. Nevertheless, **AC** is a subject that seems to be largely independent of language proficiency.

There were no statistically significant differences between the Grade 9 language groups on this measure, and overall **AC** correlated poorly with the DAT-S. Mid-year results were similar between language groups, and there were no DAT-S measures with adequate explanatory power. By year-end, both Grade 9 language groups' results were moderately correlated with the DAT-S, and for the L1 group, **T2** (verbal reasoning) proved to have the most explanatory power. The L2 group exhibited a more diffuse pattern of prediction, with **T3**, **T7**, **T8**, and **T9** all having a degree of predictive power. Once again the L2 group seems to have used different cognitive strategies in their completion of tasks presented in English, but the fact that academic performance on this measure was comparable between the groups suggests that despite different cognitive strategies being employed, the groups' performances were approaching homogeneity. Further, **T9** began to emerge once again as an important predictor of subsequent performance in the L2 group, and it is only unfortunate that more observations for this variable did not exist for the Grade 9 group.

The three guiding hypotheses of this study were once again confirmed by these results, and the pattern of convergence in terms of linguistic proficiency in the Grade 9 group was once again observed.

4.4 Economic & Management Science

The individual DAT-S subtests for the Grade 8 group that contributed the most explanatory power to predicting **EMS** are **T3** (non-verbal reasoning), **T4** (computations), and **T5** (reading comprehension). This is true for both the L1 and L2 groups, but the results between the groups diverged in an interesting manner. For the L1 group, **T5** provided the weakest correlation (of the three most strongly correlated tests), and the explanatory power of this variable diminished at the year-end examination period. Precisely the opposite pattern was observed in the L2 group, for whom reading comprehension (**T5**) was the best predictor of subsequent performance in **EMS**, and the explanatory power of **T5** increased at the year-end examinations for the **L2** group.

This prompts the hypothesis that the L1 group had been better equipped to automatise their reading comprehension skills, to the point where their comprehension of the reading material was sufficiently automatic that it longer had great explanatory power in predicting their performance on **EMS**. The L2 group, however, had the most difficulties in the first stage of academic endeavour – that of adequate comprehension of the subject matter and questions. Thus the best predictor of the L2 group's performance on **EMS** was their ability to read and comprehend the subject matter and examinations in English. Other strong predictors for performance on **EMS** for the L2 group were **T1** (vocabulary), and **T2** (verbal reasoning), both tests which are measures of English proficiency. Tests **T1** and **T2** did not correlate highly with **EMS** in the L1 group. This once again points to a situation in which language, and language comprehension, is sufficiently automatised in the L1 group to have a negligible impact on their performance on this measure. These results indicate that for the Grade

8 L2 learners, language proficiency was the most important variable in their performance on **EMS**.

There were no significant differences between the Grade 9 language groups on **EMS** and the pattern of correlations was broadly similar between groups. While the correlations between the different DAT-S subtests were moderately strong for all but **T6** (comparison) for both groups, generally DAT-S subtests exhibited slightly more predictive power for the L1 group. It seems that **EMS** requires a diverse range of cognitive strategies to be employed by students, regardless of language preference. The pattern observed in the Grade 9 group mirrored that seen in the Grade 8 group, the primary difference being that the academic performance of the groups had converged in the Grade 9 group.

<u>4.5 Human & Social Sciences</u>

The Grade 8 language groups' performances were significantly different at all testing times, with the L2 group performing at a lower level than the L1 group. In the L1 group, the best predictor of performance was **T4**, and this is largely explicable when one considers that scientific disciplines generally require computational skills. For the L2 group however, **T2**, **T5**, and **T9** proved to be the best predictors of subsequent performance. Thus L2 learners ability to adequately comprehend what they were reading (**T5**), use the English language as a reasoning tool (**T2**), and remember what they were taught in their language of instruction (**T9**) was of greater importance than their computational abilities. This pattern is remarkably similar to that demonstrated by the students' results on **ML**, and these results suggest that remedial teaching for L2 students who are struggling in disciplines that require mathematical ability should not be solely focussed on computational ability. Since linguistic proficiency emerged as the best predictor of L2 learners performance in mathematically based subjects, remedial teaching for this group should contain a large degree of linguistic support, despite the intuitive feeling that 'if you do badly at maths you should practice your sums more'.

Results on this measure were somewhat anomalous for the Grade 9 class. Mid-year results were not significantly different between the language groups, but the year-end results showed significant differences between the groups. Further, mid-year correlations with the DAT-S showed little or no predictive power for any tests in the

L1 group, while the L2 group's results were fairly well predicted by the DAT-S. The mid-year and year-end results for the L2 group broadly followed a similar pattern to those observed for the same period in the Grade 8 L2 group. **T4** was the best predictor of performance in this group mid-year, with a moderate degree of explanatory power residing in **T7** and **T9**. No DAT-S scores held any explanatory power for this period in the L1 group. By year-end, the results of the different language groups had become statistically different, while the explanatory power of the DAT-S had increased exponentially in the L1 group. **T4**, **T7**, and **T9** were still the strongest predictors of performance in the L2 group. The L1 group showed a more distributed pattern of prediction, with **T6** and **T7** having the least predictive power. This is a strange pattern of results, and while it demonstrates once again that the different language groups must use different cognitive strategies to complete academic tasks, it also suggests that a third variable existed for this subject that is unaccounted for by the available data.

4.6 Language, Literacy, and Communication in English

The Grade 8 scores for **LLC1** displayed an interesting divergent pattern between the language groups. The groups' results differed significantly, with the L2 group performing at a lower level than the L1 group. The best predictor of the L1 group's performance was **T4**, but **T9** proved to have a degree of explanatory power. It is not unexpected to find that computational ability is related to linguistic performance, since language usage and computations are both systems of symbolic representation and manipulation**.** The scores for the L2 group showed that a medium to high correlation existed between **LLC1** and every subtest on the DAT-S. This trend strengthened at the year-end testing time. It is clear that L2 learners must actively use far more skills than their L1 counterparts when performing tasks specifically in English. This pattern suggests that all abilities tested by the DAT-S are closely linked to English proficiency, and this conclusion can be extrapolated to apply to the majority of school results as well.

It is encouraging to note that both mid-year and year-end results on this measure did not differ significantly between the two Grade 9 language groups. This fact alone pointed to a situation in which the L1 and L2 groups are attaining similar levels of language proficiency with continued exposure. Further, the pattern of DAT-S scores is remarkably similar between the language groups, and the **stanine** scores have strong predictive power for both groups at both measurement times. Most unexpected of all, at the year-end examinations, the L2 group outperformed their L1 counterparts on **LLC1**. This strongly suggests that the perceived pattern of convergence in language skills between the groups is actual, and thus that linguistic and academic parity when taught and tested in English is attainable.

While the increased similarity between the language groups is an interesting result in itself, the differences in DAT-S predictions are most telling. Mid-year results showed a pattern of prediction for the L1 group in which all DAT-S subtests other than **T6** and **T8** had moderate to strong predictive power. This is not a surprising finding, since it has been repeatedly demonstrated that English language skills affect a wide range of tested abilities when the test is conducted in English. The L2 group demonstrated a somewhat different pattern of scores, with all DAT-S subtests having predictive power other than **T3**, **T4**, and **T6**. This pattern did not repeat itself at year-end, at which time both language groups demonstrated similar performance on all measures, with only **T6** having little predictive power for either group. The overall pattern of scores suggests substantial convergence in linguistic ability and comprehension between the language groups, and the almost identical pattern of scores observed at year-end is strong evidence that linguistic disparities are being eliminated over time.

4.7 Language, Literacy, and Communication in Afrikaans

The best predictors of performance in the Grade 8 L1 group were **T4** and **T9**. This is to be expected since usage of a second language is closely related to the abilities of symbolic representation and manipulation, which seem to be tapped into with **T4**, and of course a learner's ability to remember the words and patterns of the unfamiliar language which would be measured by **T9**. The memory aspect of this test mirrors the performance of the L2 group on **LLC1**, but the pattern is not exactly similar since all the DAT-S tests are presented in English, which is the familiar language for the L1 group, but the less familiar tongue for the L2 group. The pattern of predictors that emerged within the L2 group was strikingly similar to the pattern that emerged in the **LLC1** variable. This is hardly surprising, since the L2 group experiences both Afrikaans and English as additional languages, and thus we would expect the pattern of scores to be similar between these variables. The strongest predictors of the L2 group's scores were, once again, **T2**, **T5**, and **T9**. Memory was the strongest predictor of performance in the L2 group, but it is interesting that verbal reasoning and reading comprehension were such strong predictors in this group, despite these DAT-S scores being based on English language proficiency. This backs up the study conducted by Hovens (2002), who showed that reading and comprehension skills could be transferred across languages. If the L2 learners scored highly in their verbal reasoning and reading comprehension in English, it seems that these learners were most readily able to transfer these skills to Afrikaans. This provides strong support for the contention that reading and verbal skills should be developed in the L1 first, so that easy transference of these skills can occur when learning the L2.

The Grade 9 language groups' academic performance on this measure differed significantly, with the L2 group once again performing at a lower level than their L1 counterparts. **T9** was the best predictor of academic performance in L1 learners at both measurement times, and for L2 learners at year-end. **T9** demonstrated very weak predictive validity for the L2 group mid-year, but once again **T9** results must be treated with caution for the Grade 9 group. The correlations for the L2 learners at year-end showed an almost identical pattern to those exhibited on the **LLC1** measure. This is to be expected, since **LLC1** and **LLC2** are both L2 subjects for this group.

4.8 Life Orientation

Despite the Grade 8 correlations between the DAT-S and **LO** being so weak in the L1 group that any relation between these tests can be immediately dismissed, valuable insights can be gained when the L1 and L2 groups are compared. If only the L1 correlations are examined, the immediate conclusion would be that academic success in **LO** is wholly unrelated to the abilities tested by the DAT-S. The strongest correlation for the L1 group was between **LO** and **T1**, and this was $r = .27$ mid-year and $r = .22$ at year-end. Thus only the weakest of associations existed between **LO** and general English vocabulary in the L1 group. A very different pattern was evident when the L2 results were analysed however. The L2 group's DAT-S scores all exhibited medium to strong correlations with **LO** throughout the year. Since the only differentiating factor that is apparent between the groups is home language, this pattern of scores suggests that a large percentage of an L2 learner's results in all subjects, when tested in their L2, are reliant on their mastery of the language of testing.

Despite the Grade 9 language groups achieving academic results that were not significantly different, the patterns of results on DAT-S subtests were distinct. The best individual predictors of achievement in **LO** for the L1 group were **T1**, **T2**, and **T5**. This pattern suggests that basic English language skills and comprehension of written material are the most important factors that predict success for L1 learners in **LO**. The pattern exhibited by the L2 learners was markedly different, with fairly low correlations present for almost all DAT-S subtests other than **T4**, **T7**, and **T9** mid-year, and **T4** and **T7** at year-end. This pattern suggests that computational and spatial visualisation skills are important for L2 learners' success in **LO**. This is an anomalous result however, as **LO** does not deal with subject matter that calls for such skills, at least on an intuitive level. It is possible that the DAT-S does not adequately predict L2 learners' abilities in terms of **LO**, and thus predictions on this variable should be treated with caution when the DAT-S is used as a predictor.

4.9 Natural Science

There was divergence in the pattern of DAT-S correlations between the Grade 8 language groups on individual tests. For the L1 group, the best predictors of performance were **T3** (non-verbal reasoning) and **T5**, but at the end of the year the best predictor of L1 performance was **T4** (computations). The L2 group exhibited a strikingly different pattern of predictors, with moderate correlations present for all subtests other than **T6** (comparison) and **T8** (mechanical insight), this pattern remaining constant throughout the year. This again argues for the position that an L2 learner must use a diverse range of strategies to interpret and perform academic tasks, in order to compensate for their linguistic difficulty. It should be noted that for the L2 group, **T9** (memory) was consistently moderately to strongly correlated with subsequent performance on all academic tasks. This indicates that L2 learners are consistently applying strategies that involve learning and remembering the material, in favour of strategies that promote deeper understanding of the material. The pattern for L1 learners on **T9** shows much lower correlations across all variables, and in many cases **T9** is not at all correlated with subsequent academic performance.

Results on **NS** were not significantly different between the Grade 9 language groups, and this lends credence to the assumption that the groups were approaching parity in terms of results. If the overall results achieved by the language groups in Grades 8 and 9 are compared, it quickly becomes clear that the Grade 9 group is far more homogenised in terms of their academic results, as far fewer significant differences are present. The language groups performed similarly not only in terms of academic results, but also in terms of the pattern of correlations with DAT-S subtests. For both language groups, both mid-year and at year-end, all DAT-S subtests displayed mild to moderate predictive power other than **T6**. The remarkable similarity between both groups' performances then, indicates that **NS** is a good test of academic ability across language groups at this level. This pattern was not present in the Grade 8 group however, and further investigation needs to be undertaken with higher grades to see if this perceived pattern of increased homogeneity between language groups continues.

4.10 Technology

Neither the **stanine** nor the individual subtests of the DAT-S correlated significantly with the academic performance of the Grade 8 L1 group on this measure. Once again a different pattern was observed for the L2 group. Mid-year, the **stanine** score exhibited a weak to moderate correlation with L2 performance, the strongest individual predictor of performance being **T9** with a correlation coefficient of $r = .38$. At year-end, the L2 scores on **TECH** correlated far more strongly with DAT-S performance. The only subtest without a degree of explanatory power was **T6** (comparison). It is clear that language preference has a distributed effect on all aptitude tests and all academic tests. The **stanine** seemed to be a consistently good predictor of L2 performance and the individual subtests that had the most explanatory power across the range of subjects emerged as **T2**, **T3**, **T5**, and **T9**. It seems that L2 learners are forced to rely more on their reasoning skills and degree of English comprehension in the completion of academic tasks, along with a strong reliance on memorisation of material. While L1 learners need to be proficient in only one or two aptitudes to succeed in academia when tested and taught in their L1, L2 learners must integrate a variety of skills to achieve comparable results.

The Grade 9 L1 and L2 academic results were significantly different on the **TECH** measure at both measurement times. In addition, the patterns of correlations were very different between the groups, with the DAT-S proving to be a far better predictor of results in the L1 group overall. The L1 group's results were well predicted by the DAT-S, and the subtests with the most predictive power were **T2**, **T5**, **T8**, and **T9**. This fits well with the abilities assumed to contribute to good performance in this subject, which requires an understanding of the concepts presented in English, an understanding of the mechanical nature of the subject matter, and memory skills. The L2 group's mid-year results were not predicted at all by the DAT-S. The year-end results for the L2 groups were also not well predicted by the DAT-S, with weak correlations present for **T4**, **T7**, and **T8**. While this pattern is somewhat different from that exhibited by the L1 group, it is still explicable in the context of the subject matter examined in **TECH**. The primary point of interest about these patterns of results is that the DAT-S does not adequately predict the results of the L2 group, while having good explanatory power for the L1 group.

5. Conclusion

This study investigated the link between home language and academic potential. Since South African learners are a linguistically heterogeneous group, while the primary language of instruction is English, it was necessary to explore the impact that language of instruction had on the potential of L2 learners.

While the students in this study all attended the same school, and should have had broadly similar BICS, all academic tests examine CALP almost exclusively. Theory predicted that the L2 learners would be behind their monolingual peers on this measure. This was one of the primary hypotheses of the study, and the learners' academic results and their aptitudes as predicted by the DAT-S confirmed this hypothesis. The fact that the majority of L2 learners in South Africa are educated in a consecutive, unbalanced, and subtractive bilingualism framework goes some way towards explaining this observed phenomenon.

The second hypothesis was that the DAT-S would show different predictive patterns for L1 and L2 learners. This seemed likely, as the DAT-S was presented in English, and thus the L2 learners would have to use different cognitive strategies to complete the test than those utilised by their L1 peers. This hypothesis was also confirmed by the results, and a primary finding was that L2 learners relied far more heavily on memorisation strategies than the L1 subjects. Thus the results suggest that an L2 learner's performance on the T9 (memory) subtest on the DAT-S is one of the best predictors of subsequent performance. Nonetheless it was found that the DAT-S was still a good predictor of academic performance in the L2 group, albeit with different subtests generally predicting L2 and L1 performance on the same academic subject. This finding confirmed the third hypothesis of the study.

There were some limitations to this study. Since the students were a pre-existing group, and the study was non-experimental in nature, the power and generalisability of these findings are somewhat weakened. Nonetheless the sample was adequately large, and the L2 learners were diverse in terms of their home languages. These factors suggest that the findings of this study can be cautiously applied to L2 learners in other South African schools. Further research could attempt to replicate this study in different settings within South Africa to determine how far these results can be generalised.

Of great interest was the perceived pattern that the Grade 9 L2 learners were rapidly approaching parity with their monolingual peers. This suggests that long term exposure to English instruction was building the L2 learners CALP in this language. It is extremely significant that the Grade 9 L2 learners outperformed their L1 peers on their English language subject at year end. Although the difference between the groups on this measure was not statistically significant, this is the ideal situation, since when linguistic parity is achieved neither language group should significantly outperform the other. Further research could be done on Grades 10, 11, and 12 to investigate whether this pattern of improvement continues.

Another important finding was that language variables were very significant for L2 learners when tested on computational and scientific subjects. This is contrary to the intuitive position that if a learners mathematics is weak they need more mathematical training. The findings suggest that an L2 learner must deal with a linguistic as well as a computational barrier in these subjects, and it seems likely that remedial English classes would be an important adjunct to improving L2 learners' marks on these subjects.

Overall the L2 learners exhibited a diffuse pattern of correlations between their academic and DAT-S scores when compared to the L1 group. This pattern suggests that L2 learners must use a far more diverse range of cognitive strategies to perform CALP-type tasks. Thus an L2 learners must always add at least one extra mental step to every problem, that of translation, which their L1 peers forgo. It is likely that timed testing underestimates L2 learners abilities for this reason, since more time is required for an L2 learner to achieve the same result as an L1 learner. Current educational practice should take this finding into account when timed assessments are employed in the testing of L2 learners.

Future research in this field could attempt to determine exact patterns of prediction on the DAT-S that can show that a certain matrix of scores has a certain meaning for L1 learners, while holding different predictive power for L2 learners. It is encouraging however that the DAT-S displayed good predictive power for both language groups, and further that all the evidence points towards a convergence of language skills the longer the learners are taught in English. It would be most interesting to see if this trend proves robust in future research on this topic.

Educators working with L2 learners can employ the findings of this study in their assessments of L2 learners. Teachers can identify those learners in need of linguistic support using the DAT-S, and the findings indicate that remedial language teaching would be most effective for the majority of L2 academic problems. While a marked convergence in language proficiency was observed in the Grade 9 learners, most results in this group were still significantly different indicating that language proficiency is still an important differentiating factor between learners. The finding that memory is an important aspect of an L2 learners ability to function in the L1 should also be taken into account by educators. The results on this measure on the DAT-S can be an important indicator for educators of the outcomes that can be expected from an L2 learner.

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Appendix

Grade 8 – Descriptive Statistics

Variable	Home lang	N	Mean	Std Dev	Std Err	Minimum	Maximum
Stanine	**1**	85	5.0835	1.5025	0.163	1.5	8.3
Stanine	**2**	85	3.9718	1.5392	0.167	1	7.8
T1	**1**	85	4.9176	1.6562	0.1796	1	8
T1	**2**	85	3.3294	1.8348	0.199	1	9
T2	**1**	85	5.2824	1.8362	0.1992	1	9
T2	**2**	85	4.1176	1.9359	0.21	1	9
T3	**1**	85	5.2353	1.8365	0.1992	1	9
T3	**2**	85	4.5059	2.0795	0.2256	1	8
T4	**1**	85	3.9412	1.6062	0.1742	1	7
T4	**2**	85	3.3765	1.5734	0.1707	1	8
T5	**1**	85	5.5059	2.1801	0.2365	1	9
T5	**2**	85	3.7765	2.0838	0.226	1	8
T6	**1**	85	6.0824	2.3514	0.255	1	9
T6	**2**	85	4.8118	2.244	0.2434	1	9
T7	**1**	85	5.5529	1.9427	0.2107	1	9
T7	**2**	85	4.6	1.7607	0.191	2	8
T8	**1**	85	4.6588	1.9245	0.2087	1	9
T8	**2**	85	3.6706	1.5916	0.1726	1	7
T9	**1**	85	6.0588	2.1064	0.2285	1	9
T9	**2**	85	4.1412	2.5315	0.2746	1	9
MI	**1**	85	50.388	13.029	1.4132	20	74
MI	**2**	85	41.482	13.5	1.4643	13	75
AC	**1**	85	66.553	11.144	1.2087	43	88
AC	**2**	85	63.788	10.805	1.1719	43	85
EMS	**1**	85	55.8	15.134	1.6415	24	89
EMS	**2**	85	46.059	14.872	1.6131	17	85
HSS	**1**	85	55.035	12.456	1.351	30	80
HSS	**2**	85	46.165	15.309	1.6605	15	80
LLC1	**1**	85	65.906	10.345	1.1221	45	87
LLC1	**2**	85	59.341	9.9278	1.0768	40	86
LLC2	**1**	85	58.588	13.895	1.5072	27	91
LLC2	**2**	85	48.106	15.742	1.7075	5	87
LO	**1**	85	64.624	9.1962	0.9975	43	83
LO	**2**	85	63.247	9.945	1.0787	38	87
NS	**1**	85	60.165	16.596	1.8001	21	89
NS	**2**	85	51.306	15.872	1.7216	24	89
TECH	**1**	85	70	11.083	1.2021	34	89
TECH	**2**	85	60.929	10.967	1.1896	0	80
LLC1 %	**1**	85	63.129	7.6684	0.8318	43	78
LLC1 %	**2**	85	58.271	8.2222	0.8918	42	82
LLC2 %	**1**	85	59.8	11.18	1.2127	37	90
LLC2 %	**2**	85	50.165	13.367	1.4499	21	79
MLMMS %	**1**	85	65.012	10.646	1.1548	41	86
MLMMS %	**2**	85	59.424	11.239	1.2191	37	87
NS %	**1**	85	62.988	11.999	1.3015	37	87
NS %	**2**	85	55.906	12.132	1.3159	35	85
HSS %	**1**	85	60.459	9.9732	1.0817	40	82
HSS %	**2**	85	52.871	12.541	1.3603	25	79
A&C %	**1**	85	75.588	6.896	0.748	60	91
A&C %	**2**	85	72.424	7.6569	0.8305	57	89
LO %	**1**	85	74.306	5.2577	0.5703	62	87
LO %	**2**	85	73.659	6.8201	0.7397	55	89
EMS %	**1**	85	58.624	11.352	1.2312	39	84
EMS %	**2**	85	51.294	11.927	1.2937	29	80
TECH %	**1**	85	73.918	7.5423	0.8181	50	88
TECH %	**2**	85	67.329	8.4309	0.9145	51	87

Grade 8 – T-Tests

Variable	Method	Variances	DF	t Value	Pr > |t|
Stanine	Pooled	Equal	168	4.77	<.0001
Stanine	Satterthwaite	Unequal	168	4.77	<.0001
T1	Pooled	Equal	168	5.92	<.0001
T1	Satterthwaite	Unequal	166	5.92	<.0001
T2	Pooled	Equal	168	4.02	<.0001
T2	Satterthwaite	Unequal	168	4.02	<.0001
T3	Pooled	Equal	168	2.42	0.0164
T3	Satterthwaite	Unequal	165	2.42	0.0164
T4	Pooled	Equal	168	2.32	0.0218
T4	Satterthwaite	Unequal	168	2.32	0.0218
T5	Pooled	Equal	168	5.29	<.0001
T5	Satterthwaite	Unequal	168	5.29	<.0001
T6	Pooled	Equal	168	3.6	0.0004
T6	Satterthwaite	Unequal	168	3.6	0.0004
T7	Pooled	Equal	168	3.35	0.001
T7	Satterthwaite	Unequal	166	3.35	0.001
T8	Pooled	Equal	168	3.65	0.0004
T8	Satterthwaite	Unequal	162	3.65	0.0004
T9	Pooled	Equal	168	5.37	<.0001
T9	Satterthwaite	Unequal	163	5.37	<.0001
MI	Pooled	Equal	168	4.38	<.0001
MI	Satterthwaite	Unequal	168	4.38	<.0001
AC	Pooled	Equal	168	1.64	0.1024
AC	Satterthwaite	Unequal	168	1.64	0.1024
EMS	Pooled	Equal	168	4.23	<.0001
EMS	Satterthwaite	Unequal	168	4.23	<.0001
HSS	Pooled	Equal	168	4.14	<.0001
HSS	Satterthwaite	Unequal	161	4.14	<.0001
LLC1	Pooled	Equal	168	4.22	<.0001
LLC1	Satterthwaite	Unequal	168	4.22	<.0001
LLC2	Pooled	Equal	168	4.6	<.0001
LLC2	Satterthwaite	Unequal	165	4.6	<.0001
LO	Pooled	Equal	168	0.94	0.3502
LO	Satterthwaite	Unequal	167	0.94	0.3502
NS	Pooled	Equal	168	3.56	0.0005
NS	Satterthwaite	Unequal	168	3.56	0.0005
TECH	Pooled	Equal	168	5.36	<.0001
TECH	Satterthwaite	Unequal	168	5.36	<.0001
LLC1 %	Pooled	Equal	168	3.98	0.0001
LLC1 %	Satterthwaite	Unequal	167	3.98	0.0001
LLC2 %	Pooled	Equal	168	5.1	<.0001
LLC2 %	Satterthwaite	Unequal	163	5.1	<.0001
MLMMS %	Pooled	Equal	168	3.33	0.0011
MLMMS %	Satterthwaite	Unequal	168	3.33	0.0011
NS %	Pooled	Equal	168	3.83	0.0002
NS %	Satterthwaite	Unequal	168	3.83	0.0002
HSS %	Pooled	Equal	168	4.37	<.0001
HSS %	Satterthwaite	Unequal	160	4.37	<.0001
A&C %	Pooled	Equal	168	2.83	0.0052
A&C %	Satterthwaite	Unequal	166	2.83	0.0052
LO %	Pooled	Equal	168	0.69	0.4894
LO %	Satterthwaite	Unequal	158	0.69	0.4895
EMS %	Pooled	Equal	168	4.1	<.0001
EMS %	Satterthwaite	Unequal	168	4.1	<.0001
TECH %	Pooled	Equal	168	5.37	<.0001
TECH %	Satterthwaite	Unequal	166	5.37	<.0001

Grade 8 – Equality of Variances

Variable	Method	Num DF	Den DF	F Value	Pr > F
Stanine	**Folded F**	84	84	1.05	0.8255
T1	**Folded F**	84	84	1.23	0.35
T2	**Folded F**	84	84	1.11	0.629
T3	**Folded F**	84	84	1.28	0.2566
T4	**Folded F**	84	84	1.04	0.8506
T5	**Folded F**	84	84	1.09	0.6798
T6	**Folded F**	84	84	1.1	0.6694
T7	**Folded F**	84	84	1.22	0.3691
T8	**Folded F**	84	84	1.46	0.0835
T9	**Folded F**	84	84	1.44	0.0939
MI	**Folded F**	84	84	1.07	0.7457
AC	**Folded F**	84	84	1.06	0.7778
EMS	**Folded F**	84	84	1.04	0.8731
HSS	**Folded F**	84	84	1.51	0.0604
LLC1	**Folded F**	84	84	1.09	0.707
LLC2	**Folded F**	84	84	1.28	0.2548
LO	**Folded F**	84	84	1.17	0.4747
NS	**Folded F**	84	84	1.09	0.6838
TECH	**Folded F**	84	84	1.02	0.9236
LLC1 %	**Folded F**	84	84	1.15	0.5242
LLC2 %	**Folded F**	84	84	1.43	0.1034
MLMMS %	**Folded F**	84	84	1.11	0.6206
NS %	**Folded F**	84	84	1.02	0.9202
HSS %	**Folded F**	84	84	1.58	0.0371
A&C %	**Folded F**	84	84	1.23	0.3393
LO %	**Folded F**	84	84	1.68	0.0181
EMS %	**Folded F**	84	84	1.1	0.6513
TECH %	**Folded F**	84	84	1.25	0.3093

Grade 9 – Descriptive Statistics

Variable	Home lang	N	Mean	Std Dev	Std Err	Minimum	Maximum
Stanine	1	71	4.9521	1.6385	0.1944	1.8	8.5
Stanine	2	82	3.9378	1.3238	0.1462	1	7.5
T1	1	69	4.3768	1.8319	0.2205	1	9
T1	2	80	3.6	1.5145	0.1693	1	6
T2	1	69	5.2029	1.8754	0.2258	1	9
T2	2	80	4.125	1.7016	0.1902	1	8
T3	1	69	5.1159	2.0475	0.2465	1	9
T3	2	80	3.8	2.0952	0.2343	1	8
T4	1	69	4.1739	2.1071	0.2537	1	9
T4	2	80	3.6875	1.6657	0.1862	1	9
T5	1	69	5.3478	2.2546	0.2714	1	9
T5	2	80	3.9375	1.8442	0.2062	1	8
T6	1	69	5.8406	2.3239	0.2798	1	9
T6	2	80	5	2.2892	0.2559	1	9
T7	1	69	5.4638	1.9672	0.2368	1	9
T7	2	80	4.7125	1.8973	0.2121	1	9
T8	1	69	4.6812	1.851	0.2228	1	9
T8	2	80	3.625	1.4788	0.1653	1	8
T9	1	20	4.5	2.7625	0.6177	1	9
T9	2	25	3.92	2.3965	0.4793	1	8
MI	1	72	56.889	14.05	1.6558	24	90
MI	2	83	54.012	13.594	1.4921	28	90
AC	1	72	62.486	17.367	2.0467	34	90
AC	2	83	62.771	14.576	1.6	36	90
EMS	1	72	47.056	18.777	2.2128	8	85
EMS	2	83	43.916	17.331	1.9023	7	81
HSS	1	72	61.722	85.598	10.088	21	770
HSS	2	83	47.928	12.183	1.3373	20	77
LLC1	1	72	63.431	10.357	1.2206	35	87
LLC1	2	83	61.964	9.5131	1.0442	38	84
LLC2	1	72	56.403	14.525	1.7118	19	84
LLC2	2	83	47.795	13.514	1.4834	8	84
LO	1	72	58.472	11.227	1.3232	35	84
LO	2	83	60.337	12.163	1.335	40	95
NS	1	72	46.931	20.193	2.3798	5	94
NS	2	83	41.169	21.056	2.3111	2	83
TECH	1	72	65.486	14.922	1.7586	23	90
TECH	2	83	60.145	13.998	1.5365	23	86
LLC1 %	1	72	62.722	9.0293	1.0641	46	88
LLC1 %	2	83	63.289	7.1372	0.7834	48	84
LLC2 %	1	72	55.931	12.257	1.4445	34	82
LLC2 %	2	83	50.494	8.1785	0.8977	33	73
MLMMS %	1	72	61.861	14.903	1.7563	35	95
MLMMS %	2	83	58.94	12.208	1.34	35	91
NS %	1	72	53.444	13.046	1.5375	22	79
NS %	2	83	52.072	12.191	1.3382	22	76
HSS %	1	72	55.833	12.711	1.498	24	88
HSS %	2	83	50.651	11.298	1.2401	29	80
A&C %	1	72	64.278	11.067	1.3043	43	88
A&C %	2	83	64.94	8.8474	0.9711	46	88
LO %	1	72	64.111	13.237	1.56	42	98
LO %	2	83	63.867	11.85	1.3008	40	96
EMS %	1	72	52.389	15.265	1.799	24	86
EMS %	2	83	51.048	12.359	1.3566	29	85
TECH %	1	72	63.972	10.785	1.271	38	86
TECH %	2	83	58.687	9.4002	1.0318	38	81

Grade 9 – T-Tests

Variable	Method	Variances	DF	t Value	Pr > |t|
Stanine	Pooled	Equal	151	4.23	<.0001
Stanine	Satterthwaite	Unequal	134	4.17	<.0001
T1	Pooled	Equal	147	2.83	0.0053
T1	Satterthwaite	Unequal	132	2.79	0.006
T2	Pooled	Equal	147	3.68	0.0003
T2	Satterthwaite	Unequal	139	3.65	0.0004
T3	Pooled	Equal	147	3.86	0.0002
T3	Satterthwaite	Unequal	145	3.87	0.0002
T4	Pooled	Equal	147	1.57	0.118
T4	Satterthwaite	Unequal	129	1.55	0.1246
T5	Pooled	Equal	147	4.2	<.0001
T5	Satterthwaite	Unequal	131	4.14	<.0001
T6	Pooled	Equal	147	2.22	0.028
T6	Satterthwaite	Unequal	143	2.22	0.0282
T7	Pooled	Equal	147	2.37	0.0191
T7	Satterthwaite	Unequal	142	2.36	0.0195
T8	Pooled	Equal	147	3.87	0.0002
T8	Satterthwaite	Unequal	130	3.81	0.0002
T9	Pooled	Equal	43	0.75	0.4551
T9	Satterthwaite	Unequal	37.9	0.74	0.4628
MI	Pooled	Equal	153	1.29	0.1977
MI	Satterthwaite	Unequal	148	1.29	0.1988
AC	Pooled	Equal	153	-0.11	0.9117
AC	Satterthwaite	Unequal	139	-0.11	0.9128
EMS	Pooled	Equal	153	1.08	0.2809
EMS	Satterthwaite	Unequal	146	1.08	0.2837
HSS	Pooled	Equal	153	1.45	0.1485
HSS	Satterthwaite	Unequal	73.5	1.36	0.1794
LLC1	Pooled	Equal	153	0.92	0.3597
LLC1	Satterthwaite	Unequal	145	0.91	0.3627
LLC2	Pooled	Equal	153	3.82	0.0002
LLC2	Satterthwaite	Unequal	146	3.8	0.0002
LO	Pooled	Equal	153	-0.99	0.3254
LO	Satterthwaite	Unequal	152	-0.99	0.3226
NS	Pooled	Equal	153	1.73	0.0853
NS	Satterthwaite	Unequal	151	1.74	0.0844
TECH	Pooled	Equal	153	2.3	0.0229
TECH	Satterthwaite	Unequal	147	2.29	0.0236
LLC1 %	Pooled	Equal	153	-0.44	0.6633
LLC1 %	Satterthwaite	Unequal	135	-0.43	0.6686
LLC2 %	Pooled	Equal	153	3.29	0.0013
LLC2 %	Satterthwaite	Unequal	121	3.2	0.0018
MLMMS	Pooled	Equal	153	1.34	0.1819
MLMMS	Satterthwaite	Unequal	137	1.32	0.1882
NS %	Pooled	Equal	153	0.68	0.4998
NS %	Satterthwaite	Unequal	147	0.67	0.5019
HSS %	Pooled	Equal	153	2.69	0.008
HSS %	Satterthwaite	Unequal	143	2.66	0.0086
A&C %	Pooled	Equal	153	-0.41	0.6798
A&C %	Satterthwaite	Unequal	135	-0.41	0.6846
LO %	Pooled	Equal	153	0.12	0.9039
LO %	Satterthwaite	Unequal	144	0.12	0.9047
EMS %	Pooled	Equal	153	0.6	0.5468
EMS %	Satterthwaite	Unequal	136	0.6	0.5528
TECH %	Pooled	Equal	153	3.26	0.0014
TECH %	Satterthwaite	Unequal	142	3.23	0.0015

Grade 9 – Equality of Variances

Variable	Method	Num DF	Den DF	F Value	Pr > F
Stanine	**Folded F**	70	81	1.53	0.0643
T1	**Folded F**	68	79	1.46	0.1031
T2	**Folded F**	68	79	1.21	0.4034
T3	**Folded F**	79	68	1.05	0.8491
T4	**Folded F**	68	79	1.6	0.0443
T5	**Folded F**	68	79	1.49	0.0853
T6	**Folded F**	68	79	1.03	0.8933
T7	**Folded F**	68	79	1.08	0.7532
T8	**Folded F**	68	79	1.57	0.0547
T9	**Folded F**	19	24	1.33	0.5052
MI	**Folded F**	71	82	1.07	0.7699
AC	**Folded F**	71	82	1.42	0.1258
EMS	**Folded F**	71	82	1.17	0.4821
HSS	**Folded F**	71	82	49.36	<.0001
LLC1	**Folded F**	71	82	1.19	0.456
LLC2	**Folded F**	71	82	1.16	0.5263
LO	**Folded F**	82	71	1.17	0.4911
NS	**Folded F**	82	71	1.09	0.7205
TECH	**Folded F**	71	82	1.14	0.5742
LLC1 %	**Folded F**	71	82	1.6	0.0401
LLC2 %	**Folded F**	71	82	2.25	0.0004
MLMMS %	**Folded F**	71	82	1.49	0.0814
NS %	**Folded F**	71	82	1.15	0.5517
HSS %	**Folded F**	71	82	1.27	0.302
A&C %	**Folded F**	71	82	1.56	0.0506
LO %	**Folded F**	71	82	1.25	0.3323
EMS %	**Folded F**	71	82	1.53	0.0652
TECH %	**Folded F**	71	82	1.32	0.2293

Grade 8 – Simple Statistics

Simple Statistics – 1st Language							
Variable	**N**	**Mean**	**Std Dev**	**Sum**	**Minimum**	**Maximum**	**Label**
ML	85	50.3882	13.0294	4283	20	74	ML
AC	85	66.5529	11.1436	5657	43	88	AC
EMS	85	55.8	15.1342	4743	24	89	EMS
HSS	85	55.0353	12.4561	4678	30	80	HSS
LLC1	85	65.9059	10.3448	5602	45	87	LLC1
LLC2	85	58.5882	13.8953	4980	27	91	LLC2
LO	85	64.6235	9.19624	5493	43	83	LO
NS	85	60.1647	16.5959	5114	21	89	NS
TECH	85	70	11.083	5950	34	89	TECH
LLC1%	85	63.1294	7.66841	5366	43	78	LLC1 %
LLC2%	85	59.8	11.1801	5083	37	90	LLC2 %
ML%	85	65.0118	10.6464	5526	41	86	ML %
NS%	85	62.9882	11.9995	5354	37	87	NS %
HSS%	85	60.4588	9.97324	5139	40	82	HSS %
A&C%	85	75.5882	6.89599	6425	60	91	A&C %
LO%	85	74.3059	5.2577	6316	62	87	LO %
EMS%	85	58.6235	11.3515	4983	39	84	EMS %
TECH%	85	73.9177	7.54228	6283	50	88	TECH %
Stanine	85	5.08353	1.50253	432.1	1.5	8.3	Stanine
T1	85	4.91765	1.65624	418	1	8	T1
T2	85	5.28235	1.83622	449	1	9	T2
T3	85	5.23529	1.83645	445	1	9	T3
T4	85	3.94118	1.60619	335	1	7	T4
T5	85	5.50588	2.18012	468	1	9	T5
T6	85	6.08235	2.35135	517	1	9	T6
T7	85	5.55294	1.94267	472	1	9	T7
T8	85	4.65882	1.92448	396	1	9	T8
T9	85	6.05882	2.10641	515	1	9	T9

Grade 8 - Correlations

Pearson Correlation Coefficients – 1st Language, N = 85 Prob > |r| under H0: Rho=0										
	Stanine	T1	T2	T3	T4	T5	T6	T7	T8	T9
ML	0.61542	0.48972	0.47355	0.54392	0.67008	0.46198	0.30748	0.23128	0.40368	0.48237
ML	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	0.0042	0.0332	0.0001	<.0001
AC	0.54284	0.47659	0.46819	0.51596	0.48073	0.41222	0.17771	0.30356	0.4047	0.42006
AC	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	0.1037	0.0047	0.0001	<.0001
EMS	0.52003	0.31802	0.38889	0.45917	0.46085	0.44979	0.13161	0.20383	0.35487	0.39099
EMS	<.0001	0.003	0.0002	<.0001	<.0001	<.0001	0.2299	0.0613	0.0009	0.0002
HSS	0.57805	0.46121	0.47425	0.48884	0.53147	0.47542	0.12956	0.2496	0.45343	0.49948
HSS	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	0.2373	0.0212	<.0001	<.0001
LLC1	0.37267	0.37405	0.29848	0.25246	0.45606	0.31304	0.05269	0.33139	0.2555	0.4111
LLC1	0.0004	0.0004	0.0055	0.0198	<.0001	0.0035	0.632	0.0019	0.0183	<.0001
LLC2	0.45492	0.28715	0.31489	0.33694	0.44056	0.32292	0.11619	0.17303	0.35439	0.42221
LLC2	<.0001	0.0077	0.0033	0.0016	<.0001	0.0026	0.2896	0.1133	0.0009	<.0001
LO	0.11405	0.26838	0.11141	-0.0173	0.19514	0.10818	-0.1786	0.04777	0.07674	0.26849
LO	0.2987	0.013	0.31	0.8755	0.0735	0.3244	0.102	0.6642	0.4851	0.013
NS	0.44449	0.30844	0.26371	0.40963	0.37552	0.40271	0.11252	0.10939	0.23884	0.2599
NS	<.0001	0.0041	0.0147	<.0001	0.0004	0.0001	0.3052	0.3189	0.0277	0.0163
TECH	0.10916	0.1122	0.00643	0.16377	0.10031	0.09263	0.0137	0.13049	0.20372	0.08312
TECH	0.32	0.3066	0.9534	0.1342	0.361	0.3991	0.9009	0.2339	0.0615	0.4495
LLC1%	0.51112	0.47514	0.42517	0.41541	0.59698	0.44821	0.18559	0.35155	0.43783	0.47784
LLC1%	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	0.089	0.001	<.0001	<.0001
LLC2%	0.41346	0.25241	0.25504	0.34847	0.41766	0.37735	0.23204	0.14931	0.31217	0.38975
LLC2%	<.0001	0.0198	0.0185	0.0011	<.0001	0.0004	0.0326	0.1726	0.0036	0.0002
ML%	0.61667	0.3248	0.45473	0.57587	0.60781	0.39878	0.2696	0.37497	0.44411	0.30043
ML%	<.0001	0.0024	<.0001	<.0001	<.0001	0.0002	0.0126	0.0004	<.0001	0.0052
NS%	0.5648	0.30604	0.40592	0.47823	0.53364	0.42117	0.18822	0.1923	0.34728	0.33066
NS%	<.0001	0.0044	0.0001	<.0001	<.0001	<.0001	0.0845	0.0779	0.0011	0.002
HSS%	0.54621	0.40663	0.40889	0.44968	0.56429	0.42229	0.24458	0.26755	0.45732	0.45941
HSS%	<.0001	0.0001	0.0001	<.0001	<.0001	<.0001	0.0241	0.0133	<.0001	<.0001
A&C%	0.42997	0.25549	0.32988	0.42042	0.51799	0.30938	0.14528	0.29001	0.30056	0.29673
A&C%	<.0001	0.0183	0.002	<.0001	<.0001	0.004	0.1846	0.0071	0.0052	0.0058
LO%	0.16943	0.21893	0.13029	0.07383	0.21502	0.1764	-0.0762	0.0928	0.15751	0.1725
LO%	0.1211	0.0441	0.2346	0.5019	0.0481	0.1063	0.4882	0.3982	0.15	0.1144
EMS%	0.50065	0.34216	0.3981	0.44288	0.53157	0.39166	0.22017	0.20768	0.37606	0.41766
EMS%	<.0001	0.0013	0.0002	<.0001	<.0001	0.0002	0.0429	0.0565	0.0004	<.0001
TECH%	0.10987	0.08427	0.09196	0.13635	0.17255	0.12347	0.05006	0.11121	0.15305	0.10147
TECH%	0.3168	0.4432	0.4026	0.2134	0.1143	0.2602	0.6491	0.3109	0.162	0.3555

Grade 8 – Simple Statistics

Simple Statistics – 2nd Language							
Variable	**N**	**Mean**	**Std Dev**	**Sum**	**Minimum**	**Maximum**	**Label**
ML	85	41.4824	13.5001	3526	13	75	ML
AC	85	63.7882	10.8046	5422	43	85	AC
EMS	85	46.0588	14.872	3915	17	85	EMS
HSS	85	46.1647	15.3094	3924	15	80	HSS
LLC1	85	59.3412	9.92778	5044	40	86	LLC1
LLC2	85	48.1059	15.742	4089	5	87	LLC2
LO	85	63.2471	9.94497	5376	38	87	LO
NS	85	51.3059	15.8723	4361	24	89	NS
TECH	85	60.9294	10.9673	5179	0	80	TECH
LLC1%	85	58.2706	8.22219	4953	42	82	LLC1 %
LLC2%	85	50.1647	13.3674	4264	21	79	LLC2 %
ML%	85	59.4235	11.2392	5051	37	87	ML %
NS%	85	55.9059	12.1318	4752	35	85	NS %
HSS%	85	52.8706	12.5412	4494	25	79	HSS %
A&C%	85	72.4235	7.65689	6156	57	89	A&C %
LO%	85	73.6588	6.82006	6261	55	89	LO %
EMS%	85	51.2941	11.9272	4360	29	80	EMS %
TECH%	85	67.3294	8.43094	5723	51	87	TECH %
Stanine	85	3.97176	1.53922	337.6	1	7.8	Stanine
T1	85	3.32941	1.83477	283	1	9	T1
T2	85	4.11765	1.93595	350	1	9	T2
T3	85	4.50588	2.07951	383	1	8	T3
T4	85	3.37647	1.57341	287	1	8	T4
T5	85	3.77647	2.08382	321	1	8	T5
T6	85	4.81176	2.24401	409	1	9	T6
T7	85	4.6	1.76068	391	2	8	T7
T8	85	3.67059	1.59156	312	1	7	T8
T9	85	4.14118	2.53148	352	1	9	T9

Grade 8 - Correlations

Pearson Correlation Coefficients – 2nd Language, N = 85

Prob > |r| under H0: Rho=0

	Stanine	T1	T2	T3	T4	T5	T6	T7	T8	T9
ML	0.73696	0.52844	0.56991	0.57089	0.64148	0.54259	0.33038	0.50756	0.49118	0.55568
ML	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	0.002	<.0001	<.0001	<.0001
AC	0.63107	0.3999	0.514	0.45519	0.50614	0.49067	0.42649	0.3741	0.30535	0.60218
AC	<.0001	0.0001	<.0001	<.0001	<.0001	<.0001	<.0001	0.0004	0.0045	<.0001
EMS	0.71307	0.55162	0.62536	0.53448	0.52459	0.57242	0.33851	0.5233	0.4716	0.55251
EMS	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	0.0015	<.0001	<.0001	<.0001
HSS	0.7825	0.57274	0.69182	0.53582	0.58947	0.65346	0.36719	0.52053	0.51673	0.67549
HSS	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	0.0005	<.0001	<.0001	<.0001
LLC1	0.65621	0.41726	0.525	0.61259	0.44133	0.48826	0.36843	0.3893	0.49768	0.5987
LLC1	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	0.0005	0.0002	<.0001	<.0001
LLC2	0.52632	0.36231	0.50741	0.43183	0.27378	0.47106	0.32881	0.4796	0.38059	0.58335
LLC2	<.0001	0.0007	<.0001	<.0001	0.0112	<.0001	0.0021	<.0001	0.0003	<.0001
LO	0.51733	0.3615	0.39792	0.41526	0.41243	0.41918	0.30084	0.37421	0.37751	0.45303
LO	<.0001	0.0007	0.0002	<.0001	<.0001	<.0001	0.0051	0.0004	0.0004	<.0001
NS	0.47945	0.4568	0.41297	0.34547	0.42197	0.38794	0.27638	0.36652	0.26983	0.4143
NS	<.0001	<.0001	<.0001	0.0012	<.0001	0.0002	0.0105	0.0006	0.0125	<.0001
TECH	0.35947	0.15676	0.28131	0.30173	0.24095	0.29049	0.10055	0.29075	0.26191	0.38199
TECH	0.0007	0.1519	0.0091	0.005	0.0263	0.007	0.3599	0.0069	0.0155	0.0003
LLC1%	0.80412	0.56851	0.65986	0.63107	0.54048	0.71437	0.39509	0.47054	0.55	0.73138
LLC1%	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	0.0002	<.0001	<.0001	<.0001
LLC2%	0.71063	0.48412	0.67456	0.52673	0.44191	0.62873	0.35704	0.47931	0.48996	0.72332
LLC2%	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	0.0008	<.0001	<.0001	<.0001
ML%	0.74914	0.49252	0.62689	0.55459	0.5631	0.62626	0.41433	0.48814	0.57359	0.61295
ML%	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
NS%	0.56228	0.50254	0.48049	0.4082	0.45029	0.46865	0.27134	0.4268	0.32453	0.49002
NS%	<.0001	<.0001	<.0001	0.0001	<.0001	<.0001	0.012	<.0001	0.0024	<.0001
HSS%	0.79444	0.57202	0.69592	0.5704	0.54246	0.70177	0.39126	0.5648	0.5889	0.67892
HSS%	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	0.0002	<.0001	<.0001	<.0001
A&C%	0.61588	0.39331	0.5146	0.45592	0.37989	0.57305	0.39962	0.35004	0.5352	0.56806
A&C%	<.0001	0.0002	<.0001	<.0001	0.0003	<.0001	0.0002	0.001	<.0001	<.0001
LO%	0.56553	0.33731	0.48005	0.40683	0.43036	0.48461	0.35357	0.39002	0.38765	0.53653
LO%	<.0001	0.0016	<.0001	0.0001	<.0001	<.0001	0.0009	0.0002	0.0002	<.0001
EMS%	0.73782	0.5689	0.6182	0.54542	0.54402	0.62967	0.37616	0.52721	0.51377	0.58885
EMS%	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	0.0004	<.0001	<.0001	<.0001
TECH%	0.60683	0.33768	0.5738	0.40526	0.46797	0.48196	0.18076	0.5415	0.46864	0.51152
TECH%	<.0001	0.0016	<.0001	0.0001	<.0001	<.0001	0.0978	<.0001	<.0001	<.0001

Grade 9 – Simple Statistics

Simple Statistics – 1st Language							
Variable	**N**	**Mean**	**Std Dev**	**Sum**	**Minimum**	**Maximum**	**Label**
ML	72	56.8889	14.0498	4096	24	90	ML
AC	72	62.4861	17.3668	4499	34	90	AC
EMS	72	47.0556	18.7766	3388	8	85	EMS
HSS	72	61.7222	85.5975	4444	21	770	HSS
LLC1	72	63.4306	10.3568	4567	35	87	LLC1
LLC2	72	56.4028	14.525	4061	19	84	LLC2
LO	72	58.4722	11.2275	4210	35	84	LO
NS	72	46.9306	20.193	3379	5	94	NS
TECH	72	65.4861	14.9223	4715	23	90	TECH
LLC1%	72	62.7222	9.02925	4516	46	88	LLC1 %
LLC2%	72	55.9306	12.257	4027	34	82	LLC2 %
ML%	72	61.8611	14.9028	4454	35	95	ML%
NS%	72	53.4444	13.0458	3848	22	79	NS %
HSS%	72	55.8333	12.7113	4020	24	88	HSS %
A&C%	72	64.2778	11.0673	4628	43	88	A&C %
LO%	72	64.1111	13.2373	4616	42	98	LO %
EMS%	72	52.3889	15.2653	3772	24	86	EMS %
TECH%	72	63.9722	10.7847	4606	38	86	TECH %
Stanine	71	4.95211	1.63845	351.6	1.8	8.5	Stanine
T1	69	4.37681	1.83192	302	1	9	T1
T2	69	5.2029	1.87538	359	1	9	T2
T3	69	5.11594	2.0475	353	1	9	T3
T4	69	4.17391	2.10711	288	1	9	T4
T5	69	5.34783	2.25458	369	1	9	T5
T6	69	5.84058	2.32394	403	1	9	T6
T7	69	5.46377	1.96723	377	1	9	T7
T8	69	4.68116	1.85102	323	1	9	T8
T9	20	4.5	2.76253	90	1	9	T9

Grade 9 - Correlations

Pearson Correlation Coefficients – 1st Language

Prob > |r| under H0: Rho=0

	Stanine	T1	T2	T3	T4	T5	T6	T7	T8	T9
ML	0.67587	0.36264	0.62202	0.50559	0.61826	0.42778	0.12643	0.47014	0.64326	0.28297
ML	<.0001	0.0022	<.0001	<.0001	<.0001	0.0002	0.3006	<.0001	<.0001	0.2267
AC	0.29907	0.1254	0.35526	0.13664	0.22611	0.28964	0.21879	0.09626	0.07782	0.4114
AC	0.0113	0.3046	0.0027	0.2629	0.0617	0.0158	0.0709	0.4314	0.5251	0.0715
EMS	0.59234	0.45076	0.5267	0.39077	0.38651	0.52225	0.13574	0.32278	0.39932	0.35952
EMS	<.0001	0.0001	<.0001	0.0009	0.001	<.0001	0.2661	0.0068	0.0007	0.1195
HSS	0.18833	0.15554	0.1965	0.15663	0.14689	0.11344	0.08014	0.12772	0.20614	0.34456
HSS	0.1158	0.2019	0.1056	0.1987	0.2284	0.3534	0.5127	0.2957	0.0893	0.1368
LLC1	0.59192	0.61201	0.5405	0.32229	0.39907	0.62009	0.16915	0.33368	0.28296	0.58133
LLC1	<.0001	<.0001	<.0001	0.0069	0.0007	<.0001	0.1647	0.0051	0.0185	0.0072
LLC2	0.37304	0.27883	0.36901	0.26877	0.33708	0.24969	0.24098	0.1705	0.27593	0.38688
LLC2	0.0014	0.0203	0.0018	0.0255	0.0046	0.0385	0.0461	0.1613	0.0217	0.092
LO	0.42047	0.29425	0.39943	0.13147	0.28772	0.41407	0.20906	0.22062	0.31174	-0.0826
LO	0.0003	0.0141	0.0007	0.2816	0.0165	0.0004	0.0847	0.0685	0.0091	0.7293
NS	0.51327	0.41091	0.46689	0.31744	0.36491	0.46029	0.09631	0.18591	0.37258	0.14414
NS	<.0001	0.0005	<.0001	0.0079	0.0021	<.0001	0.4312	0.1262	0.0016	0.5443
TECH	0.38828	0.10812	0.27307	0.33819	0.23309	0.35025	0.14327	0.24166	0.2632	0.44772
TECH	0.0008	0.3765	0.0232	0.0045	0.0539	0.0032	0.2402	0.0454	0.0289	0.0478
LLC1%	0.6274	0.57484	0.65838	0.36377	0.42773	0.67181	0.26464	0.41346	0.45683	0.6226
LLC1%	<.0001	<.0001	<.0001	0.0021	0.0002	<.0001	0.028	0.0004	<.0001	0.0034
LLC2%	0.48231	0.45446	0.48404	0.345	0.39114	0.45823	0.24101	0.24098	0.33784	0.5994
LLC2%	<.0001	<.0001	<.0001	0.0037	0.0009	<.0001	0.046	0.0461	0.0045	0.0052
ML%	0.6846	0.44673	0.63789	0.48808	0.51266	0.58458	0.15315	0.32145	0.54317	0.5767
ML%	<.0001	0.0001	<.0001	<.0001	<.0001	<.0001	0.209	0.0071	<.0001	0.0078
NS%	0.54384	0.46193	0.54223	0.40949	0.38731	0.56981	0.09016	0.30945	0.44308	0.34694
NS%	<.0001	<.0001	<.0001	0.0005	0.001	<.0001	0.4613	0.0097	0.0001	0.134
HSS%	0.58192	0.41928	0.62926	0.33791	0.34416	0.6775	0.12882	0.25127	0.48005	0.39881
HSS%	<.0001	0.0003	<.0001	0.0045	0.0038	<.0001	0.2915	0.0373	<.0001	0.0815
A&C%	0.35726	0.23118	0.45796	0.15944	0.18404	0.32497	0.26416	0.23581	0.20486	0.36617
A&C%	0.0022	0.056	<.0001	0.1907	0.1301	0.0064	0.0283	0.0511	0.0913	0.1123
LO%	0.46171	0.40935	0.51622	0.25075	0.29938	0.44047	0.12849	0.20388	0.31485	0.15077
LO%	<.0001	0.0005	<.0001	0.0377	0.0125	0.0002	0.2927	0.0929	0.0084	0.5258
EMS%	0.62299	0.39631	0.59859	0.44734	0.45069	0.58309	0.19101	0.41367	0.47596	0.56451
EMS%	<.0001	0.0007	<.0001	0.0001	0.0001	<.0001	0.1159	0.0004	<.0001	0.0095
TECH%	0.54602	0.31611	0.52258	0.3939	0.34123	0.51018	0.10923	0.2418	0.42095	0.4746
TECH%	<.0001	0.0081	<.0001	0.0008	0.0041	<.0001	0.3716	0.0453	0.0003	0.0345

Grade 9 – Simple Statistics

Simple Statistics – 2nd Language

Variable	N	Mean	Std Dev	Sum	Minimum	Maximum	Label
ML	83	54.0121	13.5938	4483	28	90	ML
AC	83	62.7711	14.5764	5210	36	90	AC
EMS	83	43.9157	17.3312	3645	7	81	EMS
HSS	83	47.9277	12.1833	3978	20	77	HSS
LLC1	83	61.9639	9.51308	5143	38	84	LLC1
LLC2	83	47.7952	13.514	3967	8	84	LLC2
LO	83	60.3374	12.1628	5008	40	95	LO
NS	83	41.1687	21.0556	3417	2	83	NS
TECH	83	60.1446	13.9984	4992	23	86	TECH
LLC1%	83	63.2892	7.13721	5253	48	84	LLC1 %
LLC2%	83	50.494	8.17846	4191	33	73	LLC2 %
ML%	83	58.9398	12.2079	4892	35	91	ML %
NS%	83	52.0723	12.1913	4322	22	76	NS %
HSS%	83	50.6506	11.298	4204	29	80	HSS %
A&C%	83	64.9398	8.84742	5390	46	88	A&C %
LO%	83	63.8675	11.8505	5301	40	96	LO %
EMS%	83	51.0482	12.3594	4237	29	85	EMS %
TECH%	83	58.6868	9.40022	4871	38	81	TECH %
Stanine	82	3.9378	1.32382	322.9	1	7.5	Stanine
T1	80	3.6	1.51449	288	1	6	T1
T2	80	4.125	1.70164	330	1	8	T2
T3	80	3.8	2.0952	304	1	8	T3
T4	80	3.6875	1.66569	295	1	9	T4
T5	80	3.9375	1.84421	315	1	8	T5
T6	80	5	2.28922	400	1	9	T6
T7	80	4.7125	1.89732	377	1	9	T7
T8	80	3.625	1.47875	290	1	8	T8
T9	25	3.92	2.39653	98	1	8	T9

Grade 9 - Correlations

Pearson Correlation Coefficients – 2nd Language

Prob > |r| under H0: Rho=0

	Stanine	T1	T2	T3	T4	T5	T6	T7	T8	T9
ML	0.58122	0.35609	0.41488	0.38314	0.45322	0.40732	0.04952	0.54352	0.5243	0.49958
ML	<.0001	0.0012	0.0001	0.0005	<.0001	0.0002	0.6627	<.0001	<.0001	0.011
AC	0.19167	-0.0948	-0.0071	0.21724	0.0947	0.17294	-0.1	0.10214	0.00176	-0.0275
AC	0.0845	0.4031	0.9499	0.0529	0.4034	0.125	0.3777	0.3673	0.9877	0.8962
EMS	0.41106	0.25652	0.26126	0.25304	0.37017	0.26794	0.14774	0.44708	0.31584	0.20892
EMS	0.0001	0.0216	0.0192	0.0235	0.0007	0.0163	0.1909	<.0001	0.0043	0.3162
HSS	0.49276	0.30323	0.28471	0.24558	0.48817	0.3648	0.1597	0.43083	0.34746	0.43812
HSS	<.0001	0.0063	0.0105	0.0281	<.0001	0.0009	0.1571	<.0001	0.0016	0.0285
LLC1	0.44515	0.47317	0.36777	0.14443	0.27123	0.51416	0.07416	0.4716	0.44708	0.50922
LLC1	<.0001	<.0001	0.0008	0.2012	0.015	<.0001	0.5132	<.0001	<.0001	0.0093
LLC2	0.30539	0.2235	0.16223	0.1668	0.20446	0.30041	-0.058	0.3956	0.1777	0.14686
LLC2	0.0053	0.0463	0.1505	0.1392	0.0689	0.0068	0.6092	0.0003	0.1148	0.4836
LO	0.36746	0.22643	0.27081	0.20815	0.31062	0.17418	0.14916	0.34414	0.26531	0.55677
LO	0.0007	0.0434	0.0151	0.0639	0.005	0.1223	0.1866	0.0018	0.0174	0.0038
NS	0.41823	0.3219	0.25334	0.2198	0.408	0.31607	0.12402	0.47906	0.3515	0.24933
NS	<.0001	0.0036	0.0234	0.0501	0.0002	0.0043	0.2731	<.0001	0.0014	0.2294
TECH	0.17703	-0.0159	0.0567	0.15483	0.16931	0.06628	0.03892	0.26078	0.08584	0.05245
TECH	0.1116	0.889	0.6174	0.1703	0.1333	0.5592	0.7318	0.0195	0.449	0.8034
LLC1%	0.61312	0.59127	0.38305	0.33618	0.43618	0.65673	-0.004	0.46315	0.54479	0.82362
LLC1%	<.0001	<.0001	0.0005	0.0023	<.0001	<.0001	0.9721	<.0001	<.0001	<.0001
LLC2%	0.51694	0.38222	0.36354	0.30041	0.35003	0.45386	0	0.57018	0.52144	0.67892
LLC2%	<.0001	0.0005	0.0009	0.0068	0.0015	<.0001	1	<.0001	<.0001	0.0002
ML%	0.44794	0.28592	0.29507	0.29922	0.39525	0.29055	0.03858	0.47225	0.39673	0.43309
ML%	<.0001	0.0101	0.0079	0.007	0.0003	0.0089	0.734	<.0001	0.0003	0.0306
NS%	0.46658	0.30149	0.33733	0.32126	0.33867	0.36317	0.00521	0.49112	0.3955	0.35639
NS%	<.0001	0.0066	0.0022	0.0037	0.0021	0.0009	0.9634	<.0001	0.0003	0.0803
HSS%	0.47353	0.37951	0.3069	0.22932	0.43107	0.41675	0.16424	0.43397	0.39847	0.451
HSS%	<.0001	0.0005	0.0056	0.0407	<.0001	0.0001	0.1455	<.0001	0.0003	0.0237
A&C%	0.42209	0.09773	0.22089	0.38105	0.26288	0.29473	0.00373	0.41052	0.39325	0.44566
A&C%	<.0001	0.3885	0.0489	0.0005	0.0185	0.008	0.9738	0.0002	0.0003	0.0256
LO%	0.38488	0.25609	0.23795	0.26413	0.30056	0.2681	0.14597	0.38109	0.25158	0.24189
LO%	0.0004	0.0219	0.0336	0.0179	0.0068	0.0162	0.1964	0.0005	0.0244	0.244
EMS%	0.57979	0.39505	0.39316	0.38207	0.48175	0.43795	0.09445	0.51636	0.48632	0.54644
EMS%	<.0001	0.0003	0.0003	0.0005	<.0001	<.0001	0.4046	<.0001	<.0001	0.0047
TECH%	0.33631	0.14345	0.19185	0.19752	0.30705	0.24876	0.14432	0.35184	0.30949	0.16337
TECH%	0.002	0.2043	0.0882	0.0791	0.0056	0.0261	0.2015	0.0014	0.0052	0.4352