The relationship between brain dominance, body laterality and literacy skills in Grade 2 learners in a school in KZN

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DECLARATION

I, Esther Marloth, declare that

(i) The research reported in this thesis, except where otherwise indicated, is my original work.

(ii) This thesis has not been submitted for any degree or examination at any other university.

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As the candidate's supervisor I, Dr Audrey Klopper, agree to the submission of this thesis.

Signed:

ABSTRACT

There is no doubt that basic literacy is vital to modern education. Although the majority of the population can read, many children, teenagers and adults seriously struggle with mastering reading skills. Most learners learn to read without great difficulty when they enter school. However, each year a portion of children experience significant problems learning to read. Educators in South African public schools are concerned that many learners are not learning to read and spell adequately. Multiple research conducted in South African schools indicate that a large number of children within the Foundation Phase experience problems with reading and spelling.

Brain research suggests that for most people, the language centre of the brain resides in the left hemisphere of the brain. From this, it can be theorised that left-brain dominant learners would learn literacy skills, such as phonological awareness, spelling and reading, with greater ease. Other researchers have theorised that a correspondence between brain, eye, ear and hand dominance favours effective learning. The brain cannot learn without the sensory intake from the eyes, ears and hands. It is hypothesised that, since the brain works with a cross-over pattern, the dominant eye, ear and hand should be on the opposite side of the dominant brain.

The desire was to dig deeper into this topic to find out if brain dominance, the correspondence between body and brain dominance, and mixed dominance do affect literacy learning as brain researchers suggest these dominances do. That is where the idea of this study was born.

I investigated a number of relationships, namely the relationship between literacy skills and phonological awareness, between literacy skills and brain dominance, between literacy skills and eye dominance, between literacy skills and hand dominance, between literacy skills and ear dominance, the relationship between reading and spelling skills and finally which body dominance profile correlates with high literacy skills.

Data were collected from 119 Gr 2 South African middle-class learners of mixed nationality and both genders. This data related to brain-, hand-, eye- and ear- dominance, and literacy skills such as reading, speliing and phonological awareness. Each participant was individually assessed to determine the dominant eye, ear and hand. Participants also completed the Neethling young child indicator brain profile to determine the dominant side

of the brain, as well as the standardised ESSI reading and spelling tests and a phonological awareness test, which uses both real words and nonwords.

In this study, I found that phonological awareness is a good indicator of reading and spelling skills and that reading and spelling skills are related. Left brain, right eye, and left ear dominance was found to be associated with a statistically significant literacy skill advantage, whereas no significant support was found for an association between hand dominance and literacy skill advantage. These findings are important because they provide some answers to questions concerning the relationships between the various components of literacy (phonological awareness, reading and spelling), and between various dominances (brain, eye, ear and hand dominance) and literacy skill. They also provide possible causes of learning challenges, which may be addressed and overcome.

The work described in this thesis was carried out at the School of Science, Learner Support Education, North-West University, from January 2010 to October 2012 under the supervision of Dr Audrey Klopper (supervisor) and Prof. ML Vanderlee (co-supervisor).

Ethical clearance number: NWU-00080-11-A2.

This study represents original work by the author and has not otherwise been submitted in any form for any degree or diploma to any tertiary institution. Where use has been made of the work of others, it is duly acknowledged in the text.

Esther Marloth

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APD:	auditory processing disorder
AS:	assessment standard
CAPD:	central auditory processing disorder
CAPS:	Curriculum and Assessment Policy Document
DIBELS:	Dynamic Indicators of Basic Early Literacy Skills
DoE:	Department of Education
EAL:	English as Additional Language
ELLT:	English became the language of learning and teaching
FAL:	First Additional Language
HBDI:	Herrmann Brain Dominance Instrument
IEA:	International Association for the Evaluation of Educational Achievement
IPM:	information processing model
IQ:	intelligence quotient
LO:	learning outcome
LEA:	left ear advantage
LOQ:	The Learning Orientation Questionnaire
LTM	long-term memory
MBTI:	Myers-Briggs Type Indicator
NAAL:	National Assessment of Adult Literacy
NAEP:	National Assessment of Education Progress

NALS:	National Adult Literacy Survey
NCS:	National Curriculum Statement
NBI:	Neethling Brain Instrument
NRNCS:	The New Revised National Curriculum Statement
OBE:	outcomes-based education
REA:	right-ear advantage
RNCS:	Revised National Curriculum Statement
RRSG:	Reading Study Group
SA:	South African
SACE:	South African Counsil for Educators
SSS:	scotopic sensitivity syndrome
SM:	short sensory memory
STM:	short-term memory
UNESCO:	United Nations Educational, Scientific and Cultural Organisation
VPD:	visual processing disorder
YCI:	Young Child Indicator
ZPD:	zone of proximal development

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DEDICATION

This thesis is dedicated to my parents, Danie and Elsa Bosman, my parents-in-law, Gerard and Elretha Marloth, my husband, Coligny, my children Madeli, Heinrich and Minette, and my twin sister, Eloise van Niekerk.

CHAPTER 1
INTRODUCTION

1.1 STATEMENT OF THE PROBLEM AND MOTIVATION FOR THE RESEARCH

Bradley and Bryant (1985, p. 38) state, “Of all the things children have to learn when they get to school, reading and writing are the most basic, the most central and the most essential”. Pumfrey (2001) adds that, not being able to read in modern society is to be disempowered, impoverished, marginalised and frequently demeaned, and to be cut off from major resources of knowledge, insights and speculations. A clear link has been shown to exist between academic success and reading skills in normally developing learners, as well as learners with language delays (Kamhi & Catts, 1991). It is therefore important to understand how to improve basic literacy. Good literacy skills help learners to develop good self-esteem. Without literacy skills, learners will find it very difficult to complete schoolwork satisfactorily. Unfortunately, however, an alarming number of learners are not learning basic skills of literacy adequately (Catts et al., 2002).

According to estimates by the National Institute of Health (2010), 80% of people with learning disorders have reading disorders. However, it has been challenging to define all the different aspects of reading disabilities (Fletcher et al., 2007). This is an international problem (Shaywitz, 1998). A study conducted by Juel (1994) found that only one out of eight learners who are not reading at grade level by the end of their first grade will ever go on to read at grade level. Prior knowledge learners bring with them to school forms a foundation on which new information can be imbedded. The new information is integrated into a conceptual schema, thus making the knowledge usable (Gerace, 1992; Hauslein & Smith, 1995; Kilpatrick et al., 2001; Larkin, 1985; Novak & Gowin, 1984; Stanton, 1990; Stevenson & Palmer, 1994; Willis, 1993). Consequently, if learners enter school lacking the necessary prior knowledge, they are likely to continue performing below grade level as they progress through the schooling system (Perie et al., 2005; Snow et al., 1998).

Hannaford (1995) explains that everyone has the ability to learn; however, individuals learn differently and in their own unique ways. There is a vast diversity of human beings with different learning styles. The Revised National Curriculum Statement (RNCS) acknowledged these differences in learning styles. Every class is certain to

contain learners who learn and understand information different from the majority (South Africa, Department of Education [SA, DoE], 2003).

Language functions such as reading, writing and spelling, develop parallel with hemispheric dominance and they mutually influence each other (Stout, 2005). Dominance is the preference of one side of the body to the other side. According to Hannaford (1999), individuals tend to use one half of the brain more than the other. Stout (2005) explains that during childhood through to adulthood, each person develops brain dominance, which means that he or she shows the inclination to act and think in the mode of either the left or right hemisphere. The education system tends to favour learners with left-brain dominance in that this type limits creativity and relies mostly upon words and numbers. This is suggested by the finding that learners who are dominant in the left brain are generally more successful in the educational system than learners who are dominant in the right brain (Bogen, 1975; Ornstein & Galin, 1973; Wittrock & Wiley, 2008). Flora et al., (2009) sharply criticise the narrow left-brain approach in the educational system and suggest there is little allowance for a holistic approach to learning with creativity or subjectivity. Educational systems tend to neglect to consider the needs of right-brain dominant individuals, since teachers tend to teach mainly using words, whereas these learners tend to think in pictures (Freed & Parsons, 1998). This may cause teachers to diagnose right-brain dominant learners as functionally illiterate, when perhaps the learners' literacy levels could be improved if the teacher were to change his/her teaching approach.

For learning to occur, information needs to enter the brain. This information may enter the brain through the person's senses (Hannaford, 1999). We all show preferences for some senses over others. Body laterality is the tendency to favour one side of the body over the other. The most common sign of laterality in humans is right- or left-hand preference (Annett, 1998). Approximately 90% of the population is dominant in the right hand (Hugdahl, 2005). Every human has a dominant eye, which does the main focusing, a dominant ear, which listens more attentively, and a dominant leg, which for example kicks more accurately. The development of a dominant eye, ear, hand and leg occurs naturally. Some authorities advise that people should not try to change body dominance patterns, but that it may be beneficial to try to develop non-dominant parts of the body, such as the non-dominant eye or ear (Pumfrey & Reason, 1991).

Research indicates a correlation between learners with reading and spelling problems and mixed dominance, when the eye, ear and hand on the same side of the body are not dominant (Harp, 2009). Learners with mixed dominance often experience

immaturities and irregularities in laterality (awareness of left and right) which can cause perceptual, organisational and performance problems when learning to read and spell (Kokot, 2010).

1.2 PURPOSE OF THE STUDY

Reading and spelling development and performance have implications for a learners' overall success. Identifying specific factors that relate to reading and spelling ability can provide educators with the ability to target those learners who are at risk of becoming poor spellers. In this study, I[1] have attempted to gain a better understanding of the relationship between brain, eye, ear and hand dominance and the effect it may have on acquiring literacy skills. In the past, brain research suggested a possible disadvantage in Literacy skills for right brain dominant learners. However, there are controversy about the effect of eye, ear and hand dominance on acquiring Literacy skills.

Data collection and analysis in this study were guided by the following questions and sub-questions:

1. Which relationship exists between the various components of literacy (phonological awareness, reading and spelling)?
   - What is the relationship between spelling and reading skills?
   - What is the relationship between phonological awareness and literacy skills?
2. Which relationships exist between literacy skills and various body dominances in Grade 2 learners in a KZN school?
   - What is the relationship between brain dominance and literacy skills?
   - What is the relationship between eye dominance and literacy skills?
   - What is the relationship between hand dominance and literacy skills?
   - What is the relationship between ear dominance and literacy skills?
3. Which body dominance profile is associated with high literacy skills?

[1] Please take note that the researcher will write in the first person to avoid passive construction. This is recommended by a number of authorities on academic writing, such as Bak (2012).

1.3 HYPOTHESIS

There is a correlation between brain dominance, body laterality and performance in literacy skills.

1.4 RESEARCH DESIGN AND METHODOLOGY

1.4.1 The literature study

An in-depth literature study of relevant sources on these topics served as background for this study. The following key words were used while searching for information: *early literacy development*, *phonological awareness*, *spelling skills*, *reading skills*, *brain dominance*, *eye dominance*, *hand dominance*, *ear dominance* and *body laterality*. Search engines such as RSAT (SA magazine articles), EBSCOhost Academic Search Premier, ERIC database and Google Scholar were used.

1.4.2 Research paradigm

This study was embedded in the positivist paradigm with a quantitative approach. A positivist paradigm requires accurate quantitative data with precise empirical observations of individual behaviour. The data were therefore collected by means of experiments and surveys (Maree, 2010). The aim of this study was to answer questions objectively according to measurable variables in order to explain a phenomenon. In a positivist approach, the hypothesis is tested by carefully analysing the research results (Krause, 2005; Leedy & Ormrod, 2001; Neuman, 2000). A quantitative study is systematic and objective. In a quantitative study, numerical data from a selected subgroup is used to make conclusions about the group (Maree, 2010).

1.4.3 Research design

A cross-sectional survey design was used in this study. In a cross-sectional survey study, participants are tested or monitored only once. The data collected in this way provide information about the population which is limited to the period within which the research was done. The cross-sectional survey design is often used as it is much more economical than a longitudinal design. Cross-sectional surveys can describe the general characteristics of the sample at a given time. However, such studies cannot provide information about changes of the population over time, and are also less effective than qualitative studies at sensing the complexities of individual cases (McCombs & Whisler, 1997).

1.4.4 Population and sample

The total population (N=119) of Grade 2 learners in a school in the Umzinyathi district in KwaZulu-Natal was involved in this research. The school is situated in an urban area and is attended by 900 learners. It is a private primary school. Approximately half the learners are white with the remainder are approximately equally divided between being black and Indian. The teacher–learner ratio is approximately 1 for every 23 learners. All the Grade 2 teachers were appropriately qualified, and had South African Council for Educators (SACE) registration. The school is very well resourced and draws learners from an upper-middle class socio-economic background. Consent for the research was obtained from parents of all the participants as well as from the principal of the school. Consent was also obtained from the ethical committee at North-West University.

1.4.5 Measuring instruments

Eye, hand and ear dominance were determined through observations. Each learner's dominant eye was determined by asking them to focus with both eyes open on a distant point, by looking through a small hole cut out of cardboard. The participant was directed to close one eye without moving his or her head or eyes. The same procedure was repeated for the other eye. The eye that kept the focus point in the hole was accepted to be the dominant eye. Each participant was then asked to peep through an empty toilet role and a key hole in a nearby door. I assumed that the eye the participant chose to peep through these holes was the dominant eye.

To determine the participant's dominant hand, each learner was asked to write his/her name. They were also asked to pretend drinking from a cup they were given and they were asked to pretend brushing their teeth. I assumed that the hand the participant chose to use was the dominant hand.

To determine the participant's ear dominance, each learner was asked to listen to a radio playing softly across the room and to figure out what was playing. They were also asked to put an ear to a door to listen for sound on the other side. I assumed that the ear the participant chose to turn towards the sound was the dominant ear. The ear used to perform the task was accepted to be the learner's dominant ear.

Brain dominance was determined by using the Neethling Brain Instrument (NBI). Individuals had to look at a set of 20 pictures and then had to choose the picture they liked

best in every set. A standardised analysis procedure is included with this instrument and was used to determine the brain dominance profile of each participant.

All participants completed a phonological awareness test, a reading and a spelling test. The ESSI spelling test was used to determine spelling ability (Esterhuyse et al., 2002). The phonological awareness tests that were used tested segmenting, blending and deletion and were developed by Nel and Malda (2011), based on work by Schuele and Boudreau (2008).

1.4.6 Data collection procedure

Each participant was assessed to determine the dominant eye, hand and ear, after which each participant completed the Neethling Young Child Indicator (YCI) brain profile (Neethling, 2000) to determine the dominant side of the brain. Next, each participant's reading and spelling skills were assessed with the ESSI reading and spelling test (Esterhuyse et al., 2002). Thereafter, the participant's phonological awareness was tested by using real words and nonwords (Schuele & Boudreau, 2008).

1.4.7 Data analysis

Like all statistical techniques, correlation is only appropriate for certain kinds of data. Correlation works for quantifiable data in which numbers are meaningful, usually quantities of some sort (Zucker, 2011). Correlation tests were used to determine the extent of correlation between two continuous variables. A resulting r-value greater than 0,6 was accepted as a strong indicator of correlation. The correlation coefficient (or "r") ranges from -1,0 to +1,0. The closer r is to +1 or -1, the more closely the two variables are related. If r is close to 0, it means there is no relationship between the variables. If r is positive, it means that as one variable gets bigger the other gets bigger. If r is negative, it means that as one gets bigger, the other gets smaller (Zucker, 2011).

Where correlations were sought, the data were also represented graphically using a scatter plot. In each of these, each child is represented as a point. Trend lines have been added to the scatter plot to draw attention to the extent of the correlation, with a steeper gradient and fewer outlying points indicating a greater correlation strength. When the relationship between two variables, where one variable was discrete, was investigated, whether the difference between the means of the variables was statistically significant or not, was determined using a Student's t-test assuming equal variance. A p-value of less than 0,01 (greater than 99% probability of significance) was accepted as indicating

statistical significance. The p-value, short for Pearson or product-moment correlation, is the most common type of correlation. It is appropriate in quantitative data in which numbers are meaningful, usually quantities of some sort (Zucker, 2011).

In such cases, the means are represented graphically using bar graphs. In these bar graphs, error bars show standard deviation. A literacy score was calculated for each child by adding all the scores the child obtained (i.e. the scores for the spelling, reading and phonological awareness tests). This score was used as an indicator of literacy and the relevant statistics calculated, and presented in graphs in Chapter 4.

1.5 THEORETICAL REFERENTS

A number of terms and concepts were central to this study. These are mentioned in Chapter 2, together with the meanings attached to them for the purposes of this dissertation. A number of the issues central to the study are also briefly touched on, beginning with the context in which this study was situated, namely the South African national curriculum. I then discuss reading, spelling and phonological awareness, which I consider to be aspects of literacy skill. Finally, I review the literature on brain, eye, ear and hand dominance, and the influence of each on learning to read and spell.

1.6 ETHICAL ASPECTS OF THE RESEARCH

The following ethical aspects applied during this research. Consent was obtained from the Department of Education in KZN. The researcher remained detached from the participants in order to draw unbiased conclusions (Leedy & Ormrod, 2001). No child was humiliated or put under stress during the study. Consent was obtained from the principal of the school. Consent was obtained from the parents of all the participants. The identity of the learners and the school are protected and kept confidential. All information, collecting of data, findings, results and communication with lecturers were handled with accuracy and honesty.

1.7 CONTRIBUTION OF THE STUDY

In this study, I sought to understand the relationship between various body dominances and literacy skill. Such knowledge should enable educators to perform accurate and timely diagnosis of problems related to literacy.

1.8 PRELIMINARY STRUCTURE/CHAPTER DIVISION

The theoretical framework with which the research was approached is outlined in Chapter 2. In the presentation of this framework, the South African curriculum, literacy and language teaching theories, literacy skills such as reading, spelling, phonological awareness and dominance patterns of the brain, eye, ear and hand, are discussed in greater detail than has been done in this introduction. In the discussion on research methodology in Chapter 3, the research design is described and justified. This includes a description of how data were collected, analysed and interpreted, as well as a discussion of the validity, reliability and the limitations of study. Assertions are given in answer to the research questions in Chapter 4. The dissertation ends, in Chapter 5, with a summary, a discussion of the limitations of the study and suggestions of the implications of this work.

The chapters are divided as follows:

Chapter 1: Introduction

Chapter 2: Literature review

Chapter 3: Research design

Chapter 4: Data analysis and interpretation

Chapter 5: Summary and implications for research and practice

CHAPTER 2
LITERATURE REVIEW

The purpose of this chapter is to situate this study within the existing understanding of literacy development, particularly within the South African context. This provides a literature-based background to this study. The following key words were used when searching for information: *early literacy development*, *phonological awareness*, *spelling skills*, *reading skills*, *brain dominance*, *eye dominance*, *ear dominance*, *hand dominance* and *lateralization*. Search engines such as RSAT (SA magazine articles), EBSCOhost Academic Search Premier, ERIC database and Google Scholar were used. A discussion of the South African literacy curriculum is given to clarify the context of this study. Aspects of literacy, namely phonological awareness, reading and spelling are then discussed. Finally, literature about the dominance of various body parts, and the relationship between this and literacy is reviewed.

2.1 CURRICULUM

In this section, I discuss the South African curriculum, with a focus on reading in the Foundation Phase. I also refer to the problems, including tension and uncertainty, associated with the on-going change in the South African curriculum.

2.1.1 Literacy in the South African curriculum

Teaching in South African schools takes place within the framework of the National Curriculum Statement (NCS), which clearly states the goals, expectations and outcomes to be achieved in South African schools (South Africa, Department of Education [SA, DoE], 2002). The National Curriculum is also based on the vision and values of the Constitution of South Africa (Act 108 of 1996), where it is stated that basic literacy is the right of every citizen (South Africa, Department of Education [SA, DoE], 1997). The Manifesto on Values, Education and Democracy explains that every South African has the right to learn to read, write and count (South Africa, Department of Education [SA, DoE], 2001). The ability of all citizens to read and write ensures the success of any nation. The language learning area can be considered to be the most important learning area since it is foundational to all other learning areas. Without obtaining successful language skills, no other learning area can succesfully be learnt. This is why teachers should ensure that

language is used correctly across the curriculum and that sufficient time and attention be given to language (SA, DoE, 2003).

2.1.2 Historical changes in the South African literacy curriculum

Since 1994, a policy of inclusion has been practised in South African education (Engelbrecht et al., 1999). This policy states that disabled learners should be included in all aspects of life, including education (Macleod, 1995). Any learner, regardless of his or her special educational needs, may be enrolled in a mainstream school and should be taught in the mainstream environment (Kriegler & Farman, 1994). While this is a highly desirable situation in many developed countries, it presents challenges in South Africa (Henderson, 1989).

Since 1994, South Africa has been undergoing radical social, political, economic and cultural changes. These changes include the introduction of a radically different school curriculum with an outcomes-based approach. Another major change was the introduction of a single Department of National Education, replacing the 19 different education departments of the previous Apartheid-era (Chisholm, 2005). Thousands of valuable, experienced teachers resigned from teaching due to feelings of insecurity which resulted from these changes (Zinn, 2000).

Outcome-based education (OBE) was introduced into South African schools in 1997. The main purpose of OBE was to overcome the curricular divisions of the past. The new curriculum required a shift from traditional to constructivist pedagogy. A traditional pedagogy is based on an authoritarian view of teaching (Dirks, 1998). The teacher is seen as an infallible source of knowledge whose job it is to present this knowledge, mainly through direct instruction, to passive learners. In contrast, a constructivist view of teaching emphasises the importance of learners undergoing sense-making activities, by means of which they manipulate concepts, and in doing so, construct understanding (Dirks, 1998). However, the implementation did not proceed as smoothly as it was meant to, and prompted a curriculum review in 2002. A study done by Ramoroko (2006) revealed that teachers did not fully understand the assessment standards in OBE and how to work with it. Jansen et al., (1999) showed that teachers in general were very unsure about what was expected of them in the OBE curriculum. According to Chisholm (2003), the OBE curriculum had many shortcomings, such as a lack of alignment between curriculum and assessment policy and inadequate orientation, training and development of teachers. This led to the first Revised National Curriculum Statement (RNCS) Grades R–9 and the

National Curriculum Statement (NCS) Grades 10–12. The Revised National Curriculum Statement (RNCS) provided for flexibility by providing only loose guidelines for content requirements, and required that 30% of what is taught came from content not specified by the curriculum (SA, DoE, 2003).

On-going implementation challenges resulted in another review in 2009. While the review was in progress, some changes were introduced in schools. The Minister of Basic Education, Mrs Angie Motshekga, referred to these changes as “short-term, immediate changes, with long-term implications” (SA, DoE, 1996). The New Revised National Curriculum Statement (NRNCS) is now called the National Curriculum Statement (NCS) Grades R–12 and is accompanied by a Curriculum and Assessment Policy Statement (CAPS), as well as the National Protocol for Assessment Grades R–12. The National Protocol for Assessment Grades R–12 has removed the flexibility of the OBE system by stipulating exactly what should be taught, providing a tight schedule and the introduction of a First Additional Language (FAL).

Shortly before the National Curriculum was reviewed a second time, The Foundations for Learning Campaign was introduced. This comprised a four-year campaign to create a national focus to improve reading, writing and numeracy abilities of all South African children’ (South Africa, Department of Education [SA, DoE], 2008). One of the objectives explained in the Foundations for Learning Campaign document was to get all South Africans involved in the drive to get children writing, reading and calculating at age-appropriate levels by 2011. The campaign also aimed to ensure that average performances in Literacy and Numeracy in all primary schools would not be less than 50% by 2011 (SA, DoE, 2008). However, these goals have not been met (South Africa, Department of Education [SA, DoE], 2011).

In January 2012, the Curriculum and Assessment Policy Statement, Grades R–12 (CAPS) was introduced in the Foundation Phase in all South African schools. There appears to be a general weariness amongst teachers related to the continual changes the system has been through over the last ten years. It is time-consuming to study the new curriculum documents, implement the changes, and adapt all documentation to fit into the new stipulations. Another huge concern is that First Additional Language (FAL) has now been introduced in Grades 1 to 3. This requires 2–4 teaching hours a week. In the past, teachers felt they did not have enough teaching time for Home Language, which contributed to the poor reading achievements in South Africa. Teaching Home Language will now have even less time.

2.1.3 Inadequate implementation of the literacy curriculum

Despite the stress that the South African curriculum places on literacy, it appears that successful implementation of the curriculum is limited. A number of recent reports about reading demonstrate that South African schools, in general, are experiencing a reading crisis, with large numbers of children failing to learn to read successfully. For example, the South African Department of Education (SA, DoE) found that 54% of Grade 3 learners assessed below their chronological age reading competency (SA, DoE, 2002). The Department of Education (DoE) in the Western Cape voiced its concern and stated that the reading problem should receive serious attention, especially in the foundation phase (South Africa, Department of Education [SA, DoE], 2006). In 2003, another systemic evaluation was performed country-wide in the Foundation Phase and produced the following results in two components of literacy. The average achievement for listening comprehension was 68%, and for writing, 39%. The Minister of Education at the time, Professor Asmal, voiced his concern that the curriculum did not explicitly mention the need for students to know how to read and write (Asmal, 2003). In 2006, the South African Department of Education revealed the disturbing fact that 61% of South African learners still could not read by the end of Grade 3. Results of a systemic evaluation that was undertaken in 2007 revealed an alarmingly low mean of 36% for literacy in Grade 3 learners.

The gap between the idealised curriculum and the poor literacy results can partly be understood in terms of challenges South African teachers face. Perhaps the most obvious of these is the fact that there are eleven official languages in South Africa and therefore a large percentage of learners are in fact multilingual speakers who do not have English as their first language. The term currently used to refer to these learners who are learning in English, rather than in their mother tongue, is *English as Additional Language* (EAL) *speakers*. English is the language of learning and teaching (ELLT) for many South African EAL learners (De Witt et al., 1998). While first language instruction remains the ideal, it is not practically possible and this is believed to contribute to learning barriers in learners (Macleod, 1998). Many non-mother tongue learners have been found to experience difficulty in all areas of reading (De Witt et al., 1998) and this has major implications in the South African education system. Learning to read is a complex task and is made more difficult if the learner is acquiring more than one language at the same time (Yavas & Goldstein, 1998). There is limited research regarding which levels of proficiency actually constitute multilingualism (Gutierrez-Clellen, 1999).

South African teachers face other challenges in addition to multilingualism. According to Engelbrecht et al. (1999) these include not being trained to deal with special learning needs, large class sizes, and a lack of special needs support. There is a need to adequately identify learners who are at risk of developing reading and spelling difficulties, so as to be able to provide early interventions to these learners (Gilbertson & Bramlett, 1998). In order to improve reading skills the possible causes of the reported poor achievements need to be identified and addressed (De Witt et al., 2008). However, faced with the challenges discussed above, it is hardly surprising that South African learners' performance falls short of that envisioned in the curriculum documents.

2.1.4 Summary

In this section, I have described the constant changes in the South African curriculum as well as the reading crisis that exists in South African schools among Foundation Phase learners. The challenges these changes provide have probably contributed towards the gap between the ideals laid down in the curriculum and the poor literacy results observed in general in South African schools. With this study, I sought to add to existing knowledge about factors contributing to poor literacy levels in learners. In this way, I hope to contribute to attempts to improve literacy learning amongst South African learners. It is therefore necessary to turn our attention to a discussion on literacy and the acquisition of specific literacy skills such as phonological awareness, spelling and reading skills.

2.2 LITERACY AND LANGUAGE

In this section, I discuss a number of aspects, which are central to literacy and language development. I discuss what literacy is and why it is important, how literacy is developed, and various theories of literacy learning and teaching.

2.2.1 Definitions

Definitions of literacy usually include a component of ability with language and the power this gives the individual to participate within society. Examples include the definition given by the National Assessment of Adult Literacy (2003), according to which literacy is the use of printed and written information to function successfully in society, to achieve personal goals, and to develop personal knowledge and potential. The UNESCO (2003) definition states that literacy is the ability to identify, understand, interpret, create,

communicate and compute thoughts by using print and written materials associated with varying contexts.

Literacy involves the integration of speaking, listening and critical thinking with reading and writing (Williams & Snipper, 1990; Winch et al., 2001). As suggested by these definitions, literacy is closely linked to language. Definitions of language include that language is a body of words and the systems for their use which are common to people who are of the same community, culture, tradition or nation, and possibly the same geographical area (Random House Dictionary, n.d.).

2.2.2 Why is literacy so important?

Approximately 50 years ago the United Nations Educational, Scientific and Cultural Organization declared literacy to be a basic human right (UNESCO, 2000) along with other basic rights such as food, water, housing and health care. The development of literacy skills forms the foundation of all academic achievement (Washington, 2001). According to UNESCO (2003), the ability to read and write is the basis and the heart of all other education. Literacy is a human right and a tool to empower oneself to develop mentally and socially. It is a powerful weapon in the never-ending struggle between success and failure. Without the ability to read, write or do maths, it is impossible to take part in a democratic society and to live according to the Constitution of our country (SA, DoE, 2001). Finally, developing solid literacy skills in the people of a country is the secret to economic vitality and prosperity.

Millions of people worldwide hide behind the dark veil of illiteracy (World Literacy Foundation, 2012). According to the World Literacy Foundation (2012, p. 7), “One in five adults cannot read this sentence.” For the literate, it is taken for granted that one is able to perform activities such as filling out a job application, reading a sign or a map, understanding a doctor’s prescription or even helping children with homework. However, the shame and humiliation experienced by the illiterate, when they are unable to perform these activities, is beyond description. The illiterate will experience difficulty in all spheres of life and will not reach their full potential as individuals and citizens. Without literacy, it is difficult to take part in the world surrounding us. With the development of technology and more and more uses and functions for literacy, children need to achieve ever higher standards of literacy to “be literate” and to gear them for a very fast-developing society.

Another concern about illiteracy is that illiteracy is closely related to crime. Research suggests that two-thirds of learners who cannot read proficiently by the end of

the 4th grade will end up in jail or on welfare (Moats, 2000; Bellamy, 1999; Campbell et al., 2001; UNESCO, 2003; Write Express Corporation, 2011). Maugin and Loeber (1996) suggest that there is a link between reading failure and crime. Beatty et al. (2001) found that over 70% of inmates in America's prisons cannot read above a fourth-grade level. Children who have difficulty acquiring sufficient language skills are at an increased risk of social, emotional and behavioural problems (Rvachew, 2006). If children struggle to express themselves and understand others, it is not surprising that psychosocial and emotional adjustment problems ensue.

2.2.3 Learning literacy

In order to understand the South African reading crisis and how it might be alleviated, we need to understand how people develop literacy skills. In order to do this, we need to understand how people learn in general, and how people learn literacy skills, in particular. Research literature abounds with theories and studies about how people learn (Dirks, 1998; Piaget & Inhelder, 1969; Lombardi, 2011; Clay, 2005; McGee & Richgels, 1990; Santrock, 2004). These include constructivist learning theories, cognitive psychology, socio-cultural and ecological perspectives, and recent brain research. Each of these is discussed below, together with implications of these theories to informing how teachers should teach to support effective learning.

Constructivist learning theory

According to constructivist learning theory, learners learn as they actively make sense of new information, rather than by passive absorption of information (Dirks, 1998). Piaget (1945) pioneered the constructivist idea of building knowledge through experiences. Piaget and Inhelder (1969) explain that there are two separate channels (auditory and visual) for processing information. Learning is an active process of filtering, selecting, organising, and integrating information received through these two channels. Dewey (1969) as well as Piaget and Inhelder (1969) recognised the value of experiences that played an important role in expanding learners' mental structures. They suggested that learners constantly adjust their view of how things work, based on new auditory and visual experiences and reflections about those experiences. Dewey, Montessori, and Kolb (Cooperstein & Weidinger, 2003) represent the constructivist learning theory where experiential learning occurs through real-life experience to construct knowledge. A mentor guides the mature learner in the learning process (Lombardi, 2011).

Bruner (1960) was one of the founding fathers of constructivist theory. Constructivism is a broad conceptual framework with numerous perspectives. Bruner's theoretical framework was based on the theme that learners construct new ideas or concepts based on existing knowledge and that learning is an active process. During the 1940s, Bruner's early work focused on the impact of needs, motivations and expectations and their influence on perception. Cognitive and socio-cultural learning theories can be consistent with constructivist learning theory. These are discussed below.

Cognitive theories of learning

Cognitive theories of learning attempt to understand tacit mental (cognitive) processes. They assume that people learn from one another through observation, imitation and modelling. The teacher's thinking must be made visible to the students and the student's thinking must be made visible to the teacher. Two very influential cognitive theorists in this regard are Jean Piaget and Jerome Bruner (Clay, 2005; McGee & Richgels, 1990).

Piaget's (1955) research on children's development led him to propose that children progress through four cognitive developmental stages extending from birth to the acquisition of language as is presented in Figure 2.1 (Piaget, 1957). These stages are the sensorimotor, preoperational, concrete operational and formal operational stages. In the sensorimotor stage, infants construct an understanding of the world by seeing and hearing together with physical actions. Children also develop an understanding that objects continue to exist even when they cannot be seen, heard or touched (Santrock, 2004). The pre-operational stage succeeds the sensorimotor stage, and begins around two years of age. Intelligence is demonstrated through the use of symbols, images and drawings. Language use matures, and memory and imaginations are developed. The child assumes that others see situations from his or her viewpoint. Pre-operatory thought is developed, which refers to any procedure for mentally acting on objects. This is followed by the concrete operational stage, which occurs between the ages of 7 and 11 years and is characterised by the appropriate use of logic. The final stage is the formal operational period, which commences at around 11 years of age and continues into adulthood. In this stage, individuals move beyond concrete experiences. They begin to think abstractly, reason logically and draw conclusions from the information available. Children begin to consider possible outcomes and consequences of actions and develop problem-solving skills (Ginsburg & Opper, 1979; MacLeod, 1995, 1998; Piaget, 1936, 1945, 1957; Santrock, 2008a).

Piaget's theory has been investigated in the context of literacy learning (Bereiter, 2002; Brow et al., 1989; Cobb, 1994; Dirks, 1998). These authors agreed that children form connections that link written words, and their meaning and different connections predominate at different stages of development. In the beginning, learners start with recognising different sounds. In the next stage, they may learn the symbols (written letters) for the sounds. Thereafter, they may recognise that words are made up of sounds and that the letters represent the sounds in the words. The words start off easy as two- and three-letter words but become longer and more difficult as the learner progresses through the stages. The final stage should possibly be the reading with comprehension stage.

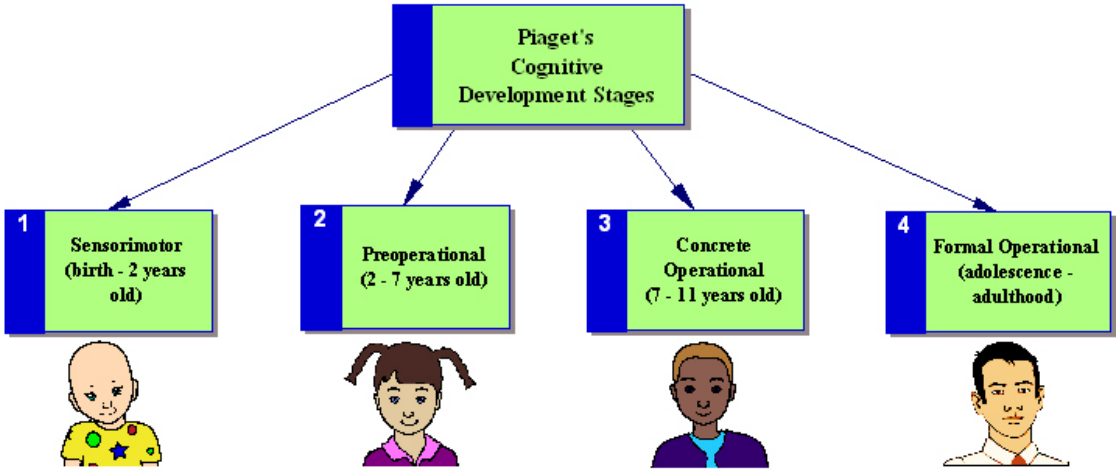


Figure 2.1 Schematic representation of Piaget's four cognitive developmental stages (Piaget, 1957).

Bruner (1961) also looked at the development of human cognition. He opposed the fatalistic view, presented by Piaget (1955) that children in certain stages are unable to perform certain mental tasks. Instead, he presented the point of view that children are capable of much more than what the average adult expects from them. He explained that they are active problem solvers and capable of dealing with complicated tasks and subjects. Bruner and Goodman (1947) suggested that children's cognitive development can be speeded up. This was widely divergent from the dominant views in education at the time, but found an audience. Bruner also differed from Piaget in that Bruner leant more strongly towards the influence of the social and cultural environments on learning. This was due to Bruner being influenced strongly by Vygotsky's writings (Vygotsky, 1962). Bruner and Postman (1949) argued that aspects of cognitive performance are facilitated by language. They stressed the importance of the social setting in the acquisition of language. Their views were similar to those of Piaget (1945) but he placed more emphasis on the social influences on development. Unlike Piaget, however, Bruner (1960) argued that social factors, particularly language, were important for cognitive growth. Bruner

suggested that different ways of thinking (or representation) were important at different ages (Cazden, 2001; Gardner, 2001; Smith, 2002).

Piaget (1957) also introduced the concepts of *accommodation* and *assimilation*. Assimilation describes how humans accept new information that fits comfortably into their pre-existing cognitive structures. Accommodation, unlike assimilation, is the process of altering one's pre-existing cognitive structures so as to be able to accept new information which conflicts with prior knowledge (Gruber & Voneche, 1995; Mussen, 1983; Piaget, 1955; Santrock, 2008b). Constructivists such as Kirschner et al. (2006) and Mayer (1988) support accommodation and assimilation and promote the information processing model (IPM) of learning, which is discussed below. These constructivists suggest that learning is more effective when a student is actively engaged in the learning process rather than attempting to receive new knowledge passively.

The information processing model (IPM) of learning

The IPM's main value is the attention it draws to the role of the limited capacity of short-term memory in learning. Figure 2.2 below, taken from Mayer (1988), summarises the IPM. The figure explains that the IPM is inappropriate for teachers to provide a large amount of information or complex problems to learners without providing some support to minimise the load on the working memory. As illustrated in this model, some of the information presented to a person's short sensory memory (SM) is selected by attention being paid to it, and this is passed on to the short-term memory (STM) where it is easily lost after a short time if not rehearsed or linked. During rehearsal, links are formed within the components of this new knowledge. While the new knowledge is in the STM, pre-existing knowledge may be accessed from the long-term memory (LTM) and, during a process of comparison and evaluation, transformations may occur either in the new knowledge or the pre-existing knowledge, or in both. Links between new and prior knowledge are formed. The new knowledge may then be stored in the LTM within a knowledge schema. This may be accessed and brought into the STM for output when needed (Goleman, 1995; Higbee, 1993).

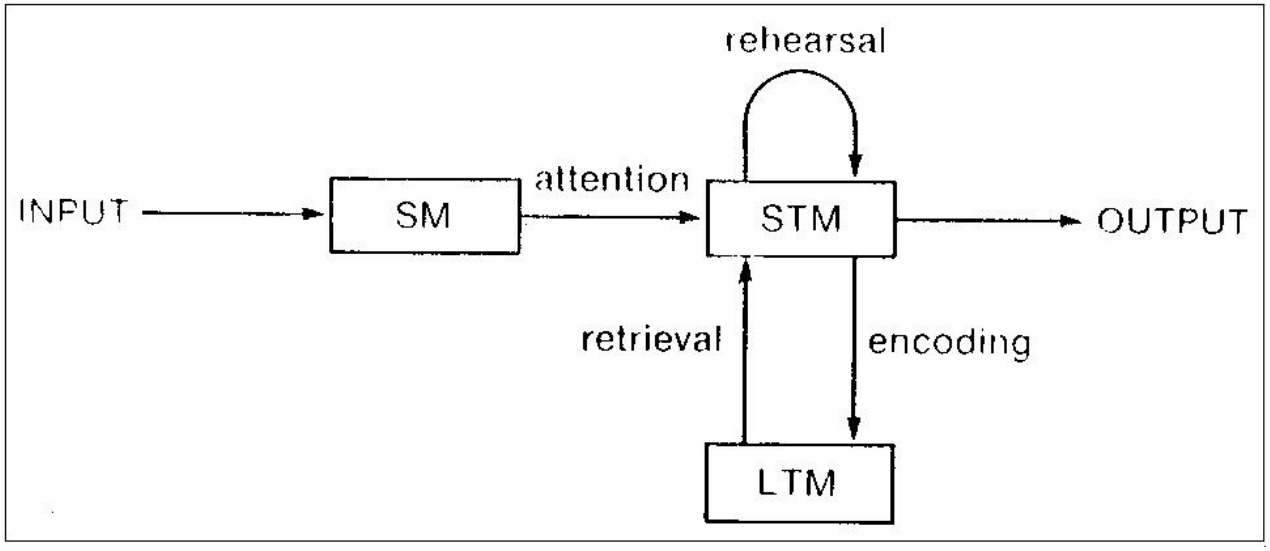


Figure 2.2 Schematic representation of the human information processing system (Mayer, 1988, p. 15).

Socio-cultural and ecological learning perspectives

Perhaps the most prominent contributor to socio-cultural theory is Vygotsky (1978). Vygotsky largely focused on the connections between people and the socio-cultural context within which they act and interact. In his theory of the zone of proximal development, Vygotsky proposed that learning occurs when learners engage, in a social setting, with tasks that are too difficult for them to manage without social interaction (Crawford, 1996). According to Vygotsky (1978), speech and writing are tools that humans develop from a culture. They use these tools mainly for social interaction and ways to communicate needs. However, Vygotsky believes that the internalisation of these tools leads to higher thinking skills.

Consistent with Vygotsky, Bronfenbrenner (Bronfenbrenner, 1979, 1986, 1990, 1994) maintains that interactions with others and the environment are keys to development. Bronfenbrenner extends Vygotsky's views by arguing that one should consider the entire ecological system within which growth occurs in order to understand human development. This ecological system is composed of five socially organised subsystems that help support and guide human growth. These are the micro-, meso-, eco-, macro- and chromo-systems. The micro-system refers to the immediate environment closest to the child, with which the child has direct contact. This includes the child's family, classroom, peer group and neighbourhood. Berk (2000) explains that, at this level, relationships have an impact in two directions, both away from the child and towards the child. These interpersonal attributes greatly affect how an individual perceives him or herself (Gregson, 2001). The meso-system refers to the interaction of two micro-system environments: the connection between a child's home and the school system. This layer

provides the connection between the structures of the child's micro-system (Berk, 2000). These organisational or institutional factors shape the environment within which the individual and interpersonal relations occur (Gregson, 2001). The eco-system refers to the layer that defines the larger social system within which the child does not function directly. Parent workplace schedules or community-based family resources are examples. The child may not be directly involved at this level, but he or she does feel the positive and negative forces involved in the interaction between the eco-system and his or her own system (Berk, 2000). The macro-system refers to the layer that may be considered the outermost layer in the child's environment, not solely geographically or physically, but emotionally and ideologically as well. While not being a specific framework, this layer is comprised of cultural values, customs and laws (Berk, 2000). Bronfenbrenner (1979) also claimed that the richer the medium for communication in this system, the more influential it is on the micro-system. The chronosystem encompasses the dimension of time as it relates to a child's environments. Elements within this system can be either external, such as the timing of a parent's death, or internal, such as the physiological changes that occur with the aging of the child. As children get older, they may react differently to environmental changes and may be more able to determine more how such changes will influence them.

Bronfenbrenner (1990) recognised the instability and unpredictability of family life, since people's physical and emotional health are all the time at risk. Addison (1992) suggests that such instability may result in a failing economy and therefore, the instibility and unperdictability may be a most destructive force in a child's development. Children look for affirmations in the relationships with prominent adults in their direct environments, and if they do not find the attention they are looking for, they will look for attention in inappropriate places (Bronfenbrenner, 1990). Schools and teachers should work to support the primary relationship occurring within children's homes. Schools should create an environment that welcomes and nurtures families. Vygotsky's (1978) sociocultural theory and Bronfenbrenner's (1986) ecological theory both emphasise that interactions between people, as well as interactions between people and their environments, influence learning.

Many studies have examined the effects of the quality and style of parent–child interactions on children's development and functioning (Berk & Spuhl, 1995; Klein & Alony, 1993; Magill-Evans & Harrison, 2001; Mahoney & MacDonald, 2003; Mahony et al., 1998; Tzuriel & Weiss, 1998; Zambrana-Ortiz & Lidz, 1995). These studies support Vygotsky's concept of the zone of proximal development, and his thinking on cognitive construction

and reconstruction through human social interactions. Perez (2004) and Compton-Lily (2006) agree that literacy is situated socially and culturally and motivate that a socio-cultural theory of literacy should be taken into consideration when teaching literacy. The socio-cultural backgrounds of children influence how children interpret and process language through their own perspectives and experiences of the world around them. The differences in the home environment influence the development of children's listening, speaking, reading and writing and therefore contribute to children's language and literacy acquisition. Washington (2001) and Reese and Gallimore (2000) pointed out that children from certain ethnic and low-income backgrounds are especially at risk for poor literacy outcomes. They support Vygotsky's theory that the differences in perceptions of appropriate literacy events cannot be culture- or context-free (Vygotsky, 1978). Children may either benefit from their home environment or their learning may be hampered (Goin et al., 2004; Hammer & Miccio, 2004). Further studies (Britto & Brooks-Gunn, 2001; Britto et al., 2006) indicate that the development of literacy at home and strategies which help children to stay motivated to learn, affect children's school readiness. The child needs informative feedback in the form of praise and encouragement, which will influence the learning experience positively. The objective is to produce within the child the expectancies of success, which will enhance the child's cognitive development (Lidz, 2003).

Wearmouth (2004) suggests that a healthy literacy environment at home, such as cooperation, increases social functioning in children and enhances effective communication. A healthy literacy environment forms the basis for a positive socio-emotional adjustment at school (Ortiz, 2004; Snow et al., 1998; Weigel et al., 2005). However, cultural and linguistic differences in the home are not the only factors that influence the acquisition of literacy skills (Reese & Gallimore, 2000). These theories contribute to explaining how children learn, develop and perceive concepts in collaboration with adults and children in and out of school (Ortiz & Ordonez-Jasis, 2005).

Brain research

The way the brain processes new information is affected by genetic, physical, social and environmental factors (Auger & Rich, 2007; Jensen, 2000). Activities and stimuli support neural pathway development. Healy (1987) points out that the more you train your brain in thinking and learning, the more capable it becomes. If neurological pathways in the brain that connect ideas are not used, they become inactive and limit brain function. It

is therefore of utmost importance to expose the brain to complex thinking strategies (Wolfe, 2001).

Chomsky (1965, 1986, 2000) suggests that a child's performance corresponds to the processes that implement competence in his or her brain. Performance is hampered by physiological limitations such as memory and time. Furthermore, spoken language is often considered as a degraded version of language, due to the existence of psychological limits of the human brain (Goldberg et al., 2006; Martin, 2007). Many studies support the fact that language processing triggers brain activity in sensory-motor areas (Aziz-Zadeh et al., 2006; Boulenger et al., 2006; Buccino et al., 2005; Goldberg et al., 2006; Hauk et al., 2004; Martin et al., 1996; Oliveri et al., 2004; Pulvermüller, 2005; Tettamanti et al., 2005).

The human brain shows dramatic growth in size during the first five years of life, from about 25% of adult size at birth, to 90% by age 5 (Shore, 1997). This size change is accompanied by increased brain tissue and an increase in the speed of neural transmission (Jensen, 1998; Wolfe, 2001). This latter research provides valuable information on identifying the best timing of when to introduce teaching for ultimate learning and brain development.

2.2.4 Teaching literacy

Learning theories describe how people learn (Dewey, 1969). Theories of teaching suggest how teachers should teach in order to promote effective learning (Skunk, 1996). I will now discuss various theories about teaching in general, as well as literacy teaching in particular. Research studies have shown that young learners perform better when the above-mentioned language skills are taught and integrated in the classroom (Xue & Meisels, 2004). The amount of teaching and instruction time spent in the classroom greatly influences learner performance (McKeown & Beck, 2004).

Further crucial elements for the development of basic reading skills are the integration of letter-sound knowledge and phonetic skills (Oudeans, 2003). A child's knowledge of letter names is a very accurate predictor of beginning reading and alphabet knowledge (Adams, 1990; Honig, 2001). After children have gained letter-sound knowledge, they are able to connect each letter with an individual phoneme (sound) and begin sounding out words (Dodd & Carr, 2003). A child with fluid recognition of letters will find learning about letter sounds and word spellings easier than a child who lacks this skill (Wood & McLemore, 2001). Knowledge of the letter-sounds are the foundation skill for

early literacy because it improves visual sound and word recognition and allows children to bridge the gap between a visual cue and a phonemic cue (McKeown & Beck, 2004).

Appropriate assessment and early intervention in literacy may solve a large proportion of the learning difficulties concerned with the attainment of literacy skills. Unfortunately, some teachers may misinterpret assessments due to a lack of knowledge and experience. They may choose inappropriate activities for assessment, possibly of an inappropriate difficulty level. They may also provide unintentionally confusing instructions and give inappropriate feedback to learner's errors (McCutchen & Berninger, 1999; Moats, 1994, 2000). Metacognition also needs to be taught explicitly. Metacognition refers to the integration of skill and will, the level of learners' awareness of the skills they have at their disposal to address a problem (Zohar, 1999). Unfortunately, many teachers themselves do not understand metacognition.

Many teachers expect all learners to learn in a specific way. Most teachers will explain new learning material in a certain way and learners who do not understand the information are often viewed as inferior instead of merely learners with different learning approaches (Harp, 2009). The education system also forces teachers to teach with a left-brain approach in mind, regardless of many right-brained learners in the schools (Hannaford, 1999). Unfortunately, most teachers do not have the knowledge, experience, time or motivation to accommodate learners who do not learn in the same manner as the majority of learners (Hannaford, 1999). Further studies have documented a relationship between teachers' disciplinary knowledge and the literacy achievement of their students (McCutchen et al., 2002; Moats & Foorman, 2003; O'Connor, 1999).

All learning groups are made up of people with different thinking style preferences, different ways of knowing and different learning styles. Effective learning is whole brained, taking advantage of all the mental processes of the brain. Teachers typically tend to design learning experiences that reflect left-brain thinking and learning preferences since text books and learning materials are also developed with the left brain in mind (Harp, 2009; Neethling, 2000). However, the design and delivery of each lesson should be whole-brained to meet the diverse learning and thinking styles of the learners (Herrmann, 1996; Jensen, 2008).

Therefore, teachers should choose their activities carefully in order to accommodate all the different types of learners in their classes. The RNCS envisions teachers to become specialists in their phases (SA, DoE, 2003). Teaching is a highly complicated process that

requires experience working with different learners, and knowledge about how to use different teaching methodologies to address the needs of those differences in learners (Goldberg, 2001). Each teacher should take full responsibility for the learners in his or her class and make sure they master the literacy skills to the best of their abilities since the ability to read and spell competently is the vehicle which transports the learner into the world of learning (Cockcroft, 2008).

Learner-centred instruction

Bruner's (1996) ideas of using concepts, experiences and meaning to motivate children to learn, with consideration to socio-cultural contexts indicate his agreement with Piaget and Vygotsky. He supports co-operative learning methods and social interactions as more efficient ways for students to construct knowledge. These learning theorists view teaching and learning as a very complex, interactive activity that cannot be standardised for all individuals.

In the constructivist classroom, the focus tends to shift from the teacher to the learners. The classroom is no longer a place where the learners sit with their arms folded, looking at the teacher and listening without interruption or even movement. The teacher no longer pours knowledge into passive students like into empty vessels to be filled (Bain, 2004; Kirschner et al., 2006). Rote memorisation is no longer seen as the ultimate method of learning. In the constructivist classroom, the learners are motivated to be actively involved in their own process of learning. The teacher functions as a facilitator who coaches, mediates, prompts and helps learners develop and assess their learning. Learners learn more, and enjoy learning more when they are actively involved, rather than just being passive listeners. Constructivism concentrates on learning as a way to think and understand and promotes social and communication skills (Mayer, 2004).

Learner-centred instruction integrates the understanding of knowledge, skills and attitudes, which learners bring to the classroom. It encourages attitudes conducive to effective learning (Bransford et al., 2000). Learning is unlikely to be effective, unless instruction is sensitive to learner diversity. Teachers should be sensitive to the socio-cultural backgrounds of the children they teach as suggested by Vygotsky's theory since these backgrounds affects learners' attitude towards intelligence (Bransford et al., 2000). The teacher's response to this variety in learners affects classroom climate, which in turn, affects motivation (Pintrich & Schunk, 2002). Research also shows that learning is enhanced in contexts where learners have supportive relationships, have a sense of

ownership and control over the learning process, and can learn with and from each other in safe and trusting learning environments (McCombs & Whisler, 1997).

Vygotsky's theory promotes learning contexts in which students play an active role in learning. Roles of the teacher and learner are in a certain sense shifted, since a teacher should collaborate with the learners to help facilitate meaningful tasks which learners can grasp comfortably (Wertsch & Sohmer, 1995). Vygotsky observed that when children were tested while doing tasks on their own, they rarely did as well as when they were working in collaboration with an adult. The process of engagement with the adult enabled them to refine their thinking to become more effective. For Vygotsky (1962), the development of language and articulation of ideas was central to learning and development.

2.2.5 The acquisition of literacy

Even before young children are able to read, they develop many skills that can help prepare them for acquiring literacy skills. They develop vocabulary and speech naturally through exposure to language. They gain knowledge about the names of the alphabet letters and normally come to realise that words are read from left to right. They learn to use letters in recurring letter patterns to spell and read (Treiman, 2000). To develop reading and spelling skills and phonological awareness, learners need explicit instruction starting with simple examples, concepts and exercises and then progressing through more and more challenging examples and concepts. Research suggests that the acquisition of early-language skills have an influence on later successful reading (Rvachew, 2006). Children do not necessarily operate in only one manner at any particular point in time. When given the proper cues, children who are learning to read should be able to use phonetic information to link print to speech (Bowman & Treiman, 2002; Rack et al., 1994; Treiman & Rodriguez, 1999; Treiman et al., 2001).

2.2.6 Summary

The main idea gathered from all the different theories to learning is that a child's learning is influenced by different aspects as he/she matures into adulthood. According to Vygotsky (1978) and Bronfenbrenner (1994), the interactions the child experience with people as well as the environment influence his or her learning. Piaget (1936) and Bruner (1960) stress that children learn through observing people around them and through imitating these people. Children also need mediators to guide them in their learning process. Piaget (1955) Bruner (1961) and Vygotsky (1978) agree that people construct new ideas and concepts based on existing knowledge. Thinking is based on the use of

mental images, which are received through sight, hearing, smell and touch. The messages received through the eyes, ears, nose and touch are processed in the brain.

2.3 READING

In order to teach reading, it is important to understand exactly what reading is. Reading is not just pronouncing words correctly. The key to successful reading is in its application or comprehension (Walker, 2000). I will review reading acquisition as well as components of reading such as reading fluency and reading comprehension.

2.3.1 Definition

On the surface, reading is simply the understanding of a written language. However, implementing strong reading skills requires much more than surface knowledge (Byrne, 1992; Ramsden et al., 1989). Not knowing how to read and write carries a stigma across race, class and gender lines (Naicker, 1999). Reading is an active process which requires the use of multiple skills simultaneously (Walker, 2000). Spache and Spache (1969) explain that the reading process begins with word recognition. The reader directs his/her attention to the print with the intention of making meaning from the print. The shape of the word, its sound and its meaning are interpreted in the brain and connect with previous mental associations. With the aid of these associations, the reader discriminates words using clues of general configuration, distinctive characteristics of the shape, some of the letters or syllables, and the implications of the sense of the sentence. According to De Jager (2006) reading is the decoding, interpreting and understanding of printed marks on paper. Reading is a complex behaviour requiring the acquisition of a number of perceptual, cognitive and linguistic abilities (Catts & Kamhi, 1987). According to PIRLS (2006), reading is a constructive and interactive process. Brinkley and Kelly (2003) agree with this statement and explain that a skilled reader actively constructs meaning from a text, and uses effective reading strategies. Skilled reading is identified as accurate, automatic word reading with understanding (Adams, 1998; Stanovich, 2000). Dubin and Bycina (1991) explain reading as a selective process taking place between the reader and the text, in which background knowledge and various types of language knowledge interact with information in the text to contribute to text comprehension. Grabe and Stoller (2002, p. 17) view reading as “the ability to understand information in a text and interpret it appropriately”.

2.3.2 Reading acquisition

Over the last few decades, there has been a significant increase in scientific research about early reading acquisition and reading difficulties with crucial implications for the teaching of reading across the world (Adams, 1990; Blachman, 1997; Browne, 1998; Gough et al., 1992; Lane et al., 2002; Perfetti, 1985; Stanovich, 2000). The average learner learns to read during the first years at the primary level of education. Consequently, one of the main goals of learning in the elementary school classrooms is each learner's acquisition of the ability to read efficiently, since all other educational goals depend on the learner's ability to read. According to De Witt et al. (2008), the importance of the development of early literacy is emphasised. A good foundation in reading is basic to all academic learning. It enables the learner to progress through life with enjoyment and confidence (Maree & Ford, 1998). If a learner cannot read and comprehend written language successfully, he or she may experience a disadvantage in all other content areas (Decker, 2007; McConnell & Rabe, 1999). According to Cummins (1984), a certain level of linguistic proficiency is necessary for academic achievement. Learners who can read fluently are therefore more likely to be able to overcome academic challenges, than those who struggle to read. Therefore, the teacher needs to be highly skilled in his/her ability to teach reading (Singh, 2009). Effective learning in the classroom depends critically on the teacher's ability to give effective instructions, maintain the interest of the learners and to keep them motivated (Ericksen, 1978). This is consistent with Vygotsky's (1962) view that meaningful learning requires social mediation since it occurs within the zone of proximal development (ZPD), where learners engage with concepts and skills too difficult for them to master without social mediation.

It is commonly believed that encouraging the learner's engagement in independent reading will facilitate reading skill development. However, the National Reading Panel (2000a) concluded that most studies in the past failed to find a positive relationship between the amount of reading a learner does independently and how well the learner is able to read. There is also little evidence of a strong direct relationship between the amount of storybook reading to the learner and the learner's own reading development (Evans et al., 2000; Senechal et al., 1998). Research points to the importance of directing the learner's attention to the print itself. Young learners prefer looking at pictures and rarely look at the print when they are being read to (Evans & Saint-Aubin, 2005; Levy et al., 2006). Furthermore, when learners have a limited but meaningful choice about the learning activity, such as which part of a text to read, they invest greater energy in learning than when the tasks are always prescribed by the teacher (Turner & Meyer, 2000).

McGee and Schickedanz (2007) studied reading stories aloud as a language development tool, and found that simply reading stories aloud is not enough to expand vocabulary in the early grades. Reading stories aloud should be integrated with comprehension skills, vocabulary, knowledge of story structures, and concept development. Therefore, students and teachers should engage in analytic conversation throughout the reading-aloud activities. The teacher should allow for practice of reading comprehension skills, such as making connections and predicting. It is also important that the teacher pause briefly to explain word meanings or phrases in context. Dramatising is also an important skill that should be role modelled by the teacher (Samuels, 2006).

Among other abilities, successful reading requires an ability to decode unfamiliar words. In other words, the learners should be able to break the words up to make sense of them. The learner should also be able to use word attack skills, and understand language structure (Honig, 2001). Word attack skills are skills needed to be able to make sense of an unknown word in the context of reading and rely on the ability to recognise the sounds that make up words and to put those sounds together (Nuttall, 1982).

2.3.3 Components of reading

The National Reading Panel identify five components of reading such as phonemic awareness, phonics, fluency, vocabulary, comprehension and many more. However, for the purpose of this study, reading fluency, comprehension, vocabulary and word recognition were addressed.

Reading fluency

Fluent reading requires rapid and accurate word recognition, but it is more than accuracy and speed (Samuels, 2006). Some authorities suggest the inclusion of expressiveness such as pitch changes, pause length, frequency and appropriate stressing of words (Schwanenflugel et al., 2004). In their study, Schwanenflugel et al. (2004) found a link between decoding speed, expressiveness and comprehension, but there was little evidence that expressiveness mediated comprehension. Bowers (1993) found that the speed with which learners name letters and digits is related to text-reading fluency. Learners who are slow to name letters are likely to be slow readers. These learners take so long to process single letters that they never get to form larger spelling patterns. Fluent readers automatically activate these larger letter patterns enabling faster whole-word reading. Sight word efficiency is an accurate indication of reading fluency (Torgesen et al., 2001). We know that fluency is generally associated with comprehension, although some

learners show adequate fluency but poor comprehension (Johnson et al., 2008). Speed, accuracy, expressiveness and comprehension are measures of fluency (Bouers, 1993). De Jager (2006) stresses the importance for a learner to be able to cross the midline of the body in order to become a fluent reader. When a learner is able to cross the midline, he/she is integrating the left and the right hemisphere of the brain. This is essential for optimal learning to take place. Poor midline crossing ability may result in difficulty when reading and writing since the eyes continually jump back to the midline when trying to cross the midline.

Comprehension

Comprehension refers to a clear understanding of what is read at the levels of literal meanings, implied meanings, and possible applications even beyond the author's meanings (Spache & Spache, 1969). Comprehension requires the reader to draw on previously learned knowledge and to rely on word meaning, ideas, and reasoning. The RAND Reading Study Group (RRSG) (2002) defines reading comprehension as the process of simultaneously extracting and constructing meaning through interaction and involvement with written language. Maharaj (2007) stresses that teachers should pay special attention to comprehension when teaching reading. The end goal of the process of learning to read is comprehension. In order to comprehend a reading selection, accomplished readers rely on two sources of meaning: individual words and the passage as a whole. Honig (2001, p. 17) claims that "the key to unlocking meaning start with the automatic recognition of each written word, which brings the meaning of that word to consciousness".

Vocabulary

Vocabulary is a crucial part of language learning, and accelerates through exposure to print, at all stages of reading development. Stahl and Nagy (2006) describe the reading comprehension and vocabulary connection as inclusive. They suggest that learners who have better vocabulary will be better readers and will make more sense of reading passages than learners with a poor vocabulary. Allington (2001) stresses that it is essential for learners to be allowed to select their own text in order to keep them motivated to read. The use of think-aloud strategies to build comprehension and vocabulary can assist students to expand their comprehension skills which may be practiced during silent reading (Wilhelm, 2001). To speak one's thoughts aloud creates an opportunity for

correction if necessary. It also assists the learner in organising his/her thoughts. This strategy is supported by Vygotsky's (1962) theories of language and thought development.

Word recognition

Accurate and fluent word recognition is associated with adequate reading comprehension (Share & Stanovich, 1995). The application of word knowledge and reasoning in language comprehension do not become fully operative in comprehending text until the learner has acquired reasonable fluency in reading (Torgesen et al., 1997). Word recognition is not the only pre-requisite for reading comprehension; there are other variables that directly or indirectly influence language comprehension as well (Adams, 1990; Gough & Tunmer, 1986; Hoover & Gough, 1990; Perfetti, 1985; Stanovich & Siegel, 1994; Sticht & James, 1984; Vellutino et al., 1988). Young readers can construct meaning from a variety of texts. They do not only read to learn but they also read for enjoyment and to remember the story (Campbell et al., 2001; Walker, 2000).

I will now turn my focus to reading disabilities and possible reasons why some learners struggle to master reading skills.

2.3.4 Reading disabilities

There are many ways in which reading acquisition can be hindered. The most obvious ones are cases of major sensory deprivation. Any problems pertaining to the eyes may cause major obstacles to the acquisition of reading. Similarly, any problems in the ears may prevent the formation of phonological representations related to speech, which makes the alphabetic principle meaningless (Gazzaniga, 2004; Shankweiler & Liberman, 1972). Language itself is of course a prerequisite for reading. Learners with language impairments generally have problems acquiring reading skills (Adams, 1990). Another obvious cause of reading disability is mental retardation. It is generally accepted that reading ability is correlated with intelligence quotient (IQ) (Snowling, 2000). There is a general concern that, even after excluding the obvious causes of failure mentioned above, a large percentage of learners still have great difficulties learning to read. Reading disabilities without apparent causes are generally called dyslexia (Stein et al., 2000).

According to the National Center for Learning Disabilities (2003), the main reasons for reading problems are commonly known as ineffective reading instruction, auditory perception difficulties, visual perception difficulties and language processing difficulties. Lane et al. (2002) also stress the importance of auditory and visual perception activities in

the acquisition of reading skills. The RAND Reading Study Group (2002) agrees with the lack of appropriate instruction but also adds the lack of sufficient oral language development in early learners, the lack of sufficient vocabulary knowledge for more complex texts, poor decoding skills and fluency, and low levels of independent reading. Weyandt (2005) found that reading disabilities occur in as many as one out of five school-aged children. He explains that there are several types of reading disorders and each type has very specific symptoms that interfere with academic performance. A study conducted by Juel (1994, p. 24) found that "only one out of eight children who is not reading at grade level by the end of first grade will ever go on to read at grade level". However, educational experts believe that significant numbers of these below-average readers can become successful readers with effective intervention (Honig, 2001). It is therefore imperative that reading disabilities be diagnosed as early as possible and that appropriate and effective intervention start immediately. It is also of utmost importance that teachers take note of the most successful methods of teaching reading.

2.3.5 Methods in reading instruction

It is interesting that children acquire speech naturally through exposure to language. However, they need explicit instruction to become fluent readers (Bowman & Treiman, 2004). A child cannot simply pick up a book and start reading. Reading is a complicated process that requires instruction in phonological awareness, letter-knowledge, phonics, spelling, strategy development, vocabulary, grammatical awareness, and comprehension strategies. It involves stimulation of multiple parts of the brain and several developmental stages through which every beginner reader should progress. It is important for beginning readers to build a foundation of skills essential to learning to read successfully (Decker, 2007). Our first priority should be to teach learners how to read successfully. The second should be to provide them with the skills necessary to be successful in all other academic areas (Fite, 2002).

In recent years, various methods of teaching reading have been debated. Although numerous educational techniques for teaching reading exist, these methods more or less fall into two categories, namely whole-word methods and phonetic methods. These two systems can also be merged to create a balanced system for teaching decoding to elementary learners.

Whole-language systems

Whole-word methods are more commonly known as whole-to-part methods or the so-called “look and say” methods of reading, in and out of vogue since the 1950s. Some researchers refer to whole-language methods as logographic instruction or lexical knowledge. In whole-word teaching, learners are taught to recognise words as holistic units via pattern–sound correspondence. Whole-word teaching is based on rote memorisation of paired-associate learning. Educators favoured this method in the past to teach reading to elementary learners, but today these methods are used mostly in conjunction with the phonetic method (Ehri et al., 2001). Whole-word methods of teaching reading implement a belief in the importance of learning meaning first and then applying that meaning to written language (Bovee, 1972; Spache & Spache, 1969). This practice allows learners to understand at an early stage that “reading is no more than talk written down” (Stauffer, 1970, p. 24). The work by Chall (1967) showed that the so-called “look and say” methods of reading result in slower learning than phonics-based reading methods. The same conclusion was reached by the National Reading Panel’s (2000a) study of early reading in the USA. The National Reading Panel (2000b) also compared the effect sizes reported for “large unit” versus “small unit” phonics teaching. The analysis showed that the impact of early “large unit” teaching versus early “small unit” teaching was statistically insignificant, though the impact was significant in each case (Ehri et al., 2001).

According to Spache and Spache (1969), the whole-language approach is extremely personal and individualised, instilling a love of reading in learners by actively engaging them in the process of reading and giving it meaning. Heilman (1998) criticises this method, stating that the method is very vague. It is not clear exactly what it involves or how to do it. Thus, each teacher may interpret and approach the method differently (Jeynes & Littell, 2000). This ambiguity creates the problem that teachers do not teach reading skills in a logical sequence, but merely assume that the learners will learn them incidentally, resulting in the possibility that learners will never develop their fullest potential in reading. Although there is a huge controversy as to whether phonics is an essential component of teaching learners how to read, it is a fact that some learners manage to become fluent readers without ever receiving explicit phonics instruction (Wagner et al., 1997). Learners who learn to read by themselves without any reading instruction also contribute to the question about the essentiality of phonics instruction (Fletcher-Flinn & Thompson, 2000; Share, 1995).

Phonetic systems

The phonetic method, also known as systematic decoding, or phonological recoding, is a skills-based teaching method rather than a whole language method. It relies on a part-to-whole approach and provides two sub-methods: the analytic and the synthetic phonics methods. The phonetic method requires the teacher to teach reading skills explicitly, making it the most widely accepted method for teaching reading. The phonetic method stems from the idea that students should first understand the key elements of language, namely letters, sounds, syllables and words, before they will be able to read and comprehend. Lyon (1994) states that the ability to decode single words accurately and fluently depends on the ability to segment words and syllables into sound units called phonemes. This skill helps beginning readers understand how printed words relate to the sound of spoken words.

Honig (2001) suggests that phonetic instruction generally proceeds through a developmental sequence of stages. Once the learner has mastered these stages, he or she is ready to begin reading. Some people are suspicious of models requiring discrete stages. However, it is not assumed that the stages are disjoint periods influenced by abrupt cognitive changes (Silva & Alves-Martins, 2002).

The main advantage of the phonetic instruction method is that it emphasises direct skills instruction, which promotes effortless, unconscious recognition of words, enabling skilled readers to perceive letters in chunks Treiman et al. (2001) The ability to recognise individual words rapidly, effortlessly and unconsciously is a critical step in the process of learning to read. Regardless of the many advantages of the phonetic instruction method, it does also have disadvantages. Heilman (1998) and Spache and Spache (1969) criticise this method explaining that the phonetic instruction method can become very boring and rigid if taught outside of the context of reading. Some teachers may expect learners to spend a lot of time working on worksheets and learning lists of phonics rules instead of applying phonics to reading.

Another problem may be that when phonics instruction is overemphasised, reading becomes extremely mechanistic, which may cause learners to read over-cautiously, slowly and too analytically. The biggest problem has to do with inconsistency in the symbol-to-sound mapping (Ziegler et al., 1997). In some orthographies, for example English, one letter or letter cluster may have multiple pronunciations and some phonemes may have multiple spellings. English is exceptionally inconsistent because it exhibits a high degree of

inconsistency from the alphabetic principle, especially in words that contain more than one unit of meaning. This variation across languages makes it likely that there will be differences in reading development across languages (Ziegler et al., 1997). Levin, et al. (2002) found that similar effects of letter names have been found for learners learning to read and write in languages other than English. He suggests that a systematic decoding approach, in other words, using phonetic sounds to read words, is not limited to a single language.

Balanced methods

According to Honig (2001), whole-word and phonetic methods need not be seen as competing teaching methods, and a balanced method of teaching reading should be considered. This includes a combination of the whole language and the phonetic instruction approaches. Honig (2001) claims that the phonetic instruction method includes mastering the recognition of sight words (high-frequency words). Treiman and colleagues (Bowman & Treiman, 2002; Treiman & Rodriguez, 1999; Treiman et al., 2001) found evidence that pre-readers are not limited to a logographic strategy (whole-word method) when learning new words.

A balanced method includes three main strategies:

1) explicit, systematic teaching of phonemic awareness, decoding, comprehension strategies, and text organisation;
2) discussions about literature; and
3) reading a large amount of varied text.

Thus, the balanced method allows teachers to explicitly instruct word attack skills while immersing the learners in language and literature-based activities. The balanced method of teaching reading incorporates the most effective strategies from both the whole-language and the phonetic methods. Thus, the balanced method is a truly comprehensive method for teaching reading to learners since one reading skill is used to help develop the others. Hancock and Wingert (1996) agree that the balanced method of teaching reading has no immediately discernible disadvantages because it combines the best aspects of both the whole-language and phonetic methods. Du Plessis (2001) recognised the importance that mediation should induce independent activity. The sooner this happens, the better for the learner. It depends largely on the teacher to integrate explicit instruction and language experiences. Phonological awareness, spelling, reading speed and accuracy are clear components of reading skill (Samuels, 2006).

2.3.6 Summary

Acquiring reading skills follow a developmental path, which will differ from one learner to the next. All learners deserve to learn to read. Teachers, in turn, deserve to be equipped with knowledge, skills, and supported practice that will enable their teaching to succeed. This is probably the most important challenge for education to undertake. Reading as a basic life skill can make a significant impact on someone's future. Finally, there can also be some extrinsic factors, which can make the acquisition of reading difficult. These may include a variety of emotional, social or educational contexts. One of the requirements for developing reading proficiency is development of phonological awareness, which is discussed in the next section.

2.4 PHONOLOGICAL AWARENESS

As already discussed, reading consists of two primary components, namely decoding and comprehension. The decoding aspect relates to phonological awareness ability (Swank, 1994; Swank & Catts, 1994; Winch et al., 2001). I begin by explaining the meanings of various terms relevant to phonological awareness and the history and value of phonological awareness. Finally, I discuss the teaching of phonological awareness and how to assess if learning took place.

2.4.1 Definition

Phonological awareness is generally understood to be the awareness of phonological units, and the ability to manipulate those phonological units. Phonological units include syllables, onsets and rimes, rhyming words and phonemic awareness. Phonological awareness deals with the systems, structures and sounds of speech (Clark & Yallop, 1990). Syllables, onsets, rimes, rhyming words and phonemic awareness are all linguistic units. It is the sensitivity towards and the ability to manipulate these units that defines phonological awareness (Fox & Routh, 1976; Hoien et al., 1995; Stanovich et al., 1984; Treiman & Zukowski, 1996; Yopp, 1988). Phonological awareness involves the ability to recognise that a spoken word consists of smaller components such as syllables or phonemes and that these units can be manipulated (Lombardino et al., 1997). Phonology is a branch of linguistics concerned with the systematic organisation of sounds in languages. Phonology is often distinguished from phonetics. While phonetics is concerned with the physical production, acoustic transmission and perception of the sounds of speech, phonology describes the way sounds function within a given language

or across languages to encode meaning (Anderson & Ewen, 1987; Chomsky & Halle, 1968; De Lacy, 2007).

A *syllable* is a word part that contains a vowel or a vowel sound, for example “news-pa-per” has three syllables. In “ver-y”, the “y” is not a vowel. However, the “y” has the same sound as “i” such as in ink, which is a vowel, and therefore the “y” represents a vowel sound (Harris & Hodges, 1995; National Institute of Child Health and Human Development, 2000). Numerous studies have shown that an awareness of syllables typically precedes onset-rime awareness and onset-rime awareness precedes phoneme awareness (Aidinis & Nunes, 2001; Fox & Routh, 1976; Liberman et al., 1974; Lonigan et al., 1998).

Onsets and *rimes* are parts of spoken language that are smaller to syllables but larger than phonemes. An *onset* is the initial consonant(s) sound of a syllable at the beginning of a word (the onset of bag is “b”, and of swim, “sw”). A *rime* is the part of a syllable that contains the vowel and all that follows it at the end of a word in other words, the part of a word that makes it rhyme with another. For example the rime of bag is “-ag”, of swim, “-im”, of greenery, “-ery” and of frightening, “-ing” (Harris & Hodges, 1995; Kessler & Treiman, 2001; National Institute of Child Health and Human Development, 2000).

Phonics is the understanding that there is a relationship between phonemes, the sounds of spoken language, and graphemes, the letters that are used to represent those sounds in written language (Harris & Hodges, 1995; Liberman et al., 1967; National Institute of Child Health and Human Development, 2000). There are two main types of phonemes. These are called consonants and vowels (Hudson, 2000). The English language has between 40 and 44 phonemes (Liberman & Liberman, 1990).

Phonetics is the area that focuses on acoustics and articulation (Clark & Yallop, 1990).

A *phoneme* is a speech sound. It is the smallest unit of spoken language and has no inherent meaning (National Reading Panel, 2000b).

Phonemic awareness is the ability to hear, identify and manipulate the individual sounds (phonemes) in spoken words (Griffith, 1991; Harris & Hodges, 1995; National Institute of Child Health and Human Development, 2000) and the understanding that spoken words and syllables are made up of sequences of speech sounds (Yopp, 1992).

However, it does not include all aspects of the broader category of phonological awareness.

It should be noted that while some investigators use the terms *phonological* and *phonemic* knowledge synonymously, in this study I distinguish between them as suggested by Munro (1998). Phonological knowledge is knowledge of sound patterns. Phonemic knowledge is one aspect of phonological awareness and refers to the individual speech sounds (Share, 1995; Stahl & Murray, 1994). This distinction draws attention to the difference between knowledge of individual and multi-sound units and has implications for diagnosis and teaching.

The word “pen” is analysed in Figure 2.3, to illustrate how a syllable can be analysed. The syllable “pen” sits at the top of the hierarchy, with the onset unit “p” and the rime unit “en” coming directly from the syllable. The onset unit consists of a single phoneme. The rime unit consists of the vowel phoneme of “e”, or the peak of the syllable, and the following consonant of “n”, called a phoneme.

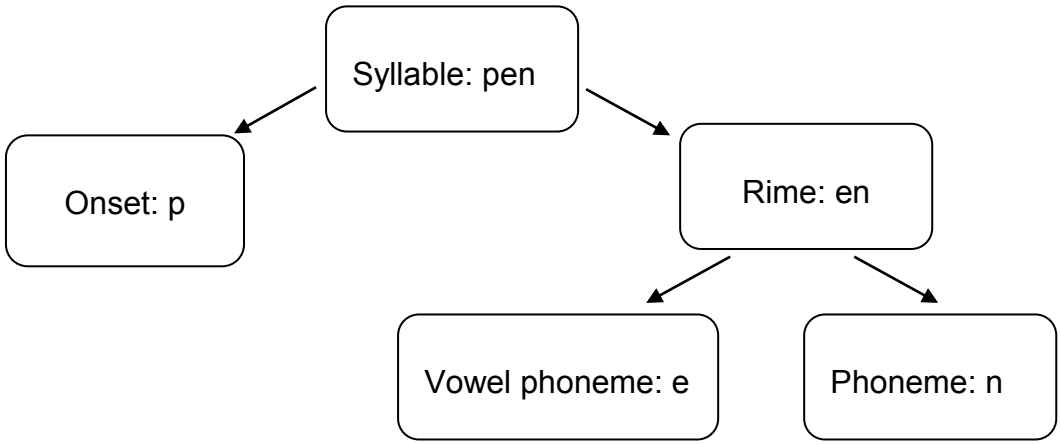


Figure 2.3 A simple hierarchical syllable structure.[2]

The word “stand” is analysed in Figure 2.4 to illustrate how a syllable can be analysed. The syllable “stand” sits at the top of the hierarchy, with the onset unit “st” and the rime unit “and” coming directly from the syllable. The onset unit consists of two

[2] Blending or segmenting the initial consonant or consonant cluster is called the onset and blending or segmenting of the vowel, and the following consonant sounds are called the rime. Therefore, rime does not mean the same as rhyme, which describes the ability to match ending sounds in words (Juel & Cupp-Minden, 2000).

phonemes “s” and “t”. The rime unit consists of a vowel phoneme “a”, and two consonant phonemes “n” and “d”.

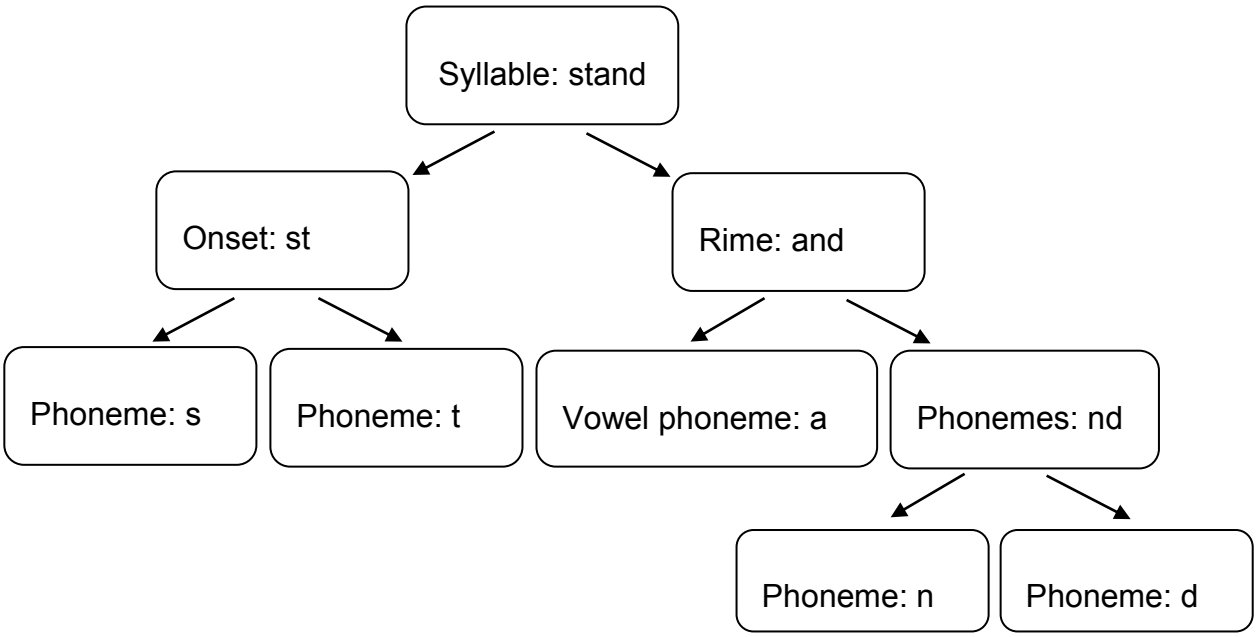


Figure 2.4 A complex hierarchical structure of the syllable with the mono-syllabic word "stand" as an example.

2.4.2 History of study into phonological awareness

Phonological awareness has its roots in the study of language and linguistics. The base word *phonology* is derived from the ancient Greek words “phone” for voice and “logos” for word (Nicholson, 1997). The study of phonological awareness has a relatively short history, dating back only to the 1960s, when the need for the awareness of language, was discovered (Nicholson, 2000). During the 1960s, the link between auditory perception and reading was examined and the first tests of what we now know as phonological awareness were developed (Chall et al., 1963; Rosner & Simon, 1971). The term *phonological awareness* came into use in the late 1970s and was used interchangeably with *phoneme awareness* (Lewkowicz, 1980). Research during the 1970s suggested there is a developmental progression in children’s awareness of phonological and phonemic awareness structures. These results highlight the importance of linguistic awareness in children (Fox & Routh, 1976; Liberman et al., 1974). In the 1980s and 1990s, authorities in the field began to reach a greater consensus concerning how phonological awareness should be defined, with clear distinctions being made between phonological awareness and phonemic awareness, as explained above (MacLean et al.,1987; Perfetti et al., 1987; Schatschneider et al., 1999; Stahl & Murray, 1994).

2.4.3 Value of phonological awareness

An awareness of phonemes is necessary to grasp the alphabetic principle that underlies our system of written language (Chard & Dickson, 1999). Spoken language is believed to be an automatic, biological function (Pinker, 1999). Liberman and Liberman (1990) argue that there is a specialised speech unit in the brain of each person that underlies the perception and production of speech, which automatically does this job for us. Written languages are derived from spoken languages. Readers should develop a sensitivity to the internal structure of words in order to benefit from formal reading instruction (Adams, 1990; Liberman et al., 1974). If children understand that words can be divided into individual phonemes and that phonemes can be blended into words, they are able to use letter-sound knowledge to read and build words. As a consequence of this relationship, phonological awareness in preschool is a strong predictor of later reading success (Ehri & Wilce, 1980; Ehri & Wilce, 1985; Liberman et al., 1974; Perfetti et al., 1987). Researchers have shown that this strong relationship between phonological awareness and reading success persists throughout school (Calfee et al., 1973; Shankweiler et al., 1995).

Research on phonological awareness has been conducted on which precursors there are to phonological awareness (Burgess, 2002; Lonigan et al., 1998; Walley, et al., 2003). The precursors of phonological awareness are those variables that may provide learners with a cognitive base in which phonological awareness can be fine-tuned, such as recognition of sounds and knowledge of the alphabet letters. A number of studies have focused on the role of phonological awareness in the acquisition and development of spelling skills and reading ability (Bradley & Bryant, 1985; Castiglioni-Spalten & Ehri, 2003; Goikoetxea, 2005; MacDonald & Cornwall, 1995; Morais et al., 1979; Sprugevica & Hoien, 2003), the relationship between spelling and phonological awareness (Castles et al., 2003; Silva & Alves-Martins, 2002, 2003), and the relationship between alphabet knowledge and phonological awareness (Blaiklock, 2004; Carroll, 2004; Foorman et al., 2003).

Learners who have been taught to read and who have developed a feeling for phonological awareness before they even started school are found to have an advantage when learning to spell (Brennan & Ireson, 1997; Hindson et al., 2005; Lundberg et al., 1988; Rohl & Pratt, 1995; Schneider et al., 1997; Sprenger-Charolles & Casalis, 1995). Clarke-Klein (1994) and Snowling (2000) suggest that learners who have difficulty reflecting on the sound structure of words will be disadvantaged. Furthermore, without sound phonological awareness skills, the acquiring of spelling skills will be hampered.

Bruck and Treiman (1990) agree, and state that one of the very significant and persisting consequences of a lack of phonological awareness skills is difficulty with spelling.

To make sense of text, the reader needs to connect the written words with spoken knowledge, enabled by phonological knowledge (Munro, 1998). Beck and Juel (1992) explain that decoding requires an understanding of the association between sounds in words and the spelling symbols that represent these sounds. Phonological awareness is essential to this association (Swank & Catts, 1994). Phonological awareness is also thought to influence reading comprehension indirectly through phonological decoding ability (Tunmer & Rohl, 1991). A key feature of learning to read is the mastery of phonological decoding skills, especially during the early phases of reading acquisition. These skills will benefit the reader and will consequently have long-lasting effects on the skilled reading system (Ziegler et al., 2001). Catts & Kamhi (1999) observed that second-grade readers with poor reading skills were four to five times more likely to have difficulties in the area of phonological awareness as well.

Phonological awareness is one of the metacognitive skills that people need specifically for reflecting on language. The other metacognitive skills that people need for language are morphological, pragmatic, semantic and syntactic awareness (Cohen & Horowitz, 2002; Juel & Cupp-Minden, 2000). Morphological awareness is knowledge about morphemes such as plurals and verb tense markers. Semantics is the aspect of language that involves understanding meaning that is conveyed by words, sentences and phrases, while syntax involves sentence construction and correct word order. Pragmatic awareness is the explicit knowledge that people have regarding the use of language in actual communication (Gillon, 2004).

2.4.4 Teaching phonological awareness

Misinterpretation and misunderstandings have dominated the highly politicised debate between whole-word approaches and skills-based phonics instruction when teaching learners how to spell and read (Paterson, 2002). This debate hinges on the fact that in order for phonics to work, it must be taught in isolation, before learners begin reading, and without regard to learners' background knowledge. Dynamic Indicators of Basic Early Literacy Skills (DIBELS) have developed instructional recommendations for teaching literacy skills (Deno & Mirkin, 1977). DIBELS were designed for use in identifying learners experiencing difficulty in the acquisition of basic early literacy skills in order to provide early support and prevent the occurrence of later reading difficulties (Dynamic

Indicators of Basic Early Literacy Skills, 2009). The International Reading Association has also developed Standards for Reading Professionals (International Reading Association, 2003). High and adequate levels of phonological awareness can be developed through carefully planned instruction, and this development has a significant influence on learners' reading and spelling achievement (Ball & Blachman, 1991; Bradley & Bryant, 1985; Byrne & Fielding-Barnsley, 1989, 1991; O'Connor et al., 1993). Activities that lead the learner to look at the print, process the print of written language, and experience the spelling-sound regularities, are needed for the learner to acquire the phonological skills needed for beginning reading (Levy et al., 2006).

Phonological awareness is acquired developmentally within the first three to four years of school (Lenchner et al., 1990; MacLean et al., 1987; Vandervelden & Siegel, 1995; Yopp, 1992). It is first displayed when learners learn and remember how words are said. Most learners do this relatively easily and with little practice. However, there are always learners who find it hard to pronounce words accurately when reading, because the written words do not always match their spoken forms. Winch et al. (2001) and Apel and Masterson (2001) also stress the importance of phonological awareness in the early years and that it involves a developmental process, like all other areas of language development. Without sound phonological awareness skills, the learner will struggle a great deal (Snowling, 2000).

Chard and Dickson (1999) suggest activities like substituting different sounds for the first sound of a familiar song can help children develop phonological awareness, a cognitive substrate to reading acquisition, for example:

Row, row, row your boat
gently down the stream.
Merrily, merrily, merrily, merrily,
Life is but a dream.

Bow, bow, bow your boat
bently bown the beam.
Berrily, berrily, berrily, berrily,
Bife is but a beam.

Sow, sow, sow your soat
sently sown the seam.
Serrily, serrily, serrily, serrily,
Sife is sut a seam.

Other activities include clapping syllables, naming the sound heard at the beginning, middle or end, and identifying rhyming words. Becoming phonologically aware prepares learners for later reading instruction, including instruction in phonics, word

analysis, and spelling (Adams et al., 1998; Chard et al., 1998). The most common barrier to learning early word-reading skills is the inability to process language phonologically (Liberman et al., 1989).

2.4.5 Assessing phonological awareness

It is important to assess phonological awareness since the importance of phonological awareness is essential to early reading and spelling skills and is used as a predictor for reading achievements (Munro, 1998). Studies suggest that phonological awareness has been identified as an important component in children's overall literacy development (Adams, 1990; Winch et al., 2001). Numerous studies have shown a relationship between learners' phonological awareness skills and the ease with which they learn to spell and eventually read (Muter et al., 1998; Stackhouse et al., 2002).

There is disagreement amongst researchers about the relative importance of various components of phonological awareness and therefore there is little consensus on how phonological awareness should be assessed. The tasks used to assess phonological awareness and the procedures used when administering them, vary greatly (Tunmer & Rohl, 1991). McBride-Chang (1995) states that it is rare for a phonological awareness test used in one study to be reused in subsequent studies despite each task involving similar functions, such as performing a mental operation on words and communicating the result.

There is still controversy regarding which of the phonological awareness skills is the most important in the development of spelling and reading. Some authorities maintain that rhyming and segmentation are the most important skills contributing to the spelling process (Munro, 1998). Hulme (2002), for example, argues that phoneme awareness influences reading, and that rime awareness has little to do with reading. Other researchers, however, consider rime awareness to be vital for learning to read by enabling reading by analogy, and maintain that phoneme awareness develops later in the process of learning to read (Goswami, 1986, 1988, 1993, 1998, 1999; Goswami & East, 2000; Goswami & Mead, 1992). Some authorities suggest that segmentation is inferior to the very important skill of rhyming (Muter et al., 1998). McBride-Chang (1995) went as far as to suggest that a large portion of phonological awareness is simple speech perception. Bertelson et al. (1997) demonstrated onset superiority over phonemes. Tunmer and Chapman (2007) have suggested that it is not the awareness of syllables, onsets, rimes and phonemes that play an important role in the linguistic structure, but instead it is the ability to articulate isolated segments of speech sounds.

Yopp and Yopp (2000) consider that it is more important to assess word recognition and comprehension than assessing any of the other reading components. Yavas and Goldstein (1998) maintain that the assessment procedures for phonological awareness should be modified by taking into consideration linguistic patterns as well as cultural and sociolinguistic factors. This is consistent with Vygotsky's socio-cultural theory (Vygotsky, 1978). The development of the Phonological Abilities Test (PAT) developed by Muter et al., (1997) has been criticised, since it has been found that the task ease and difficulty can influence the results. Anthony and Lonigan (2004) as well as Stahl and Murray (1994) found that rhyme tasks cannot be assessed in the same way as other forms of phonological awareness since rhyme tasks can be measured according to floor (too easy) and ceiling (too difficult) effects, which influence the relationship with other phonological variables.

Burgess (2002), Stahl and Murray (1994) and Anthony and Lonigan (2004) suggest that phonological awareness is thought of as a continuum of increasing awareness and ability to manipulate segmented sub-syllabic units. Assessments of phonological awareness should yield a score, which fits on a scale, rather than diagnose the learner as either having the awareness or not (Stahl & Murray, 1994). At one end of the continuum, learners are able to recognise rhyming words and distinguish and manipulate onset-rime units. At the other end, learners are able to distinguish and manipulate phonemes. Gough, Larsen and Yopp (1996) suggested that phonological awareness be measured by means of a Guttman scale. A Guttman scale is unidimensional and measures one finite ability (Coolican, 1994). In the case of phonological awareness, one may score positively on items such as onset-rime sensitivity, but once a negative score is obtained, one should not be able to score positively on any items further up the scale, such as phoneme awareness. More studies support the idea that phonological awareness in learners, such as their abilities to segment words, develops along a continuum. These studies indicated that syllable awareness occurs prior to onset-rime awareness. They suggest syllable awareness should be taught and assessed before starting to teach onset-rime awareness (Anthony et al., 2002; Bryant et al., 1990; Ellis & Cataldo, 1990; Lonigan et al., 1998; MacLean et al., 1987; Schatschneider et al., 1999; Stahl & Murray, 1994).

Munro (1998) suggests the following strategy for teaching phonological awareness and assessing accordingly. The teacher chooses a set of words such as *link*, *mink* and *sink*. The first step is to get the learners to pronounce the words correctly. Thereafter they segment the words into onsets and rimes. Then the learners are asked to suggest other words, which rhyme with the first three words and discuss the sound pattern. The learners

should be encouraged to make up nursery rhymes based on the pattern. Finally, the learners should segment the words into sounds.

2.4.6 Summary

It is clear that phonological awareness plays an important role in learning to spell and read. It is necessary to empower learners to be able to apply their knowledge of spoken language to reading and writing. Also, identifying specific phonological awareness factors and patterns that relate to spelling ability can provide teachers with the ability to target those learners who are at risk of becoming poor spellers (Uhry, 1999). I now turn my focus towards spelling.

2.5 SPELLING

Spelling and reading are related, so that problems in one area could reasonably have an influence on the other (Ball & Blachman, 1991; Bradley & Bryant, 1985; Ehri, 2000; Morris & Perney, 1984). Before learners start to read, they need to develop adequate spelling skills, which will have implications for their overall success in the educational process (Armbruster et al., 2010). I will focus on the acquisition of spelling skills in English, and will also consider some work done in other languages.

2.5.1 Definition

Spelling refers to the manner in which words are spelled or a group of letters represent a word. Another word for spelling is *orthography* (Collins English Dictionary, n.d.). In written language, spelling refers to the choice and arrangement of letters in an accepted order, which form words (American Heritage Dictionary, 2009). Spelling involves the integration of several skills including knowledge of phonological representations, grammatical and semantic knowledge as well as the formulation of analogies with words in visual memory and the knowledge of orthographic rules and conventions (Bradley & Bryant, 1985; Wagner & Torgesen, 1987).

Orthography is the study of correct spelling according to established principles. It can also be described as the aspect of language study concerned with letters and their sequences in words and the representation of the sounds of language by written symbols and spelling (American Heritage Dictionary, 2009). Orthography is correct and proper spelling (Dictionary.com, 2012). Orthography is the science of spelling by the eye instead of the ear (Experience Project, 2012). The orthography of a language specifies a standardised way of using a specific writing system to write the language. Orthography is

the art of writing words with the proper letters, in other words, correct spelling (Coulmas, 1996).

A morpheme is the smallest part of a word that has grammatical function or meaning. For example, *sawed*, *sawn*, *sawing*, and *saws* can all be analysed into the morphemes saw + -ed, or -n, or -ing, or -s, respectively. None of these last four can be further divided into meaningful units. *Saw* can stand on its own as a word; it does not have to be attached to another morpheme and is therefore described as a free morpheme as well as a root morpheme to which other morphemes are attached. The other four morphemes listed above must be affixed (attached) to some other unit, each can only occur as a part of a word. Morphemes that must be attached as word parts are said to be bound morpheme. Affixes are classified according to whether they are attached before or after the unit to which they are added. Prefixes are attached to the beginnings of words and suffixes at the ends of words (Booij, 2005; Coxhead, 2000; Haspelmath, 2002; Huddleston & Pullum, 2002).

There are four terms that relate to morphology. Syntax is the study of processes by which sentences are constructed in particular languages. The term *syntax* is also used to refer directly to the principles that govern the sentence structure of any individual language (Carnie, 2006; Freidin & Howard, 2006). Semantics is the study of meaning. It focuses on the relation between signifiers, such as words, phrases, signs and symbols, and what they stand for. Linguistic semantics is the study of meaning that is used to understand human expression through language (Giannini, 2010). Pragmatics is a subfield of linguistics, which focuses on the ways in which context contributes to meaning. Pragmatics is the study of how the transmission of meaning depends not only on the linguistic knowledge of the speaker and listener, but also on the manner, place, time, etc. of an utterance (Carston, 2002; Potts, 2005). In linguistics, lexis refers to the total word-stock or lexicon having items of lexical, rather than grammatical, meaning. Typical examples include “I see what you mean” or “Recent research shows that …” (Lewis, 1997).

A grapheme is the smallest semantically distinguishable unit in a written language. It does not carry meaning by itself. Graphemes include alphabet letters, numerical digits, punctuation marks, and the individual symbols of any of the world's writing systems (Cambridge Encyclopedia of Language, 1997). A phoneme is a basic element of a given language, from which words in that language are being built up. The phoneme is defined the smallest segmental unit of sound (International Phonetic Association, 1999).

Phonology is a branch of linguistics concerned with the systematic organisation of sounds in languages cover any linguistic analysis. Phonology is often distinguished from phonetics. While phonetics concerns the physical production, acoustic transmission and perception of the sounds of speech, phonology describes the way sounds function within a given language or across languages to encode meaning (Anderson & Ewen, 1987; Chomsky & Halle, 1968; De Lacy, 2007).

Blending involves taking two or more words, removing parts of each, and joining the units together to create a new word whose form and meaning are taken from the source words. *Smog* derives from *smoke* and *fog* and *motel* derives from *motor* and *hotel* (Pinker, 1999).

2.5.2 Development of spelling

Spelling involves the integration of several skills including knowledge of phonological representations, grammatical and semantic knowledge, as well as the formulation of analogies with words in visual memory and the knowledge of orthographic rules (Bradley & Bryant, 1985; Wagner & Torgesen, 1987). In the late sixties, language researchers began to point to regularities in spoken and printed English, and cognitive psychologists began to view people as active learners. These views brought along changes in how spelling development was approached (Chomsky & Halle, 1968; Venezky, 1970). It became apparent that learners have the ability to search actively for meaning and structure in written language when they receive appropriate instruction.

The most widely accepted approach is that of stage theories (Ehri, 1986; Gentry, 1982; Henderson, 1985) which is embedded in Piaget's development stages, namely the sensori-motor, pre-operational, concrete operational, and formal operational stages (Piaget, 1926, 1936, 1945, 1955). When learners start to develop spelling skills, they use multiple strategies and different types of knowledge when engaging in tasks, according to the developmental stage, at which they are at the time (Rittle-Johnson & Siegler, 1999; Treiman & Cassar, 1997; Varnhagen et al., 1997).

Spelling development may start with scribbling or writing random combinations of letters, which may be categorised under the sensorimotor stage. These scribbling or writing attempts differ noticeably from their drawings (Frost, 2001). Learners who are exposed to different types of literature from an early age, normally have a good deal of experience with print even before they learn to read and write. The knowledge of letter names that young learners bring with them when they first enter the classroom, may be a

possible explanation why some words are easier for them to learn than others (Bowman & Treiman, 2004). Frost (2001) describes the second stage, which is the pre-operational stage, in which children are able to write familiar words such as their own names or the names of family members. Preschool children's familiarity with their own names may allow them to develop early spelling skills. Once they have the knowledge of their own names they use that knowledge to attempt to spell new words, even if this knowledge is phonetically inappropriate (Chomsky, 1979; Fletcher-Flinn & Thompson, 2000; Gentry, 1982; Read, 1986; Stainthorp & Hughes, 1999; Treiman et al., 1993).

Lavine (1977) found that even 3-year-olds could discern clearly between writing and drawing. In some cases, the units displayed were not conventional writing, but looked similar to letters. In the study, the 3- and 4-year-olds accepted these marks as writing. The 5-year-olds showed signs of differentiating Roman letters from similar-looking symbols that were not real letters. Tolchinsky-Landsmann and Levin (1985) provided further support that children distinguish between writing and drawing from an early age. During the pre-operational stage, children's thought processes are developing, although they are still considered to be far from "logical thought" (Marsh, 1996).

During the concrete operational stage, children's thought processes become more rational, mature and logical. The child becomes less egocentric. And it is here that the child develops the concept of conservation. Although the child has not fully developed the cognitive skills needed to handle abstract problems that require mental manipulations, he/she can now deal with tangible problems (Bybee, 1982; Thorne & Henley, 1997). During the formal operational stage, the structures of development become an abstract, logically organised system of adult intelligence (Marsh, 1996). As children progress, their knowledge of the spelling system matures. Spelling development continues until the child is able to understand and use spelling rules, which can be categorised under the formal operational stage. Successful spellers possess a good deal of information about spelling, including knowledge about the spacing of words, the orientation of writing, letter sequences, and phonemes varieties.

The early stages of alphabetic writing are largely characterised by reliance on sound-based information. Detailed knowledge of orthography and morphology follow much later. Children are inclined to produce spelling patterns that are not consistent with the development stage at which they are supposedly (Varnhagen et al., 1997). The problems of stage theories are due to the failure of such theories to take into account the complexities of phonological, orthographic, and morphological knowledge as they relate to

spelling development. What is needed is an approach to spelling development that emphasises the interaction of various strategies and sources of information along with the development of skills to master reading (Rittle-Johnson & Siegler, 1999; Treiman & Cassar, 1997; Varnhagen et al., 1997).

Treiman et al. (1994) suggest that children's sound-based errors are consistent with stage theories of spelling development. Treiman (1992) supports the stage developmental theory of Piaget (1957) in proposing that there are at least three phases in the use of letter names in spelling development. The first phase is characteristic of preschoolers who are as yet unable to segment spoken syllables into smaller units. During the second phase, the child has had enough experience with print to know that English words generally contain a vowel. During this third phase, children symbolise vowels with separate letters and they use some vowel graphemes in the middle of their spelling. Children's movement through the three phases differs according to the phonological properties of a letter's name (Varnhagen et al., 1997).

Mechado (2009) explains that it is crucial for each child to master the skill of recognising letter shapes and learning letter names since this is a crucial component of the process of learning to spell and read. Once learners begin to learn that the function of alphabetic writing is to represent the sounds of language, they go through the process of learning sound-spelling correspondences in detail, from syllables to phonemes. Ferriero and Teberosky (1982) proposed that learners initially believe that the correspondence between writing and speech is at the level of the syllable. Only later do they learn that, for English and other alphabetic systems, the link between print and speech is primarily at the level of individual sounds or phonemes. This process is rooted in the development of phonological representations of words (Treiman & Bourassa, 2000). Some examples include "ck" that occur in the middle and at the end of English words, as in *packet* and *pack*. Other orthographic patterns involve doublets, or two-letter spellings in which the two letters are identical. Certain letters may occur as doublets, such as the double "e" of *peel* and the double "l" of *ill*. Other letters, such as "v" and "i", rarely double. Doublets typically occur in the middles and at the ends of words, as in *supper* and *inn*; they rarely occur at the beginnings of words as in *llama* (Niles et al., 1977; Rosinski & Wheeler, 1972; Venezky, 1970).

2.5.3 Spelling difficulties

Much of the research on children's writing has focused on children whose spellings are naturalistic (Read, 1986; Treiman, 1993) and experimental (Bruck & Treiman, 1990; Miller & Limber, 1985; Snowling, 1994; Treiman, 1985, 1994; Treiman et al., 1993; Treiman et al., 1995; Treiman et al., 1997; Van Bon & Uit de Haag, 1997). Children do not always succeed in dividing words into individual phonemes and representing each phoneme with a letter or letter group. Some children choose an unconventional letter to replace a letter in a word, for example "it" for *eat* or "t" for "ch" and some omit the second consonant in words such as "gab" for *grab*. Another case in which children spell sounds in an unconventional but plausible manner involves syllabic "r". The "r" in English takes the place of the vowel, such as "hr" for *her* and "brutr" for *brother*. These errors show that certain misspellings that are not phonetically correct nevertheless reveal children's fine sensitivity to the sounds of spoken words. Thus, the division between phonetic and non-phonetic errors that forms the basis of many schemes of classifying spelling errors (Boder, 1973; Bruck & Waters, 1988; Finucci et al., 1983; Nelson, 1980) may be misleading when applied to young children. Sound-based errors further show that spelling is, to a large extent, a process of symbolising the linguistic structure of spoken words. It is not simply a process of reproducing memorised letter sequences. Holligan and Johnston (1991) and Frost (2001) found that poor spellers are usually able to recognise the first sound in the word with ease. However, the medial and the last letter-sound remain a challenge to the majority of poor spellers. It is important that children should come to realise that the number of letters in a word's spelling does not usually match the number of syllables in its spoken form. They should progress beyond the syllabic hypothesis and relate print and speech at a more fine-grained level (Treiman & Bourassa, 2000).

The English writing system is typically considered to be an alphabetic, albeit irregular, system. For words that contain more than one unit of meaning, however, English often deviates systematically from the alphabetic principle. The spelling of a word that contains more than one meaningful unit usually reflects meaning rather than sound. It takes time for children to learn and understand the way in which morphology is reflected in spelling (Carlisle, 1988; Ehri, 1986; Gentry, 1982; Henderson, 1985; Templeton, 1992; Waters et al., 1988). It is also challenging for young children to grasp the rules by which suffixes and prefixes are added to spoken words (Carlisle, 1988). For example, the changes that take place between *magic* and *magician* or between *original* and *originality* involve variations in pronunciation and stress. However, not all morphological relations are

so complex. With simple suffixes and relatively common words, even young children find meaning in the approaches to spelling (Carlisle, 1988; Read, 1975; Treiman et al., 1994).

Children initially may struggle to grasp the grouping of phonemes. They may spell groups of phonemes with single letters like “hos” for *horse* because they consider *horse* to contain three units of sound. Children also tend to group initial consonant clusters together. They may consider the spoken word *play* to contain the initial consonant unit “pl” followed by the vowel “e”. They symbolise the “ay” with a single letter rather than analysing it into two phonemes and symbolising each phoneme with a separate letter (Bruck & Treiman, 1990; Miller & Limber, 1985; Sprenger-Charolles & Siegel, 1997; Treiman, 1993). This idea is consistent with the phonological awareness literature which has also shown that syllable-initial consonant clusters form cohesive units (Bowey & Francis, 1991; Fowler, et al., 1993; Kirtley et al., 1989; Treiman, 1992). A final example of children’s tendency to group sounds is their use of a consonant letter to represent all of the phonemes in the letter's name. Examples include “frmmr” for *farmer* and “bamblbs” for *bumblebees.* Several researchers have observed such letter-name spellings among young children (Chomsky, 1979; Derwing & Neary, 1991; Ehri, 1986; Gentry, 1982; Read, 1975; Treiman et al., 1994). The errors appear to be more common for some consonants than for others.

2.5.4 Transfer of learning

Scott (2000) found that learners often experience difficulty transferring their learning of spelling from one context to another. For example, learners can learn specific words for a spelling test and pass the test; however, when they have to use the same words in written text, they often end up with numerous errors. Klein and Millar (1990) agree with this statement and explain that some learner may spend hours filling out spelling workbooks only to make spelling errors in writing when using these same words. Some learners find it difficult to transfer any learning to new contexts (Scott, 2000). Therefore, these learners need explicit instruction, which may draw their attention to links between learnt and used contexts.

Transfer of learning occurs when learning in one context enhances (positive transfer) or undermines (negative transfer) a related performance in another context. Transfer is a key concept in education and learning theory because most formal education aspires to empower the learner to transfer his/her knowledge positively to new contexts, but very often the kinds of transfer hoped for do not occur. Findings from various sources (Pea & Kurland, 1984; Salomon & Perkins, 1989; Scribner & Cole, 1981) suggest that

transfer happens by way of two rather different mechanisms. Reflexive or low-road transfer involves the triggering of well-practiced routines by stimulus conditions similar to those in the learning context. Mindful or high-road transfer involves deliberate effortful abstraction and a search for connections. Conventional educational practices often fail to establish the conditions either for reflexive or mindful transfer. However, education can be designed to honour these conditions and achieve transfer (Lave, 1988). The mastery of reading and writing might impact broadly on cognition. Wide-ranging transfer might be expected from experience with the cognitive demands of reading and writing and the cognitive structures that text carries (Perkins & Salomon, 1992).

Under which conditions does transfer appear? Luria (1976) and Scribner and Cole's (1981) findings suggest that transfer may depend on extensive practice of the performance in question. Belmont et al. (1982) suggest that it is important not only to teach learners to apply a strategy but also to monitor their thinking processes in simple ways. This activation of self-monitoring may help learners to recognise later when they might apply the strategy they had learned. Gick and Hollyoak (1983) are of the opinion that whether transfer occurs or not depends on whether learners have abstracted critical attributes of a situation. They suggest that learners should have explicit abstractions of principles from a situation in order to foster transfer. Mindfulness refers to a generalised state of alertness to the activities one is engaged in and to one's surroundings. Langer (1989) is of the opinion that mindfulness would foster both explicit abstraction and active self-monitoring. Greeno et al. (in press) argue that transfer need not depend on mental representations that apply to the learning and target situations.

In many situations, transfer will indeed take care of itself, if the situations and conditions of reflexive transfer are met more or less automatically (Salomon & Perkins, 1989). For example, instruction in reading normally involves extensive practice with diverse materials to the point of considerable automaticity. When learners face occasions of reading outside of school, such as newspapers, magazines or pamphlets, the printed page provides a stimulus to evoke reading skills (Perkins & Salomon, 1992). In other contexts of learning, the conditions for transfer are less propitious. In such cases, two broad instructional strategies can be introduced to foster transfer, namely hugging and bridging (Perkins & Salomon, 1988). Hugging means to engage the learners in specific situations where they need to practise the required skill. In bridging, the instruction encourages the making of abstractions, searches for possible connections, mindfulness, and metacognition, which will lead to richer transfer. Education can achieve abundant transfer if it is designed to do so (Salomon & Perkins, 1989).

2.5.5 The relationship between reading and spelling

Reading requires blending skills to assemble a unified pronunciation from the separately decoded parts, while spelling requires segmentation skills in order to separate the phonemes in pronunciation. Goulandris (1994) proposed that phonic knowledge obtained through spelling is later transferred to reading, and if these basic skills have not been developed, it will seriously influence the learner's future learning to read. This has been confirmed by several studies (Ehri, 2000; Hindson et al., 2005; Kamhi & Catts, 1991). A complex inter-relationship between reading and spelling is evident and cannot be overlooked. Over the past two decades there has been considerable speculation regarding this complex inter-relationship (Willows & Scott, 1994). Spelling has received considerable attention in research because of the way it relates to reading development (Brown & Ellis, 1991).

Morphological competence is essential in acquiring reading and spelling skills. Morphological competence is needed in precise expression and comprehension because of its links to phonological, orthographic and syntactic components (Haspelmath, 2002). Knowledge of morphology has been related to both decoding (Shankweiler et al., 1995) and comprehension (Wysocki & Jenkins, 1987). In the skilled reader, morphologically competence becomes a key to speed and efficiency (Stanovich et al., 1991; White et al., 1989; Wysocki & Jenkins, 1987). White et al. (1989) describe the process by which a skilled reader uses morphographic segmentation and association quickly to identify an unfamiliar word. Firstly, the skilled reader removes the affixes to expose a root form. Secondly, the reader checks the lexicon for the meaning of the root, and thirdly, the reader adds the meaning of the root (stem) to those of each of the affixed morphemes to arrive at the meaning of the whole word. Mahony et al. (2000) have shown that good comprehenders and good decoders all show sensitivity to relational properties of morphological aspects of words.

2.5.6 Summary

Spelling skills do not develop automatically as reading skills improve. Some fluent readers continue to face spelling challenges even into advanced ages. Therefore, a particular effort should be made from as young as preschool age, to develop spelling skills. It is important that learners understand the rules of spelling and that they are given opportunities to practise these rules. However, where the English writing system is inconsistent and where English deviates systematically from the alphabetic principle,

learners should practise these examples consistently. With much practise, learners should learn these examples by heart, which should lead to the transfer of learnt spelling skills into reading and writing. Much of the success of the learners in acquiring spelling skills depends largely on the teacher (Liberman & Shankweiler, 1991).

2.6 VISUAL PROCESSING DISORDER

I now focus on visual processing disorder and what it entails. I discuss common areas of difficulty, some warning signs, and the treatments of visual processing disorder.

2.6.1 Definition

The terms *to see* and *to look* refer to apprehending something with the eyes, or detecting by means of the eyes or one eye. These terms also refer to understanding, perceiving or discerning what is seen, mentally. They may also mean “to behold” or “to view”, “to follow with the eyes”, “to watch”, or “to regard attentively” (Dictionary of the English Language, 2010; Online Etymology Dictionary, n.d.). Visual processing disorder (VPD) refers to a learner who experiences difficulty in recognising and interpreting information taken in through the eyes (Smith, 1997).

2.6.2 Visual processing

The term *visual perceptual disability* can be misleading. People normally interpret it as something that is wrong with a person’s eyesight, in other words the person’s visual acuity. However, when a learner has a learning disability, visual perceptual difficulties may be associated with the learner being unable to make sense of what he/she sees despite his/her vision not being faulty. In such a case, the learner’s brain experiences difficulties in processing the information which the eye takes in (The Learning Center Foundation, 2012). Fink (2005), Smith (1997) and Hayden et al. (1986) agree that vision is not just a matter of seeing, but it also involves recognition, integration and interpretation of information. They agree that the person experiences difficulty with processing the information taken in through the eyes. This is different from problems involving sight or sharpness of vision. A learner with visual perceptual disability may typically struggle to organise and remember the visual images he/she has just looked at (Crewther et al., 2007). This deficit presents challenges to the whole spectrum of learning and interferes with progress in every subject. It is often not until the child enters school that visual perceptual problems are detected through assessing the learning that took place (Fink, 2005).

2.6.3 Common areas of difficulty

Spatial relation refers to the position of objects in space and to accurate perception of these objects in relation with other objects. Reading is a subject where accurate perception and understanding of spatial relationships are very important. This subject relies heavily on the use of letters and punctuation. After an image enters the eye, the brain's visual perception capabilities interpret the image by connecting it to prior knowledge. Visual perception skills include the ability to tell similar words or letters apart such as "was" and "saw" or "skate" and "stake" or "b" and "d" (Lerner, 1989). Visual discrimination is the ability to differentiate objects based on their individual characteristics as well as the ability to recognise an object as distinct from its surrounding environment (Tager-Flusberg, 2001). The learner may experience difficulty in recognising distinct objects in a picture, or letters on a chalkboard or flash cards. Visual closure is the ability to recognise a symbol or object when parts of an image of the symbol or object are not visible. Visual closure can be tested, for example by asking the learner to identify or complete an incomplete drawing of a human face. An inability to undergo object recognition is a visual memory problem, whereby the person cannot retrieve the mental representation of an object being viewed (Khan & Crawford, 2001). This can interfere with the learner's ability to consistently recognise letters, words, or pictures. What is learned on one day may not be remembered the following day or the next time the learner has to do with the same stimuli. This contributes to high levels of frustration. Whole/part relationships refer to the ability to perceive individual pieces of a whole, relative to the ability to perceive the whole (Levine, 1990; National Center for Learning Disabilities, 2003).

2.6.4 Warning signs

Learners with visual perception disabilities are usually slow to begin reading. They experience difficulty with spelling and usually spell phonetically (Bloom, 1990). Copying from the chalkboard is a huge challenge. The image is forgotten between taking it in and transporting it. Learners may also find problem solving difficult due to problems visualising the scenarios in their mind. They cannot visualise the end result of a task and therefore becomes stuck in the middle and struggle to finish the task. They may experience difficulty with spatial relationships such as distance, size, shape and how things fit together to form a whole. Common problems are "day-dreaming", difficulty with estimating time and difficulty with a sense of direction. Furthermore, these learners may complain of headaches behind the eyes. They may struggle to concentrate in school and may tilt their heads in an uncomfortable position. In some cases, these children may close their eyes

slightly and peep through as if they cannot see properly (Amos et al., 1991). Blurred vision, squints or eye movement disorders may interfere with reading. This needs to be detected and treated (Fink, 2005). A study conducted by Petzold (2002) found no relationship between handedness and head tilt. However, Petzold did not examine the relationship between eye dominance and head tilt. Previc (1991) and Previc and Saucedo (1992) suggest that head tilt may reflect an underlying body laterality problem. Head tilt affects the inner ear, which may cause an imbalance in head posture. It also puts unnatural stress on the muscles which results in rapid tiring.

Teachers and parents often judge the work of learners who suffer from the kinds of problems discussed above, as the result of being careless. These teachers and parents may not be aware of the challenges and problems the learner might be dealing with or how he or she can be helped. It is possible for a learner to be intellectually gifted while also having a learning disability. It is imperative for teachers and the parents of a child with learning disabilities to understand how the child learns best, in order to help the child to succeed in his/her educational and social environments (Dehaene et al., 2005; Finn, 2011; Shaywitz, 2003). The future can be just as bright for children with learning disabilities as it is for children without, provided they receive appropriate early diagnosis and intervention to empower them to learn how to learn effectively (Shaywitz et al., 2008; Shaywitz & Shaywitz, 2005).

2.6.5 Treatment

Eye exercises may help certain eye movement disorders; however, there is insufficient scientific evidence to suggest that eye exercises can influence the visual processes within the brain. Special educational techniques and psychological support may be a more appropriate choice (Fink, 2005). The Irlen method has been used for over 25 years to identify and help people with a type of processing problem called Irlen syndrome. It is also known as scotopic sensitivity syndrome (SSS) (Smith, 1997). Irlen syndrome is a problem with the brain's ability to process visual information. Irlen filters or Irlen lenses are tinted lenses that are intended to help people with learning disabilities to improve their ability to read. According to critics, both the syndrome and the treatment are controversial and based on insufficient research (Smith, 1997).

2.7 EYE DOMINANCE

Eye dominance may play a role in learning difficulties. In the discussion below, I look at previous research on eye dominance, describe methods of determining eye

dominance, and explore the relatively new intervention strategies of attempting to alter eye dominance.

2.7.1 Definition

Ocular dominance, sometimes called “eye dominance” or “eyedness”, is the tendency to prefer visual input from one eye to the other. The side of the dominant eye and the dominant hand do not always match (Banks et al., 2004; Khan & Crawford, 2001). For the sake of this study, the term *eye dominance* was used.

2.7.2 Research in eye dominance

Early research on reading difficulties focused largely in the area of visual processing difficulties (Hayden et al., 1986; Lerner, 1989; Smith, 1997). However, little support for a visual processing cause was found (Mann et al., 1989). More recent studies have found a clear relation between eye dominance and reading and spelling problems (Toga & Thompson, 2003). Approximately two-thirds of the population is right-eye dominant and one-third, left-eye dominant (Ehrenstein et al., 2005; Eser et al., 2008; Reiss & Reiss, 1997). Pumfrey (2001) argues that a failure to develop consistent dominance of the eye’s ocular motor signals can cause confusion about where exactly words and letters are on a page, resulting in reading and spelling problems. The dominant eye is primarily relied on for precise positional information. A dominance problem relating to the eyes include confusing “b” and “d” or “was” and “saw”. Squinting eyes, or difficulty giving attention to close work may also be an eye dominance problem (Beechick, 2009). A study conducted by Cockcroft (2008) explains that a learner’s dominant eye plays a vital role in hi/her ability to read and spell accurately.

A number of authors (Cockcroft, 2008; Du Plessis, 2001; Hannaford, 1995, 1999; Harp, 2009; Herrmann, 1996; Jensen, 2008; Khan & Crawford, 2001; Lombard, 2007) suggest that the right eye is the good reading eye since it is controlled by the left side of the brain, which contains the language centre. In a study conducted by Rombouts et al., (1996), MRI tracking was used to determine the relationship between the eye and the brain. This study supported the findings of previous research (Gazzaniga, 1988; Herrmann, 1996; Sala, 1999) that the brain has a crossover pattern, which means the left side of the body is controlled by the right brain and the right side of the body is controlled by the left brain. They concluded that, because the right eye is linked to the left brain, the right eye reads critically and concentrates on detail. The right eye is able to read factual information for an extended period of time. On the other hand, because the left eye is

linked with the right brain, the left eye is the weaker reading eye (Powell et al. 2006). This eye naturally tracks from right to left and as a result is not as accurate as the right eye when it comes to reading, spelling and mathematics. People for whom the left eye is dominant have been found to be more likely to prefer visual and holistic information in their learning than people for whom the right eye is dominant (Hannaford, 1999). These authors and many more (Hannaford, 1999; Herrmann, 1996; Knecht, 2000; National Center for Learning Disabilities, 2003; Powell et al., 2006; Pulvermüller, 2005) agree that the brain and the eyes work together to enable the learner to read, spell and write accurately. Vallandigham (2001) also stresses that the human brain relies on the dominant eye and dominant inner ear to make subtle corrections in balance as the person sits upright, stands and walks.

On the contrary, authors such as Barbeito and Simpson (1991) and Ono and Barbeito (1982) suggest that eye dominance might be an artefact, with the eye which appears to be dominant merely being the one closest to the perceived object. However, such a view does not explain why 70% of the population shows a right-eye preference (Annett, 2000; Fink, 2005; Kimura, 1993). Kahn and Crawford (2001) conducted a study on eye dominance using the near–far alignment test. They found that eye dominance does shift from one eye to the other, depending on which eye is on the same side of space as the target. In normal sighting tasks, central vision should be used in order to provide equivalent opportunity for either eye to be used to align a nearby target with a distant one. According to Rombouts et al. (1996) the near–far alignment test is the most accurate test for testing eye dominance. Yardley (2012) suggests that eye dominance may change due to severe stress, ill health or activities such as extended periods of computer usage. He also explains that a very small percentage of the population may have central vision, which means that neither eye is dominant. It may also be that one eye is nearly dominant, but not fully. Velay et al. (1994) agree that eye dominance can switch from one eye to the other depending on the angle of the head as well as the angle of the object that is viewed.

2.7.3 How to determine eye dominance

There are many ways to test eye dominance. A number of these methods are now discussed.

The Miles test. The subject extends both arms forward, then brings both hands together to create a small circle with the fingers. With both eyes open, the subject focuses on a distant object through this circle. The subject then closes each eye alternatively while

keeping the head and arms very still. The eye that keeps the object in the circle is the dominant eye (Miles, 1930; Roth et al., 2002). This test was used in the study.

The Porta test. The subject extends one arm straight in front of him/her. With both eyes open, the observer aligns the thumb or index finger with a distant object. The subject then closes each eye alternatively. The eye that keeps the finger and the object lined up is the dominant eye (Dane & Gumustekin, 2002; Khan & Crawford, 2001; Porac & Coren, 1975; Roth et al., 2002).

The Dolman method. This is also known as the hole-in-the-card test. The subject is given a card with a small hole in the middle, and is instructed to hold it with both arms outstretch in front of him/her. The subject is instructed to focus on a distant object through the hole with both eyes open. The subject closes each eye alternatively. The eye that keeps the object in the hole is the dominant eye (Cheng et al., 2004).

The convergence near-point test. The subject focuses on an object that is moved toward the nose until one eye loses focus of the object. The eye that loses its focus first, is the non-dominant eye. This is an objective test of ocular dominance (Cheng et al., 2004).

Stereograms. A stereogram is a pair of two-dimensional panels depicting the view of a scene or an object from the vantage points of the right and left eyes. The subject may see a three-dimensional scene or an optical illusion, depending on the angle of the eyes. Eye dominance can be inferred by what the subject sees at various angles (Reiss & Reiss, 1997).

The pinhole test. A pinhole occluder is an opaque disk with one or more small hole(s) through it. This is used by optometrists to test visual acuity as well as eye dominance. The occluder is a simple way to focus light, temporarily removing the effects of refractive errors. Because light passes only through the centre of the eye's lens, defects in the shape of the lens have no effect while the occluder is used. The maximum improvement in a patient's vision possible, using lenses, can be estimated. The test may also give an indication of the dominant eye of the person being tested (Berens & Zerbe, 1953; Naidoo, 2002).

The ring test. The Landolt C consists of a C-shaped ring. The subject has to identify the position of the opening of the ring. The size of the C and its gap is reduced until the subject reaches a threshold error rate. The minimum perceivable angle of the gap is taken

as an indicator of the person's visual acuity. The eye with greater visual acuity is inferred as being the dominant eye (Safra, 1989).

Fogging technique. The subject fixates a distant object with both eyes open. Lenses are alternately introduced in front of each eye, which blur the distant object. The subject is then asked to state in which eye the blur is more noticeable. This is the dominant eye (Beechick, 2009; De Jager, 2006).

The tube and keyhole tests. The subject is given a tube or keyhole to peep through. The eye that the subject peeps with is assumed to be the dominant eye (Beechick, 2009; De Jager, 2006). The tube, the keyhole and the Dolman tests were used in this study.

2.7.4 Altering eye dominance

It is possible to change eye dominance by actively suppressing the visual field of the dominant eye. This is achieved with an eye patch that covers the dominant eye. The eye patch does not need to be black to blot out all light, and the dominant eye does not need to stay closed. The eye patch simply presents the dominant eye with a visual field containing nothing of visual importance. By doing this, the brain is forced to rely on the non-dominant eye for visual information. The experience does cause slight irritation and frustration for the eye patch wearer until the brain starts to adapt to not being able to use the dominant eye (De Jager, 2006; Doidge, 2007; Fink, 2005; Hagan, 2008; Hannaford, 1999; Harp, 2009; Miller, 2008; Parker-Pope, 2008; Stein, 2001; Walker et al., 1996). Parker-Pope (2008) agrees that suppressing a stronger eye is often successful in developing the weaker eye, and suggests that using a type of eye drop which blurs the vision of the dominant eye, forcing the non-dominant eye to strengthen, is superior to using an eye patch. The reason for this is mainly because learners can still peep through the eye-patch when they are not carefully watched,

2.7.5 Summary

Much information in the classroom and at home is presented visually. It seems as if the child with a visual perceptual disorder can be at a disadvantage in certain situations. More resent research (Harp, 2009; Miller, 2008; Parker-Pope, 2008) also indicates that a child who is not dominant in the right eye may experience a disadvantage. There appears to be some methods which can successfully change the dominance of the eye so that the child may overcome possible disadvantages. Cognitive pre-requisites, be it visual, auditory or more specifically linguistic, are all components of the reading system. Any disruption in

any of these cognitive pre-requisites may prevent normal reading acquisition (Hannaford, 1999). If these skills are not developed successfully, it may disrupt the whole acquisition of the reading system.

2.8 HAND DOMINANCE

Hand dominance has been a debating point for many centuries. After defining hand dominance, I review the history of hand dominance belief and research, and then look at how hand dominance can be determined.

2.8.1 Definition

Hand dominance or laterality is also called “handedness” or “hand dominance”, “chirality” or “laterality”. Hand dominance is a human attribute defined by unequal distribution of fine motor skills between a person’s two hands (Holder, 1997). Dominance refers to control or rule and laterality refers to superior development of one side of the body (American Heritage Dictionary, 2009).

An individual who is more skilled with the right hand is called right-handed, while one who is more skilled with the left is said to be left-handed. A minority of people are equally skilled with both hands, and are termed “ambidextrous”. People who demonstrate awkwardness with both hands due to a physical condition are said to be ambilevous or ambisinister. Dextrality refers to right-handedness, which refers to the preference for using the right hand. Right-handed people are more skilful with their right hands than with their left hands when performing tasks (Dictionary.com, 2012).

Cross laterality, cross dominance or mixed dominance are terms that are used to explain the phenomenon when the dominant eye, ear, hand and foot are not on the same side of the body. For example, the eye may be dominant on the right side but the hand may be dominant on the left side. Or the hand may be dominant on the left side but the leg may be dominant on the right side (De Jager, 2006; Hannaford, 1999; Harp, 2009).

2.8.2 History of hand dominance

According to Fabbro (1994), hand dominance has been known since antiquity. There are 151 verses in the Old Testament and 49 in the New Testament containing references to right- and left-handedness. Years back in history, left-handed children were often forced to become right-handed (Gazzaniga, 2009). This was mainly because of an awkwardness that existed towards left-hand writing as well as many utensils and

apparatus only accommodating right-handers. Left-handers were significantly disadvantaged during the time fountain pens were used for writing (Fabbro, 1994). The biggest difference between a right-hander and a left-hander is that the right-hander writes away from his body and pulls the pen, while a left-hander must write toward his body and push the pen. For this reason, fountain pens were problematic for left-handers (Holder, 2003).

Left-handers were also accused of criminality and dealings with the devil. One reason for this was that the Bible mentions in Matthew 25:31–46 that the lost will assemble on God's left-hand side on judgement day and those who will be saved will assemble on God's right-hand side (Dawson, 1977; Payne, 1987). In his time, Lombroso (1903) was known as the father of modern criminology, and he developed a comprehensive anthropology of the causes of criminality, insanity, feeble-mindedness, and left-handedness. According to Lombroso, left-handedness was a result of having a primitive mentality.

Throughout history, being left-handed was considered negative. The Latin word *sinistra* meant "left" as well as "unlucky" and this double meaning survives in European derivatives of Latin, and in the English word *sinister*. In French, *gauche* means both "left" and "awkward" or "clumsy". A "left-handed compliment" is considered one that is unflattering or dismissive in meaning (Santrock, 2008b; Shaw & McManus, 1993).

2.8.3 Hand dominance in young children

Most people have a preference for using one hand over the other. Usually, children younger than 18 months may use both hands equally since the dominant hand has not been established (De Witt et al., 2008; Kieler et al., 1998). These children seem to rely on which hand is closest to a desired object. The toddler will reach for the object with the hand that is the closest simply for the sake of convenience, regardless of future hand dominance. Usually by the age of 18 months, toddlers will prefer one hand above the other. By the age of 3 years, most children should have developed a dominant hand (De Jager, 2006; Hannaford, 1999). The hand with which a person writes is usually the dominant hand. In some cases, a person may alter his/her handedness as a result of injury or stress in the brain early in life, possibly before, during, or shortly after birth. Sometimes these children experience additional learning problems (Milsom, 2010).

2.8.4 Effects of hand dominance

Many tasks in daily life, such as reaching for an object, involve both eye and arm movements. A number of studies have shown that the hand and the eyes typically show stereotyped patterns of coordinated movement (Crawford et al., 2004; Land & Furneaux, 1997; Land & Hayhoe, 2001). However, in the early 1990s, researchers found little evidence to show that hand dominance had any relation to eye dominance (Fabbro, 1994). After more intensive research, it is now commonly accepted that eye and hand movements are highly coordinated both spatially and temporally and it is therefore better if the eye and hand are dominant on the same side of the body (Bekkering & Sailer, 2002; Bourassa et al., 1996; Dane & Gumustekin, 2002; Jackson et al., 2005; Johansson et al. 2001; Neggers & Bekkering, 2001; Sailer et al., 2000; Song & McPeek, 2009).

Individual differences in hand preference have been used to indicate the presence of language organisation and language processing ability since the right hand is believed to be controlled by the left hemisphere, and the left hand by the right hemisphere as illustrated in Figure 2.5. The language centres of the brain, such as Broca's area (Foundas et al., 1998) and Wernicke's area (Shapleske et al., 1999) have been shown to be located on the left side of brain in the majority (90%) of people. Given the cross-over neurological patterns between the brain and the body, this may suggest that right-handed people should show superior language skills (Foundas et al., 1996; Moffat et al., 1998; Powell et al., 2006; Vernooij et al., 2007). In contrast, left-handed people, believed to be controlled by the right hemisphere of the brain, should experience a disadvantage in developing language skills (Basic et al., 2004; Khedr et al., 2002; Knecht, Deppe et al., 2000; Szaflarski et al., 2002). In a minority of left-handed people (10%), however, the language centre is either located in the right hemisphere or partially located in both hemispheres. This relationship between handedness and language ability is not universally accepted and more research is needed to clarify this phenomenon (Milsom, 2010).

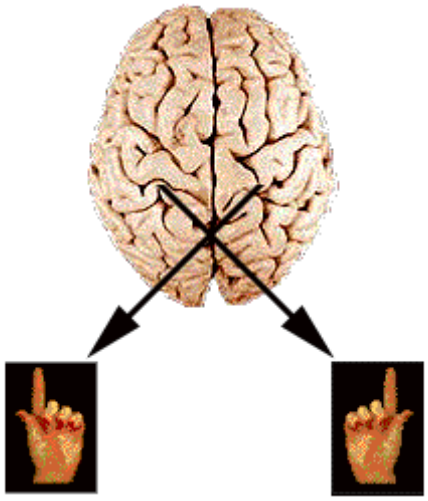


Figure 2.5 A schematic representation of the brain that works with a cross-over pattern with the hands (Chudler, 2011).

2.8.5 Prevalence

A variety of studies suggest that 70–90% of the world population is right-handed, rather than left-handed or having any other form of handedness (Annett, 2009; Holder, 1997; Hugdahl, 2005; Shaw & McManus, 1993; Tan, 1988). Many people may be right-handed but that does not necessarily mean they have a dominant eye, ear and foot all on the right side of their bodies. A person may for instance be right-handed but may kick a ball with the left foot. Research suggests that the eye, ear, hand and leg should all be dominant on the same side of the body. When the dominant eye, ear, hand and foot are not on the same side of the body, researchers believe that this condition, called cross-dominance, may cause co-ordination problems which may influence learning (Dane & Gumustekin, 2002; De Jager, 2006; Hannaford, 1995, 1999; Harp, 2009; Herrmann, 1996; Kokot, 2010). Cross-dominance may contribute to the condition in which children write back to front, also known as “mirror writing” (Doidge, 2007). Aygul et al., (2005) stress that the hand and the eye should be dominant on the same side of the body and if this is not the case, people are more inclined to get headaches and migraines.

Handedness is a vague term, and can mean different things to different people. Most people in our society identify a person’s handedness according to the hand used for writing. Within the scientific community, the vagueness of this term has led to much debate. Some researchers define handedness as the hand that performs faster or more precisely on manual tests, while others define it as the hand that one prefers to use, regardless of performance (Fisher et al., 1991). For over 150 years, many researchers have tried to figure out what the correlation is between handedness and brain lateralisation. Handedness of a human being is an expression of an inborn lateralisation of the cerebral hemispheres where one side dominates. Thus, it was commonly accepted

that a dominant right cerebral hemisphere results in a dominant left hand, and a dominance of the left cerebral hemisphere is responsible for right-handedness (Herrmann, 1996). Clarifying the relationship between handedness and functional brain specialisation may shed valuable light on issues such as dyslexia, stuttering, comparative brain research, developmental neurobiology of the brain and the origins of human language (Kokot, 2009). While some people use one hand exclusively for all tasks, others tend to swap between the hand they preferentially use, depending on the activity. There are very few people who are truly ambidextrous, i.e. show an equal level of skill in both hands (Holder, 1997). Some theorists believe that there is no such thing as to have two dominant hands. A very recent study on ambidextrous children in school, suggests that such children may be more likely to have mental health, language and academic problems than their peers since their dominant hands have not been established and may cause confusion in the brain (Bryner, 2010).

The gene for hand preference appears also to be the gene for hair whorl direction, which determines the direction in which a person's hair on top of the head turns. Left-handed people tend to have counter-clockwise hair whorls on the tops of their heads. Further investigations are looking at possible relationships between hair patterns, handedness, and brain dominance (Klar, 2012).

2.8.6 How to determine hand dominance

Hand dominance can mainly be determined through observation and questioning. However, there is an instrument called the Edinburgh inventory, which is an instrument that people hold in their individual hands and squeeze alternatively. The instrument measures the strength of the force and the scores can be compared for the right and the left hand of the person since the dominant hand is believed to be the stronger hand (Oldfield, 1971; Ransil & Schachter, 1994).

The following observations can be used to determine hand dominance: the subject is observed for the hand with which he/she writes, holds a pair of scissors when cutting, throws a ball, puts food in his/her mouth, and picks up a cup.

2.8.7 Summary

The discussion given in this section shows the value of and need for, a study such as this one to clarify the relationship between the eye and hand dominance.

2.9 AUDITORY PROCESSING DISORDER

I now focus on auditory processing disorder and common areas of difficulty, as well as treatment of this disorder.

2.9.1 Definition

Auditory processing disorder is a disorder in which an individual experiences difficulty in making sense of information taken in through the ears. This is different to problems involving hearing such as deafness or being hard of hearing. Difficulties with auditory processing do not affect what is heard by the ear, but how information is interpreted or processed by the brain (Bloom, 1990).

An auditory processing deficit can interfere directly with acquiring literacy skills. When instruction in school relies primarily on spoken language, the individual with an auditory processing disorder may have serious difficulty understanding the lessons and instructions (Lerner, 1989).

2.9.2 Common areas of difficulty

Tomatis (1996) states that the quality of hearing affects the well-being of the individual because hearing is the primary sense, being the first sense developed by the infant in the uterus, and because hearing affects the entire central nervous system. He is also of the opinion that many psychological problems are a consequence of distorted hearing. Learners who have an auditory processing disorder have difficulty recognising the sounds in words, and so have difficulty with phonological awareness, which is a precursor to reading (Bloom, 1990). Poor phonological awareness can be predictive of reading difficulty. Auditory discrimination is the ability to recognise differences in phonemes as well as sounds that are similar and sounds which are different. Furthermore, a learner who struggles with auditory memory may struggle to follow instructions given verbally or may have trouble recalling information heard through the ear. A learner with an auditory processing deficit may also find auditory sequencing challenging. Auditory sequencing is the ability to remember the order of items on a list or the order of letters in words. Finally, the learner may experience difficulty with auditory blending (Moore, 2007). For example, the learner might be able to spell a word such as “s-t-a-n-d” but may struggle to blend the letters to read the word “stand” (Bloom, 1990; Hayden et al., 1986; Moore, 2007). Katz and Wilde (1994) claim that reading and spelling are the skills most closely associated with auditory processing deficits in the educational context. Kamhi and Beasley (1985) suggest,

however, that it is difficult to establish causal connections between auditory processing and linguistic and academic performance. Cacace and McFarland (1998) report that an auditory processing disability is defined by symptoms that are not unique, but do in fact overlap with other disorders of language, reading and attention.

2.9.3 Treatment

It is important that interventions be aimed at the specific needs of the learner. Learners are very different and do not share the same strengths or areas of weaknesses (Miller, 2011). An effective intervention is one that builds on the learner's strengths in order to develop the specific areas of need. If instructions are given orally, the teacher should supplement this with written or other visual cues. A simple accommodation like backing up verbal directions with visual or written cues may make a huge difference in the learner's performance (Lovett, 2011). Simplifying verbal instructions, speaking at a slower rate and excluding as much distractions as possible can also make a difference in the learner's performance. The teacher can also plan activities that can help build auditory processing skills, for example rhyming games can help build phonological awareness as well as discriminating between similar and different sounds (Bellis, 2002; Moore, 2007).

2.10 EAR DOMINANCE

I now look at ear dominance, possible effects of ear dominance on literacy skill, how ear dominance can be determined, and the relatively new intervention strategy of attempting to alter ear dominance.

2.10.1 Definitions

Dominance, or lateralisation, refers to the localisation of function on either the right or left side of the brain, eye, ear, hand and leg. For the sake of ear dominance, one of the two ears of each person will become more active when the person has to listen attentively (Hannaford, 1999). The more active ear is considered the dominant ear. Listening is to make an effort to hear something or to pay special attention to sound for the purpose of hearing (Dictionary of the English Language, 2010; Online Etymology Dictionary, n.d.). Hearing is the sense by which the ear perceives sounds as well as the capacity to hear (Collins English Dictionary, n.d.; Dictionary of the English Language, 2010). It is therefore clear that hearing is a passive process, it happens naturally and we have limited abilities to improve it. Listening, however, is the ear's primary function and can be developed through concentration on listening more attentively.

2.10.2 Ear dominance and literacy skills

There are various views on the effect of ear dominance on literacy learning effectiveness. Some researchers, such as Tomatis (1996), suggest that right-ear dominance aids learning while left-ear dominance retards learning. He also refers to the right-ear advantage (REA) phenomenon. He explains that left-ear dominance may cause disorders such as learning disabilities and depression. People who are right-ear dominant have an advantage because the right ear processes much faster. They have more control over their voice and speech. He concluded that people having a dominant right ear relate to situations faster, respond to stimuli more appropriately, and have better control over their emotions. On the other hand, a dominant left ear caused people to be more introverted and they had less control over their responses to situations. The Tomatis method of auditory training, founded in 1969, is built on the assumption that training the right ear to become dominant improves literacy skills (Tomatis 1996). This is justified by the view that right-ear dominance is linked to left-brain dominance, and since the language centre of the brain is situated on the left hemisphere of the brain, left-brain dominance must be associated with superior literacy. However, some critics of the Tomatis method suggest that this method does not accurately remedy learning disability, and does not meet the scientific standards for efficiency (Cummings, 1986; Kershner, 1986).

Since the 1860s, much scientific research has suggested that the brain has a cross-over pattern with the body (Hannaford, 1999; Harris, 1993; Herrmann, 1996; Knecht, Drager et al., 2000). Because the brain has a cross-over pattern, a number of researchers have hypothesised that the ear should be dominant on the opposite side of the brain (Previc & Saucedo, 1992; Tomatis, 1996). Most studies involving the ear have interpreted their findings using the assumption that the REA was believed to reflect a dominant left hemisphere where the language centre is found, and a left-ear advantage (LEA) would typically indicate a right-brain dominance (European Review, 2005; Previc, 1991; Tomatis, 1996). Researchers such as Sparks and Geschwind (1968), Milner et al., (1968), Hiscock and Kinsbourne (2011), and Efron et al., (1983) support the assumption that a left-ear advantage (LEA) would typically indicate right-brain dominance. These authors claim that, in order to send messages from the left ear to the left brain, the signal has to travel from the left ear to the right hemisphere, over the corpus callosum, to the language centre in the left hemisphere. This process takes longer than just sending the message from the left ear to the right brain. This delay, even if it is just a fraction of a second, can cause auditory confusion and possible stuttering or dyslexia (Moore, 2007). Damage to the pathway anywhere along this route, similar to auditory processing disorder, would consequently

yield extinction of the left-ear input. A similar argument was made that lesions in the left hemisphere would produce a left-ear extinction effect (Bradly and Berson, 1978). It has therefore been widely accepted that the REA will contribute to optimum learning. Van Wyk (1974) and Brady and Berson (1978) found a significantly higher prevalence of left-ear dominance amongst stutterers than amongst fluent speakers, and Badenhorst (1975) found that right-ear dominant subjects were more confident speakers than were left-ear dominant subjects. These findings possibly lend empirical support to the REA view which is concluded from the fact that the brain works with a cross-over pattern and the left brain therefore is linked to the right ear.

2.10.3 How to determine ear dominance

Unlike the general consensus amongst researchers about determination of hand, eye and leg dominance, there is little agreement amongst researchers about how to determine ear dominance. Various methods have been proposed to determine ear dominance. I now discuss the theories on which each of these methods is based, and the difficulties associated with each of the methods.

Owren and Gardillo's, (2006) work on high and low chords, suggests that using pitch for determining dominance may not be reliable. Owren and Gardillo's, (2006) found that the majority of subjects showed right-ear dominance for high chords, and left-ear dominance for low chords.

Pipe (1988) used an auditory gap detection task to investigate temporal processing asymmetries in normal and mentally retarded learners. Measures of reaction time and response error revealed a REA in both normal and mentally retarded learners and therefore a left-hemispheric dominance. However, a higher incidence of left-handedness was found among mentally retarded learners who, according to Pipe (1988), indicated right-brain dominance. She concluded that some mentally retarded learners might have experienced a shift in brain dominance from left to right possibly due to brain damage in the left side of the brain.

Further studies focused on dichotic listening tasks to determine ear dominance. Dichotic listening has been used in many research studies and clinical reports related to language processing, including dyslexia (Divenyi, & Yund, 1983; Hugdahl, 1995). Dichotic listening means that two auditory stimuli are presented simultaneously, one in the left ear and one in the right ear. In the studies, each subject had to report which of the two stimuli he/she perceived best. In most cases, a right-ear advantage (REA) was reported (Bryden,

1982; Esgate et al., 1996; Gregory et al., 1983; Hugdahl, 1995; Kimura, 1961; Odenthal, 1963; Paquette et al., 1996; Yund & Efron, 1977).

In a study by Hiscock and Kinsbourne (1978), subjects listened to taped passages that consisted of three levels (positive, neutral and negative) of tone of voice crossed with three similar levels of content or meaning, resulting a total of nine different tone/content combinations. The subjects who demonstrated left-ear dominance primarily used the tone-of-voice cues to rate the passages. The subjects who demonstrated right-ear dominance used the content cues. Hiscock and Kinsbourne (1978) concluded that each hemisphere's specialisation for tone and content cues can be greatly affected by the demands of the experimental task.

Another method for determining ear dominance is for the researcher to whisper something to the subjects, and to observe which ear the subject turns towards the sound. A researcher can also ask a subject to identify what is inside a box, or on the other side of a door, by listening, and observe which ear the subject turns towards the box or door (Chudler, 2011). In this study, the last two methods were used as well as the radio method. A radio was switched on across the room. The volume was turned down. The subjects was asked to approach the radio and to listen attentively if he/she could hear anything. I observed wich ear each subject turned to the radio.

2.10.4 Altering ear dominance

Similar to developing the non-dominant eye, some researchers suggest that the dominant ear should be suppressed so that the non-dominant ear is forced to listen. Earplugs may be used to block the dominant ear (Hugdahl, 1995). Tomatis (1996) also suggests that sound be directed to the non-dominant ear in order to stimulate the ear.

2.10.5 Summary

Problems with hearing quality, auditory processing and dominance can result in attention problems and difficulty following instructions, behavioural problems and possible psychological problems, problems with speech quality and long-term memory and therefore poor academic achievement. However, once the cause of the problem is identified, the cause can be eliminated with treatment and normal functioning can be achieved.

2.11 BRAIN DOMINANCE

I now define brain dominance, discuss a history of brain hemisphere research, and review methods to determine brain dominance.

2.11.1 Definition

Brain lateralisation/dominance refers to the fact that the two halves of the human brain are not exactly alike (Schiller, 1979). Each hemisphere has functional specialisations. Brain dominance refers to a preference for using one hemisphere of the brain over the other hemisphere. In other words, tend to use the left side of their brain over the right side of their brain, while others tend to use the right side of their brain over the left side of their brain. De Jager (2006) explains that laterality is an internal awareness that the body has two sides. It refers to the imaginary line that separates the right and the left side of the body. These sides are divided by a midline. There are three midlines: between left and right, front and back, down and up. These midlines all exist in the brain as well.

2.11.2 History of brain hemisphere research

Much of what we know about the right and left hemispheres comes from studies of stroke victims. When the left side of the brain was damaged, the right side of the body lost its functioning and vice versa (Gazzaniga, 1988; Herrmann, 1996; Sala, 1999). In the 1860s and 1870s, two neurologists, Paul Broca and Karl Wernicke, observed that people who had damage to particular areas on the left side of the brain had speech and language problems. People with damage to these areas on the right side usually did not have any language problems (Rasmussen & Milner, 1977; Woods et a., 1988). The two language areas of the brain that are important for language now bear their names, i.e. Broca's area and Wernicke's area. In the 19th century, Paul Broca described the presence of left-hemisphere language regions in right-handed patients (Schiller, 1979). Since then, some researchers have speculated that left-handed people should show right-hemisphere language dominance, but have not been able to find enough evidence to support this speculation (Benson et al., 1999; Harris, 1993; Hines, 1985).

Investigations of the brain have clearly demonstrated that the left and right hemispheres differ in their structures (e.g. in the size, location and shape of different areas) and in their information processing abilities (Cabeza & Nyberg, 2000; Gazzaniga, 2000; Hellige, 2001). Since the 1860s, different scientific studies have found that in the majority of humans (approximately 95%) speech production and language comprehension

are primarily located in the left hemisphere (Cabeza & Nyberg, 2000; Hellige, 2001; Knecht et al., 2000; Papathanassiou et al., 2000). The structures involved in language functions are also more prominent in the left hemisphere of the brain, compared to the right hemisphere (Dorsaint-Pierre et al., 2006; Foundas et al., 1996; Shapleske et al., 1999).

Sperry (1961) came up with a solution to cut off the connection known as the corpus callosum, between the two hemispheres to prevent an epileptic seizure to spread from the side of the brain where it started to the opposite side of the brain. This surgical operation isolates most of the right hemisphere from the left hemisphere, which prevents damage from spreading through the brain. Some of these patients were used in research to shed light on brain damage in correlation with body functioning. The studies demonstrated that the left and right hemispheres are specialised in different tasks (Girstenbrey, 1981; Hamilton, 1998).

2.11.3 Left- and right-brain dominance

Brain dominance is affected by our genetics, childhood experiences, and family environment. Although humans tend to be “right-brained” or “left-brained”, they permit the other hemisphere to lead occasionally. Some tasks require the left hemisphere primarily, and others predominantly call on the right hemisphere. The tendency to prefer one side of the brain is called lateral dominance (Hannaford, 1995). Further research showed that in the majority of the population, neuro-anatomic structures known to be involved in language functions are larger or more pronounced in the left hemisphere, compared to the right hemisphere (Herrmann, 1996; Knecht, Deppe et al., 2000).

The brain uses information received from sight, sound, textures, smells, tastes and movement in an organised manner so that the person knows how to behave and how to respond accordingly. Sensory integration should occur naturally and should not require conscious thought or effort. However, for some, sensory integration can be inefficient. Such learners experience difficulty working out what is going on inside and outside of their bodies. These learners may experience difficulties in learning to behave and to respond appropriately (Hannaford, 1999; Harp, 2009; Lombard, 2007). Herrmann (1996) agrees and claims that people have different preferred thinking and learning styles and that those preferences influence how people store, retrieve and make meaning out of information. These preferred thinking and learning styles are linked to brain-dominance profiles. By observing these profiles, Hannaford (1995) found a direct correlation between the labels

learners receive at school according to their performances. Such labels refer to “gifted”, “talented”, “ADD”, “ADHD”, “dyslexia”, ”emotionally handicapped” or “special education”.

Stout and Ruble (1994) explain that each person develops brain dominance as he or she progresses through childhood through to mature adulthood. This means that during this time, the person develops an inclination to act and think in the mode of either the left or right hemisphere. The left hemisphere of the brain tends to be more rational, critical, analytical, focused on detail, and preferring facts and rules. The right hemisphere, on the other hand, tends to be more holistic and intuitive, responsive to visual images, and it is flexible and emotional, using imagination and fantasy (Foundas et al., 1998; Gazzaniga, 2004; Hannaford, 1999; Harp, 2009; Harris, 1993; Herrmann, 1996; Neethling, 2000; Ornstein & Galin, 1973; Ornstein & Thompson, 1984; Powell et al., 2006). Figure 2.6 presents an illustration of the two halves of the brain to show some clear differences.

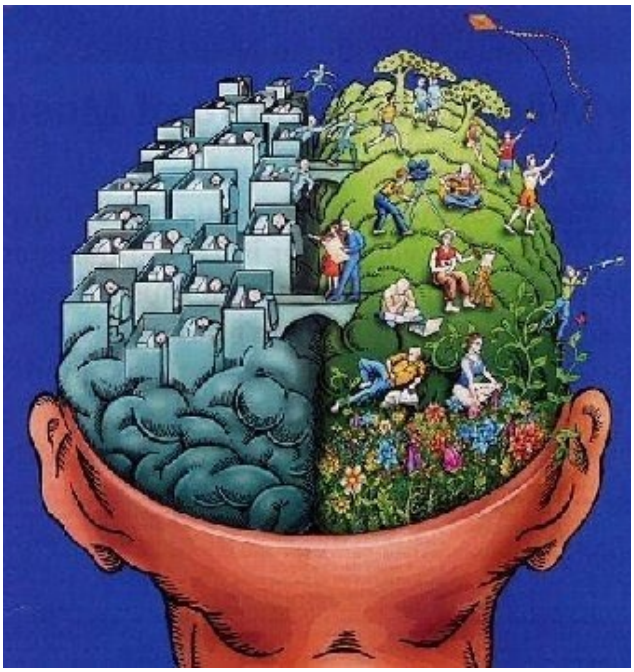


Figure 2.6 A pictorial representation of the difference between the left brain and the right brain (Freed & Parsons, 1998). “I think in pictures, you teach in words.”

According to Neethling (2000), a person does need not be only left-brain or right-brain dominant. Some people are dominant in the top brain, which means the top left hemisphere and top right hemisphere. Others are dominant in the bottom brain, which means the bottom left and bottom right hemispheres. Yet again, some people can be dominant across the brain, which means they can be dominant in the left top hemisphere and the right bottom hemisphere or in the right top hemisphere and the left bottom hemisphere. People tend to think and learn differently depending on their brain dominance

(Gazzaniga, 2009; Hannaford, 1995). A right-brained dominant person does not change into a left-brained dominant person, but a person can develop the side of his or her brain which is not dominant, to make it function more effectively (Herrmann, 1996; Neethling, 2000; Stout & Ruble, 1994).

2.11.4 The language centre in the brain

Scientists have used MRI technology to map what each part of the brain is used for. Language is lateralised to the left hemisphere of the brain but can occasionally also be found in the right hemisphere (Knecht, Deppe et al., 2000; Reid & Norvilitis, 2000). This variability indicates the high degree of freedom with which the brain instantiates language. A learner who is dominant in the right hemisphere and does not develop the skills of the left hemisphere where the language centre is found, may develop poor language skills (Halonen et al., 2006; Stout, 2005).

Shaywitz et al. (2002) did research across a large group of children between the ages of 7 and 17. These studies have shown that reading and developing reading skills activate brain activity in the left hemisphere. This is consistent with findings by a number of researchers (Booth et al., 2001; Harris, 1993; Schlaggar et al., 2002; Springer & Deutsch, 1997; Turkeltaub et al., 2003). In children with reading difficulties, areas in the right hemisphere corresponding to the position of the language centre in the left hemisphere, have been shown to be less active during reading activity (Brunswick et al., 1999; Shaywitz et al., 2002; Shaywitz, 1998). Furthermore, the degree of activation in the left posterior superior temporal hemisphere was found to correlate strongly with the extent of phonological awareness in children (Turkeltaub et al., 2003). Phonological awareness has been shown to be related to ability to undergo grapheme–phoneme processing (Paulesu et al., 2001; Simos et al., 2002; Temple, 2002; Temple et al., 2001). Interestingly, learners who struggle with reading show an inclination to hyperactivity, which is also linked to low activation in the left brain (Shaywitz, 1998; Simos et al., 2002). A remediation study further showed that, following a phonological awareness training programme, learners with reading barriers did not only become better readers, but their behaviour improved as well (Simos et al., 2002).

It is quite tempting to ascribe reading difficulties to a congenital dysfunction of the left hemisphere (Temple, 2002) resulting in disrupted phonological representations and difficulties to learn alphabetic reading (Brown et al., 2001; Galaburda et al., 1985; Rae et al., 1998). According to Stein (2001), auditory and visual processing disorders are also

samples of congenital dysfunctions in the brain. He further explains that sensory pathways to the brain are deficient in learners with auditory and visual processing disorders and reading difficulties. This leads to visual disorders causing reading difficulties, and to auditory disorders causing the phonological deficit. Some researchers (McCandliss et al., 2003) propose that sensory deficits should be observed for stimuli in a certain range of temporal frequencies characteristic of the response domain of magnocells. In the auditory domain, this refers to difficulties in auditory processing (Stein et al., 2000; Tallal, 1980). The empirical evidence is highly contradictory and split between findings consistent and inconsistent with the theory (see reviews in Ramus, 2003; Rosen & Mangonari, 2001; Skottun, 2000).

2.11.5 How to determine brain dominance

The Herrmann Brain Dominance Instrument (HBDI) is a system claimed to measure brain dominance. It does so by measuring a person's thinking preference, and assumes that particular thinking preferences are associated with particular brain dominances. The HBDI is a type of cognitive style measurement and model similar to the Myers-Briggs Type Indicator (MBTI). The Learning Orientation Questionnaire (LOQ) may also indicate brain dominance (Deardorff, 2005; DeWald, 1989; Herrmann, 1996). Brain dominance can further be assessed by MRI scans (Deppe et al., 2000; Frost et al., 1999) or the Wada test. In the Wada test, an anaesthetic is introduced to one hemisphere of the brain via one of the two carotid arteries. Once the hemisphere is anesthetised, a neuropsychological examination is used to determine dominance for language production, language comprehension, verbal memory and visual memory functions (Knecht et al., 1996). The Neethling Brain Instrument (NBI) is familiar for its very accurate indication of brain dominance. The Neethling Young Child Indicator (YCI) (Neethling, 2000) was used in this study to determine brain dominance.

2.11.6 Summary

It has been established that the brain has two halves and that different specialised functions are situated in different parts of the brain. It has also been established that people are dominant in certain parts in their brains. This influences the way people think and learn. It is therefore important to understand brain dominance, especially in education, so that the teacher may accommodate different teaching methods in order to accommodate the different brain profiles. It could also be helpful to find ways of stimulating the left brain in right-brained children in order to improve their language skills.

2.12 CONCLUSION

In this chapter, I have outlined the theoretical framework within which I operated during the research. The literature review covered a large amount of research on the topics that will be mentioned below. I started by looking at the South African curriculum and some possible challenges we are facing based on the results of systemic evaluations and literacy research. I then focused on why literacy is important as well as the teaching of literacy. Thereafter, literacy skills such as phonological awareness, spelling and reading were discussed with an in-depth overview of different aspects closely related to all three skills individually. I then turned my focus to visual processing disorder and eye dominance, which I discussed in turn. After an in-depth look at hand dominance, I focused on auditory processing disorder and ear dominance. I finally ended the chapter with a discussion on brain dominance.

CHAPTER 3
RESEARCH DESIGN

In this chapter, I describe and justify the research activities I carried out during the course of this study. The research was performed within a positivist paradigm with a cross-sectional correlational research methodology using quantitative data. The following three research questions and associated sub-questions guided the collection and analysis of data:

1. Which relationship exists between the various components of literacy (phonological awareness, reading and spelling)?
    - What is the relationship between spelling and reading skills?
    - What is the relationship between phonological awareness and literacy skills?
2. Which relationships exist between literacy skills and various body dominances in Grade 2 learners in a KZN school?
    - What is the relationship between brain dominance and literacy skills?
    - What is the relationship between eye dominance and literacy skills?
    - What is the relationship between hand dominance and literacy skills?
    - What is the relationship between ear dominance and literacy skills?
3. Which body dominance profile is associated with high literacy skills?

3.1 HYPOTHESIS

There is a correlation between brain dominance, body laterality and literacy skills.

3.2 RESEARCH PARADIGM

This study was embedded in a positivist paradigm with a quantitative approach. A positivist approach was based on the assumption that a mind-independent reality exists, which can be known through controlled survey and experimentation. Research within a positivist paradigm requires collection of accurate quantitative data by means of precise empirical observations collected by means of experiments and/or surveys (Maree, 2010). The aim of the study was to answer questions objectively according to measurable variables in order to explain a phenomenon. In a positivist approach, the hypothesis is tested by carefully analysing the research results (Krause, 2005; Leedy & Ormrod, 2001; Neuman, 2000). A quantitative study is systematic and objective. In a quantitative study,

numerical data from a selected subgroup is used to make conclusions about the group (Maree, 2010).

3.3 RESEARCH DESIGN

A cross-sectional survey design was used in this study. In a cross-sectional survey study, participants are tested in a single session, to provide a single impression of the population during the period that the research is done. The cross-section survey design is much more convenient and economical than longitudinal studies, in which participants are followed over an extended time (Cresswell, 1994). Cross-section surveys can describe the characteristics of the sample (e.g. strategy use) at a given time; however, such studies cannot give answers about how variables change over time (McCombs & Whisler, 1997).

3.4 POPULATION AND SAMPLE

The total population (N=119) of Grade 2 learners in a school in the Umzinyathi district in KwaZulu-Natal was involved in this research. The school is situated in an urban area and is attended by 900 learners. It is a private primary school. Approximately half the learners are white with the remainder approximately equally divided between being black and Indian. The teacher–learner ratio is approximately 1 teacher for every 23 learners. All the Grade 2 teachers are appropriately qualified, and had SACE registration. The school is very well resourced and draws learners from an upper-middle class socio-economic background.

Consent was obtained from the ethical committee at the North-West University. Consent was obtained from the parents of all the participants (Appendix A) as well as from the principal of the school (Appendix B). Oral consent (Appendix C) was obtained from each child who participated. This was a convenience, rather than representative, sample. Data collection needed to be economical, easily administered and relatively fast in order to be feasible, since the researcher had no financial support. These criteria were met by using a convenience sample with all the Grade 2 learners from a single school participating in the study. The choice of this school was appropriate since the school was operational and the principal, teachers and learners were enthusiastic and co-operative. It was therefore possible to collect reliable data from learners for whom it was reasonable to assume that they had been appropriately prepared for the relevant tests.

3.5 MEASURING INSTRUMENTS AND DATA COLLECTION

All participants were subjected to tests for reading, spelling, phonological awareness, eye, brain, ear, and hand dominance. The tests used to measure these variables are discussed below. These particular tests were chosen for use because of their ease of administration and because, in most cases, their validity had been established in existing literature.

3.5.1 Measuring literacy

Three components of literacy were measured: reading, spelling and phonological awareness. Reading and spelling ability were measured using the ESSI reading (Appendix D) and spelling (Appendix E) tests for Grade 2 learners (Esterhuyse et al., 2002). The reading test that was used tested reading fluency as an indicator of reading skill. Phonological awareness was measured using the segmenting, blending and deletion tests (Appendix F) developed by Nel and Malda (2011) and which is based on work by Schuele and Boudreau (2008). The reading and spelling tests were each out of 20 marks, and the phonological awareness test out of 40 marks.

3.5.2 Measuring eye dominance

Eye dominance was determined through requiring learners to complete three simple tasks, obtained from literature (Beechick, 2009; Cheng et al., 2004, De Jager, 2006; Miles, 1930; Roth et al., 2002). Observations were recorded. These tasks were:

1. Each participant was asked to peep through an empty paper towel role. I recorded which eye the child put up to the tube.
2. Each participant was asked to peep through a key hole. The eye used for this was assumed to be the dominant eye (Beechick, 2009; De Jager, 2006), and was recorded.
3. Each participant was handed a piece of cardboard with a small square cut out of the middle. I stood behind the participants and asked them to hold the cardboard very still with their arms outstretched in front of them. I instructed the participants to focus through the hole with both eyes open, on a picture which was stuck up on the wall across the room. I then asked the participant to close one eye without moving his or her head or the cardboard. I held the piece of cardboard to make sure that the participant did not move the cardboard. If the participant was unable to close one eye, I assisted him or her by covering the eye with my hand. I then asked the

participant, “Do you still see the picture or did it move out of the square?” The same procedure was repeated for the other eye. The eye, which held the picture in the square, was recorded as the dominant eye.

3.5.3 Measuring ear dominance

As discussed in Chapter 2, there is no universally accepted test for ear dominance. Therefore, tests were designed, for the purposes of this study, based on the principles used for determining eye and hand dominance, namely giving each participant the opportunity to show which ear he or she uses preferentially. Ear dominance was determined through completing two simple tasks. Observations were recorded. These tasks were:

1. I asked each participant to put his/her ear to a radio that was turned on very quietly, to listen if he or she could hear anything. I assumed that individuals prefer turning their heads to use the dominant ear, and recorded these results.
2. I asked each participant to put his/her ear to a closed door to listen if he or she could hear anybody on the other side. The room was well insulated against noise, and therefore each participant had to listen with concentration. I assumed that individuals prefer turning their heads to use the dominant ear, and recorded these results.

3.5.4 Measuring hand dominance

Hand dominance was determined through requiring participants to complete three simple tasks, obtained from literature based on studies done by Oldfield (1971) and Ransil and Schachter (1994). Observations were recorded. These tasks were:

1. Each participant was asked to write his/her name on a sheet of paper. I assumed that individuals prefer writing with their dominant hand, and recorded these results.
2. Each participant was asked to pretend drinking from a cup. I assumed that individuals prefer reaching for an object with their dominant hand, and recorded these results.
3. Each participant was asked to throw a ball. I assumed that individuals prefer throwing with their dominant hand, and recorded these results.

Additionally, data were collected from each parent, in the form of a short questionnaire (Appendix G). On a five-point scale (always left, usually left, no preference,

usually right and always right), the parents were asked to give an assessment of which hand their child uses for five common everyday activities such as drawing, throwing, cutting, holding a toothbrush when brushing teeth, and holding a spoon when eating.

3.5.5 Measuring brain dominance

The NBI brain instrument, the Young Child Indicator (Appendix H) was used to determine each child's brain dominance (Neethling, 2000). In this test, individuals have look at a set of 20 pairs of pictures, and indicate the picture preferred in each pair. This test is based on the assumption that particular preferences are associated with particular brain dominances. Guidelines for analysis are included with the instrument. Use of these guidelines yields a descriptive, non-judgmental report of the individual's thought preferences, and, therefore, left- or right-brain dominance profile.

3.6 DATA ANALYSIS

Correlation tests were used to determine the extent of correlation between two continuous variables. A resulting r-value greater than 0,6 was accepted as a strong indicator of correlation. Where correlations were sought, the data were also graphically represented using a scatter plot. In each of these, participants are represented as points. Trend lines were added to the scatter plot to draw attention to the extent of the correlation, with a steeper gradient and fewer outlying points indicating a greater correlation strength. The advantage of scatter graphs is that they retain details about the range and distribution of the data (Gay & Airasian, 2003). When the relationship between two variables were investigated, and one variable was discrete, statistical significance was determined using a Student's t-test. A p-value of less than 0,01 (greater than 99% probability of significance) (Huck, 2008) was accepted as indicating statistical significance. In such cases, the means are represented graphically using bar graphs. In these bar graphs, error bars show standard deviation.

During data analysis, correlations were sought between the various components of literacy and between various dominances in the body and literacy skills. In order to do this, the scores for the individual tests (reading, spelling and phonological awareness) were sometimes used, and at other times, combinations of the tests were used. Combinations of scores were used to find out if body laterality had an effect on reading on its own, then spelling on its own, then phonological awareness on its own and, finally, on literacy skill which was a combination of reading and spelling. This was done in order to find out if body laterality influenced all three areas or possibly only one or two of the areas. For example,

the reading and spelling test scores were added up to obtain an index referred to as “reading + spelling”, and the reading, spelling and phonological awareness scores were added together to obtain an index referred to as “literacy”.

3.7 ETHICAL ASPECTS OF THE RESEARCH

The following ethical aspects applied during this research. Permission to conduct the research was requested (Appendix I) from the Department of Education in KwaZulu-Natal and was obtained on 1 June 2011 (Appendix J). No child was humiliated or put under stress. Consent was obtained from the principal of the school and from the parents of each of the participants. The identities of learners have been protected and kept confidential. All information, collecting of data, findings, results and communication with lecturers were handled with confidentiality and honesty.

3.8 VALIDITY AND RELIABILITY

Validity refers to the extent to which a tool measures what it sets out to measure (Knapp, 1998). Internal validity relates to the extent to which the design of a research study is appropriate for the research questions. External validity relates to whether or not research findings can be generalised beyond the immediate study sample and setting (Knapp, 1998; Peat, 2002).

The internal validity of this study was demonstrated by the fit of the research design in the positivist paradigm within which the study was situated, and the appropriateness of the tests used for measuring the relevant variables. Quantitative data were collected in a controlled manner, with the researcher remaining detached from the participants in order to draw unbiased conclusions (Leedy & Ormrod, 1989). In this study, subjects were used as their own controls, which means the same group was exposed to the different treatments, one treatment at a time. Direct replication was used. This refers to replication by the same researcher, with the same subject or with different subjects, in a specific setting (Gay & Airasian, 2003). Thorough statistical analysis was done, including correlational analysis and use of Student’s t-tests. A fairly large sample (n=119) was used, improving the validity of the statistical test performed on the data. The tests used have been shown, in existing literature, to validly measure the variables they claim to measure. This is the case for all the tests used except those used to determine ear dominance (for which no literature exists). The tests developed to measure ear dominance were consistent with established measurements of eye and hand dominance, and were therefore considered likely to be appropriate.

Since this was a convenience sample, the findings of this study may not be generalisable to the entire South African Grade 2 learner population, thus possibly throwing the external reliability of this study into question. However, the representivity of the sample was improved by the fact that both genders and various races were included in the sample. The sample was, however, not at all representative of the socio-economic and educational backgrounds of all South African learners. Use of a sample that was fairly homogenous regarding socio-economic and educational backgrounds, was considered important to improve the validity of the relationships found in the study, since this improved the likelihood that the learners were appropriately and approximately equally well prepared for the tests performed. It also reduced the likelihood that these relationships were due to factors other than the relationship between the variables being compared. All the learners came from similar, upper-middle class socio-economic backgrounds and the majority of learners had attended this particular school from the inception school year (Grade R). All the learners had therefore been exposed to the same curriculum throughout their schooling.

Reliability means dependability or trustworthiness (Knapp, 1998). Trustworthiness is the degree to which a test is supposed to consistently measures whatever it measures (Peat, 2002). A small standard error of measurement indicates high reliability and a large standard error of measurement indicates low reliability (Peat, 2002). Standard deviations around each mean calculated, are given in Chapter 4. In this way, the extent of reliability of this study is represented transparently. Existing literature on the tests used in this study has already established the reliability of these tests. For example, a number of researchers (Esterhuyse et al., 2002; Huysamen, 1996; Schepers, 1992) have shown the ESSI reading and spelling tests that were used, to be reliable. Similarly, the NBI (Neethling Brain Instruments) has been tested extensively since 1980 in a wide range of studies (Korf, 2004).

The reliability of the tests used was also indicated by the consistency of data obtained from the multiple versions of tests used. Hand, ear and eye dominance were each tested using multiple tests, as has already been described. The data obtained from these tests were found to be consistent. For example, the data collected from the three tests on handedness were consistent for each child, and were also consistent with data collected from the child's parents.

3.9 LIMITATIONS

A convenience rather than representative sample was used. This decreased the generalisability of the findings to the larger South African Grade 2 population. However, as already motivated, the convenience sample's fairly homogenous educational and socio-economic backgrounds were considered to improve the validity and reliability of the findings of the relationships between the variables studied. The fact that no existing, validated test of ear dominance could be found, is also a limitation. This limitation was kept in mind when interpreting the data about the relationship between ear dominance and literacy.

3.10 CONCLUSION

In this chapter, I have described and motivated the research methodology used in this study. I have shown that the methodology used was appropriate for answering the research questions under the time, organisational and financial constraints. Accurate quantitative data were collected by means of precise empirical observations and tests. All participants were subjected to tests for reading, spelling, phonological awareness, eye, brain, ear, and hand dominance. During data analysis, relationships were sought between the various components of literacy and between various dominances in the body and literacy skills. Statistical tests (correlations and Student's t-tests) were performed to test for statistical significance of relationships observed. I have also motivated the validity and reliability of the study, and discussed the limitations of the study.

This study is valuable because it sought to provide answers to questions concerning the relationships between the various components of literacy (phonological awareness, reading and spelling), and between various dominances (brain, eye, ear and hand dominance) and literacy skill. Such knowledge should enable teachers to perform accurate and timely diagnosis of problems related to literacy. I now present my findings, in Chapter 4, and discuss these in terms of the theoretical framework given in Chapter 2.

CHAPTER 4
DATA, ANALYSIS AND INTERPRETATION

In this chapter, the research findings are presented in support of seven assertions which emerged from the data analysis and interpretation processes, guided by the study's research questions. Each assertion is supported by relevant data and a discussion of how this data were analysed and interpreted in terms of the literature reviewed in Chapter 2. Correlation tests were used to determine the extent of correlation between two continuous variables. A resulting r-value greater than 0,6 was accepted as a strong indicator of correlation. Where correlations were sought, the data are also represented graphically using a scatter plot. In each of these, each learner is represented as a point. Trend lines have been added to the scatter plot to draw attention to the extent of the correlation, with a steeper gradient and fewer outlying points indicating greater correlation strength. When the relationship between two variables were investigated, and one variable was discrete, statistical significance was determined using a Student's t-test. A p-value of less than 0,01 (greater than 99% probability of significance) (Huck, 2008) was accepted as indicating statistical significance. In such cases, the means are represented graphically using bar graphs. In these bar graphs, error bars show standard deviation (Gay & Airasian, 2003). A literacy score was calculated for each learner by adding all the scores the learner obtained (i.e. the scores for the spelling, reading and phonological awareness tests). This score was used as an indicator of literacy in the relevant statistics calculated and graphs represented in this chapter.

Analysis of the data, as presented in this chapter, was guided by the three research questions and associated sub-questions, which are repeated here:

1. Which relationship exists between the various components of literacy (phonological awareness, reading and spelling)?
    - What is the relationship between spelling and reading skills?
    - What is the relationship between phonological awareness and literacy skills?
2. Which relationships exist between literacy skills and various body dominances in Grade 2 learners in a KZN school?
    - What is the relationship between brain dominance and literacy skills?
    - What is the relationship between eye dominance and literacy skills?
    - What is the relationship between hand dominance and literacy skills?
    - What is the relationship between ear dominance and literacy skills?
3. Which body dominance profile is associated with high literacy skills?

4.1 HYPOTHESIS

There is a correlation between brain dominance, body laterality and literacy skills.

4.2 PHONOLOGICAL AWARENESS AND LITERACY

Assertion 1: *Phonological awareness is a good indicator of reading and spelling skills.*

Table 4.1 shows a strong (p= 0.70, and 0.75 respectively) correlation between reading, spelling and phonological awareness. Marked correlations are significant at p < .5000. In Table 4.2, a cronbach alpha value of .88 was obtained and therefore supported reliability to draw a correlation between reading and spelling combined and phonological awareness since a cronbach value of above .7 is considered strong evidence. In table 4.3, a strong (p= .77) correlation between reading and spelling combined and phonological awareness are evident.

Table 4.1 Correlations between reading, spelling and phonological awareness.

	Correlations Marked correlations are significant at p < .05000 N=118		
	Reading test (20)	Spelling test (20)	Phonological awareness (40)
Reading test (20)	1.0000	0.7935	0.7051
Spelling test (20)	0.7935	1.0000	0.7546
Phonological awareness (40)	0.7051	0.7546	1.0000

Table 4.2 Summary of scale.

	Summary for scale: Mean=22.71 Std.Dv.=9.77 Cronbach alpha: .88 Standardize alpha: .88 Average inter-item correlation: .79 Valid N=118			
	Mean if deleted	Var. if deleted (20)	Std.Dv. if deleted	Itm-Total correlation
Reading test (20)	11.03	26.43	5.14	0.79
Spelling test (20)	11.67	26.38	5.13	0.79

Table 4.3 Correlations between reading and spelling combined and phonological awareness.

Variable	Correlations Marked correlations are significant at p < .05000 N=118 (Casewise deletion of missing data)	
	Reading and spelling	Phonological awareness (40)
Reading and spelling	1.0000	0.7707
Phonological awareness (40)	0.7707	1.0000

In the scatter plot shown in Figure 4.1, each learner's performance in this combined reading and spelling score is plotted against his/her performance in the phonological awareness test. This shows again the strong (r= 0,75 and 0.70 respectively) correlation between phonological awareness and reading and spelling performance.

This is consistent with the majority of research done on phonological awareness as a predictor of literacy skill (Muter et al., 1997; Sprugevica & Hoien, 2003; Stackhouse et al., 2002; Stanovich et al., 1991; Treiman et al., 1993; Treiman et al., 2001; Treiman et al., 1995; Vandervelden & Siegel, 1995; Wagner & Torgesen, 1987; Yopp, 1992) (see section 2.4.3). This relationship can be understood in terms of the information model (IPM) of learning. Phonological awareness may possibly be viewed as a kind of procedural knowledge of how to manipulate sounds. Proficiency in this procedural knowledge can be viewed as reducing cognitive load during reading and spelling, therefore improving literacy performance (see section 4.4.2).

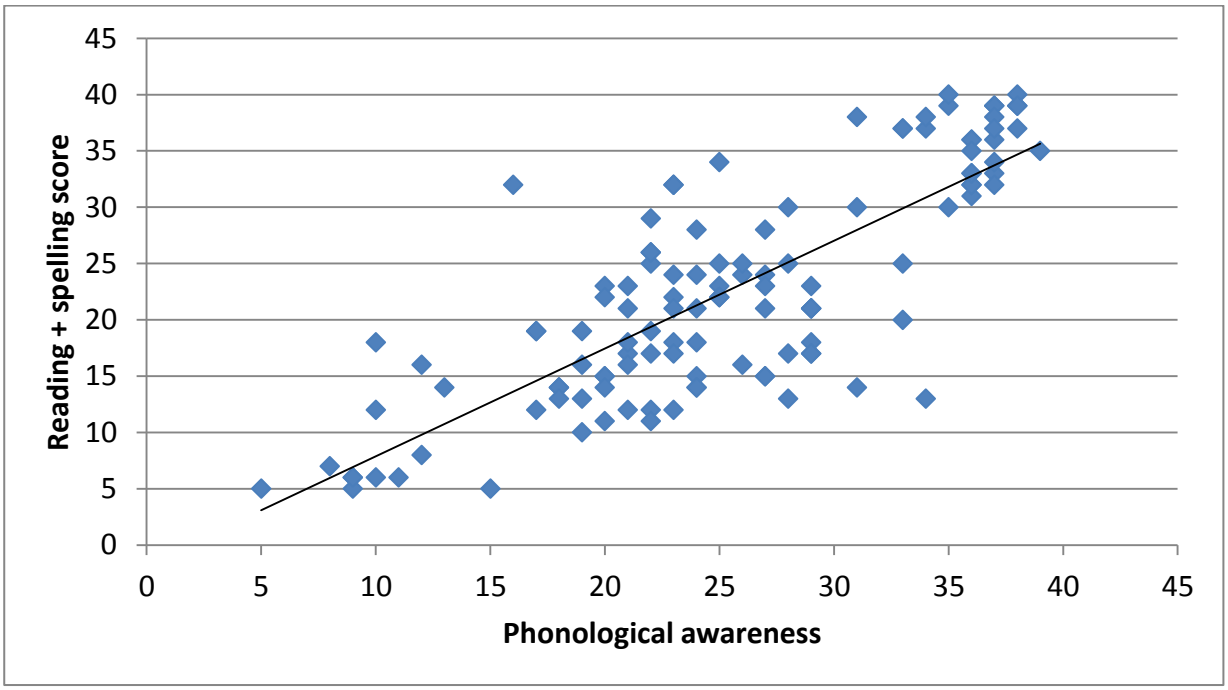


Figure 4.1 Relationship between phonological awareness and reading and spelling combined.

4.3 READING AND SPELLING SKILLS

Assertion 2: *Reading and spelling skills are related.*

In Figure 4.2, each learner's performance in each of the reading and spelling tests is represented as a point on the scatter plot. This shows a strong (r=0,79) correlation between reading and spelling skills. This is consistent with some of research done on the relationship between reading and spelling (Brown & Ellis, 1991; Ehri, 2000; Goulandris,1994; Hindson et al., 2005; Kamhi & Catts, 1991; Shankweiler et al., 1995; Wysocki & Jenkins, 1987) (see section 2.3.5.3). It may therefore be reasonable to accept that better readers are better spellers and vice versa. Proficiency in morphological competence plays an essential role in acquiring reading and spelling skills. Morphological competence is needed in precise expression and comprehension because of its links to phonological, orthographic and syntactic components (see section 2.5.2 and section 2.5.3). Therefore, it can be accepted that once the learner can spell and pronounce words correctly, he or she will also read with greater confidence.

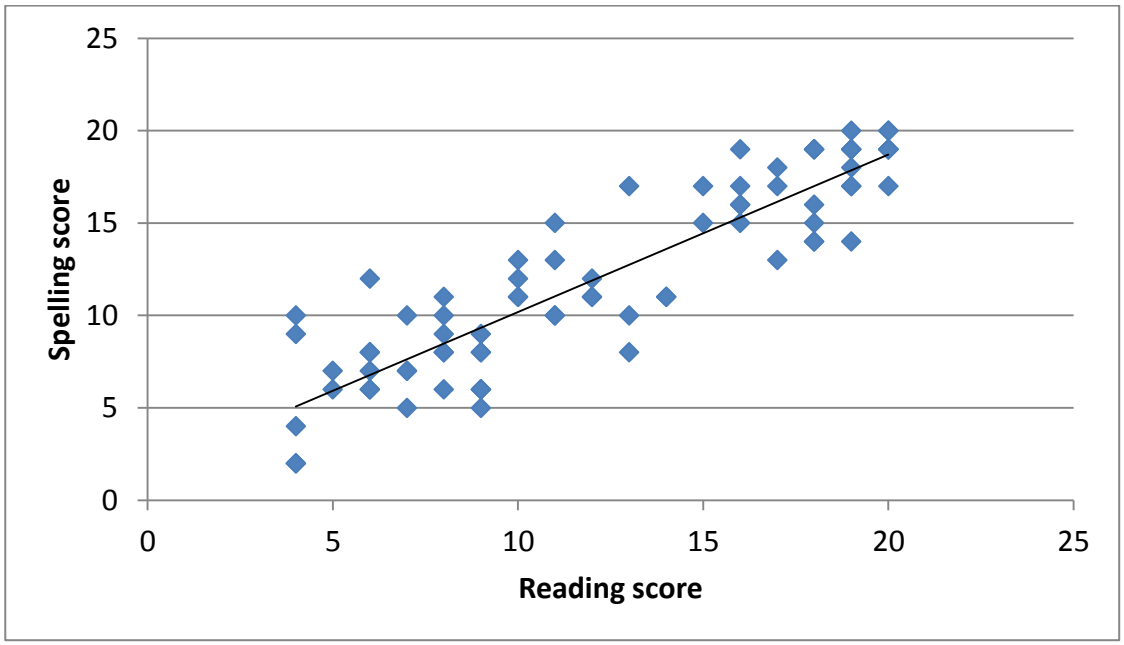


Figure 4.2 Relationship between reading and spelling skills.

4.4 BRAIN DOMINANCE AND LITERACY

Assertion 3: *Left-brain dominance appears to be associated with a literacy skill advantage.*

In Table 4.4 and Figure 4.3, data from participants having dominant right (n=21) and left (n=88) brains, are compared. This shows that the left-brain dominant participants scored significantly higher, on average, in phonological awareness, spelling, reading and literacy. This can be seen by the higher mean (X) scores of the left-brain dominant group for each of these scores, as well as p-values of <0,01 in each case. This confirms that left-brain dominant learners have a literacy skill advantage. This is consistent with the majority of research done on the relationship between brain dominance and literacy skill (De Jager, 2006; Halonen et al., 2006; Hannaford, 1995, 1999; Herrmann, 1996; Powell et al., 2006; Pulvermüller, 2005; Springer & Deutsch, 1997; Stout, 2005; Temple et al., 2001; Wittrock & Wiley, 2008) (see section 2.11.4).

These findings can be understood in terms of the literacy centre being in the left side of the brain as well as the analytical characteristics of left-brain dominant people, which incline them to focus on detail (De Jager, 2006; Foundas et al., 1998; Gazzaniga, 1988, 2009; Greco, 1982; Hamilton, 1998; Hannaford, 1995, 1999; Herrmann, 1996; Jensen, 2000; Knecht, Deppe et al., 2000; Neethling, 2000; Ornstein & Thompson, 1984; Springer & Deutsch, 1997; Stout & Ruble, 1994). Learners who are dominant in the left brain exhibit higher activity in the brain waves of the left brain where the literacy centre is.

Additionally, it seems reasonable to expect that people with an analytical mind and problem-solving skills who focus on detail, would be more likely to show great proficiency in phonological awareness since phonological awareness involves analysing sounds in detail. These traits are common in people who are left-brain dominant Therefore it seems reasonable to conclude that left-brain dominant people are more inclined to develop phonological awareness than right-brain dominant people, and therefore outperform them in literacy tests (see section 2.11.3).

Table 4.4 Literacy skill scores for left- and right-brain dominant people.

	Brain dominance	
	Left	Right
Sample size (n)	88	21
Reading skill	X=12.3	X=9.1
	Std dev=5.2	Std dev=4.3
	t=3.4; p=0.00056	
Spelling skill	X=11.8	X=7.8
	Std dev=5.1	Std dev=3.9
	t=3.4; p=0.00054	
Phonological awareness	X=26.4	X=20.0
	Std dev=8.2	Std dev=7.4
	t=2.9; p=0.0023	
Literacy skills (combined index)	X=50.5	X=36.9
	Std dev=17.2	Std dev=11.9
	t=3.4; p=0.00044	

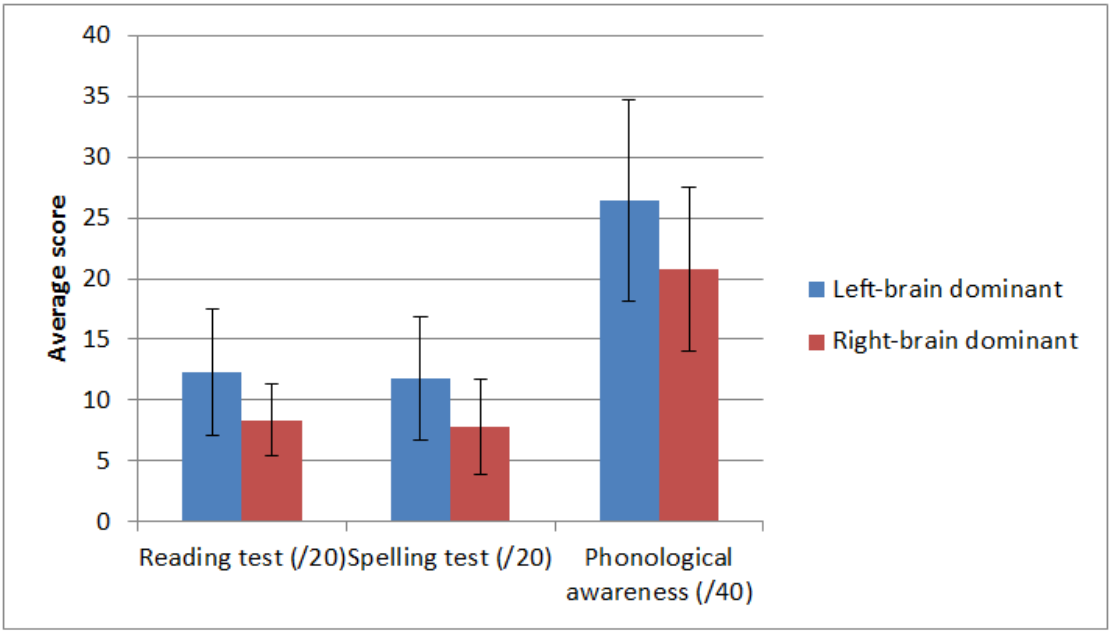


Figure 4.3 Average scores in each of three tests of components of literacy for left- and right-brain dominant subjects. Error bars show standard deviation.

4.5 EYE DOMINANCE AND LITERACY

Assertion 4: *Right-eye dominance appears to be associated with literacy skill advantage.*

In Table 4.5 and Figure 4.4, data from left eye- (n=38) and right eye-dominant (n=78) participants are compared. This shows that the right-eye dominant participants scored significantly higher, on average, in phonological awareness, spelling, reading and literacy. This is shown by the higher mean scores for the left-eye dominant group for each of these indicators, as well as p-values less than 0,01 in each case. This confirms that right-eye dominant learners have a literacy skill advantage.

This is consistent with the majority of research done on the relationship between eye dominance and literacy skills (Hannaford, 1999; Johansson et al., 2001; Khan & Crawford, 2001; Lombard, 2007; Miles, 1930; Parker-Pope, 2008; Porac & Coren, 1976; Reiss & Reiss, 1997; Roth et al., 2002; Safra, 1989). This can be understood in terms of the literacy centre being situated in the left side of the brain as well as the analytical characteristics of left-brain dominant people which incline them to focus on detail (De Jager, 2006; Foundas et al., 1998; Gazzaniga, 1988, 2009; Hamilton, 1998; Hannaford, 1995, 1999; Herrmann, 1996; Jensen, 2000; Knecht, Deppe et al., 2000; Neethling, 2000; Ornstein & Thompson, 1984; Springer & Deutsch, 1997; Stout & Ruble, 1994).

Table 4.5 Literacy skill scores for left- and right-eye dominant people.

	Eye dominance	
	Left	Right
Sample size (n)	38	79
Reading skill	X=9.9	X=12.6
	Std dev=4.0	Std dev=5.3
	t=7.2; p=0.00000	
Spelling skill	X=8.9	X=12.2
	Std dev=4.5	Std dev=5.1
	t=6.0; p=0.00000	
Phonological awareness	X=21.3	X=27.2
	Std dev=6.9	Std dev=8.4
	t=8.0; p=0.0023	
Literacy skills (combined index)	X=40.2	X=52.0
	Std dev=13.4	Std dev=17.3
	t=-3.7; p=0.0002	

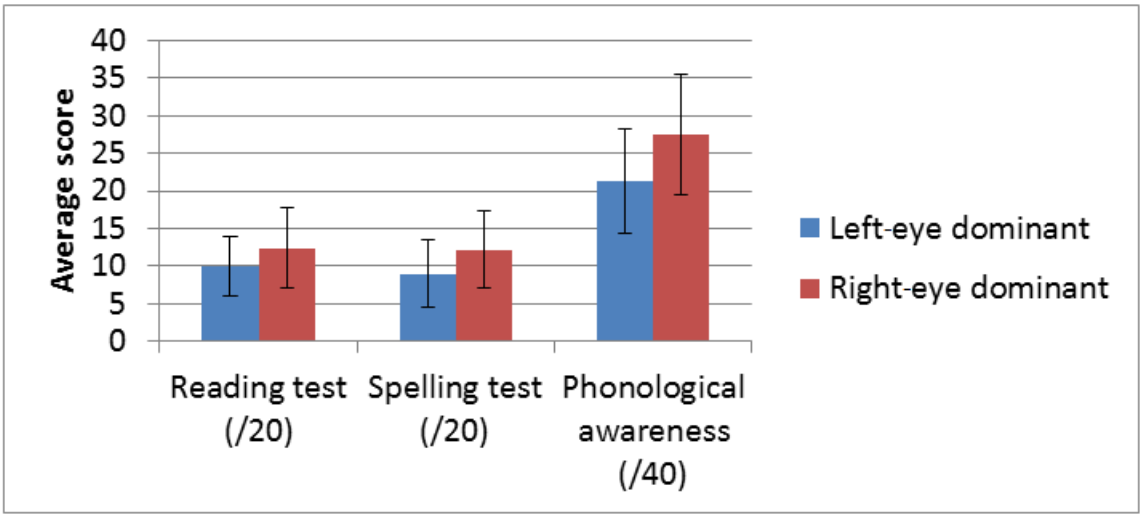


Figure 4.4 Mean scores in each of three tests of components of literacy for left- and right-eye dominant subjects. Error bars show standard deviation.

4.6 HAND DOMINANCE AND LITERACY

Assertion 5: *There is no evidence to support a relationship between hand dominance and literacy skills.*

In Table 4.6 and Figure 4.5, data from the left- (n=7) and right-hand dominant (n=111) participants are compared. The results of the p-values are all greater than 0,05 and so none of the correlations are significant. Therefore, there appears not to be a significant relationship between hand dominance and literacy skills.

This is in contradiction to research claiming that the right-handed people has an advantage in literacy (Halonen et al*.,* 2006; Hannaford, 1995, 1999; Holder, 1997; Jackson et al*.,* 2005; Stout, 2005; Temple et al*.,* 2001) as well as that the brain works with a cross-over pattern, therefore, the left brain enhances the right hand (De Jager, 2006; Foundas et al., 1998; Gazzaniga, 1988, 2009; Hamilton, 1998; Hannaford, 1995, 1999; Herrmann, 1996; Jensen, 2000; Knecht et al., 2000; Neethling, 2000; Ornstein & Thompson, 1984; Springer & Deutsch, 1997; Stout & Ruble, 1994) (see section 2.7.2). I did not find statistical significant difference in literacy performance between right- and left-hand dominant participants. This assertion may not be generalisable since the sample size was too small for left-hand dominant learners.

Table 4.6 Literacy skill scores for left- and right-hand dominant people.

	Hand dominance	
	Left	Right
Sample size (n)	7	111
Reading skill	X=10.6	X=11.7
	Std dev=5.4	Std dev=5.2
	t=0.6; p=0.56071	
Spelling skill	X=10.1	X=11.1
	Std dev=4.8	Std dev=5.2
	t=0.5; p=0.63985	
Phonological awareness	X=21.0	X=25.5
	Std dev=10.1	Std dev=8.3
	t=1.4; p=0.17332	
Literacy skills (combined index)	X=41.7	X=48.3
	Std dev=9.7	Std dev=17.0
	t=-0.9; p=0.16	

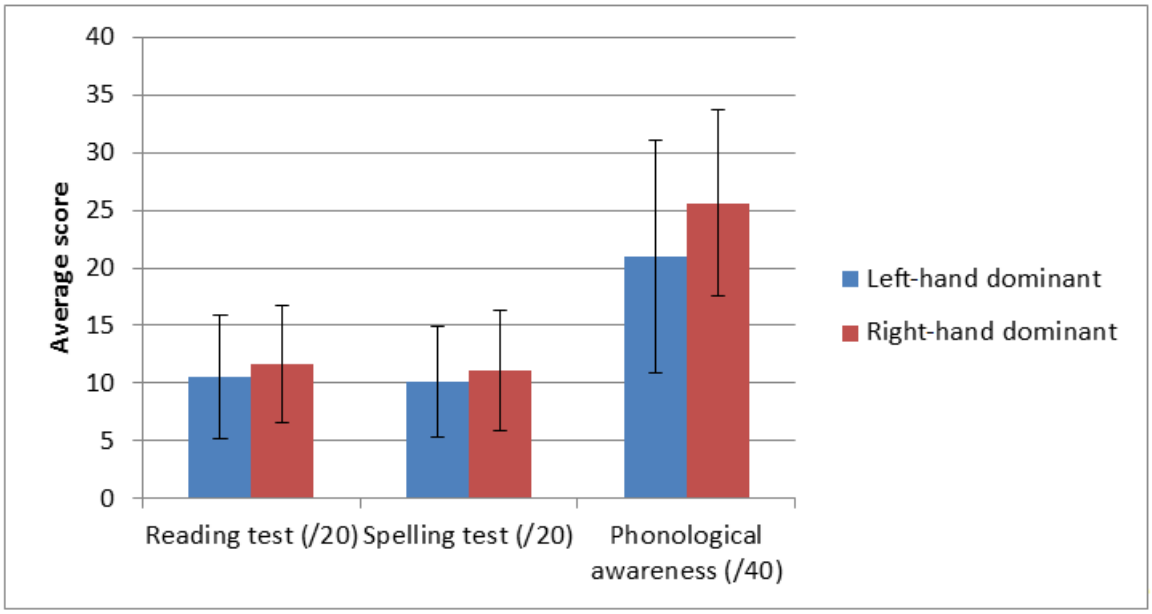


Figure 4.5 Average scores in each of three tests of components of literacy for left- and right-hand dominant subjects. Error bars show standard deviation.

4.7 EAR DOMINANCE AND LITERACY

Assertion 6: *Left ear dominance appears to be associated with literacy skill advantage.*

In Table 4.7 and Figure 4.6, data from the left- (n=49) and right-ear dominant (n=69) participants is compared. This shows that the left-ear dominant participants scored significantly higher, on average, in phonological awareness, spelling, reading and literacy. This is shown by the higher mean scores (X) obtained by left-ear dominant participants, relative to right-ear dominant, participants, as well as the p-values of <0,01. This suggests that left-ear dominant learners have a literacy skill advantage above learners with a right-ear dominance.

These findings are not consistent with the majority of research done on the relationship between ear dominance and literacy skill (De Jager, 2006; Halonen et al., 2006; Hannaford, 1999; Herrmann, 1996; Stout, 2005; Temple et al., 2001). Since the brain works in a cross-over pattern with the body, researchers mostly hypothesise that the greatest learning advantage is obtained when the right ear is dominant together with left-brain dominance (Hannaford, 1999; Harp, 2009; Herrmann, 1996; Khedr et al., 2002; Knecht et al., 2000; Milsom, 2007). These researchers and others (Fink et al., 1999; Lombard, 2007; Lovett, 2011; Moore, 2002) recognise the importance of the role the ear plays in learning; however, it appears that researchers are not clear how exactly ear dominance affects learning (see section 2.10.1).

Table 4.7 Literacy skill scores for left- and right-ear dominant people.

	Ear dominance	
	Left	Right
Sample size (n)	49	69
Reading skill	X=15.1	X=9.3
	Std dev=4.8	Std dev=3.9
	t=7.2; p=0.00000	
Spelling skill	X=14.0	X=8.9
	Std dev=5.3	Std dev=3.9
	t=6.0; p=0.00000	
Phonological awareness	X=31.1	X=21.0
	Std dev=7.4	Std dev=6.3
	t=8.0; p=0.0023	
Literacy skills (combined index)	X=60.2	X=39.2
	Std dev=16.4	Std dev=11.3
	t=8.3; p=1.3 x 10^{-13}	

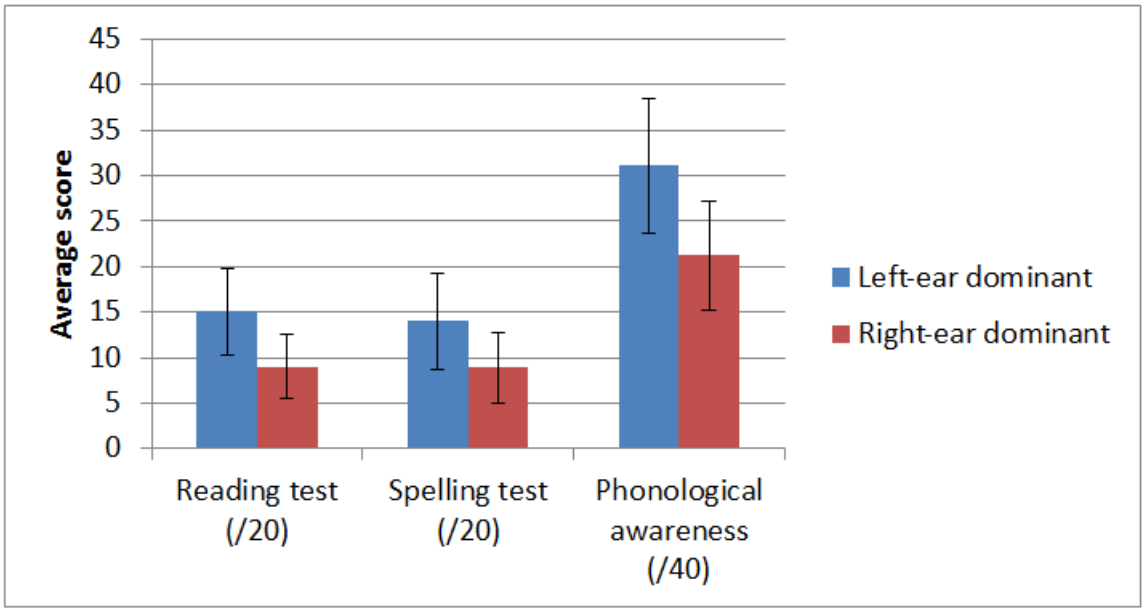


Figure 4.6 Average scores in each of three tests of components of literacy for left- and right-ear dominant subjects. Error bars show standard deviation.

4.8 OVERALL BODY DOMINANCE PROFILE AND LITERACY

Assertion 7: *The profile of left-brain, right-eye, and left-ear dominance appears to be associated with literacy skill advantage.*

In Table 4.8 and Figure 4.7, data from the left-brain, right-eye and left-ear dominant participants is compared. This shows that the left-brain, right-eye and left-ear dominant profile scored the highest, on average, in phonological awareness, spelling, reading and literacy. This is shown by this group obtaining higher mean (X) scores, and the p-values being less than 0,01 in each case. This suggests that learners who are dominant in the left brain, right eye and left ear have an advantage in acquiring literacy skills. This finding appears to be new to the body of literature on the relationship between dominance and literacy skills.

Table 4.8 Literacy skills scores for one particular profile, compared to all other participants.

	Dominance pattern	
	Left-brain, right-eye, left-ear dominant pattern	Other
Sample size (n)	27	91
Reading skill	X=18.3	X=9.7
	Std dev=1.6	Std dev=4.1
	t=7.2; p=0.00000	
Spelling skill	X=17.6	X=9.2
	Std dev=2.4	Std dev=4.2
	t=6.0; p=0.00000	
Phonological awareness	X=35.9	X=22.0
	Std dev=1.8	Std dev=6.8
	t=8.0; p=0.0023	
Literacy skills (combined index)	X=71.5	X=40.9
	Std dev=4.4	Std dev=12.6
	t=12.4; p=7.0 x 10^{-22}	

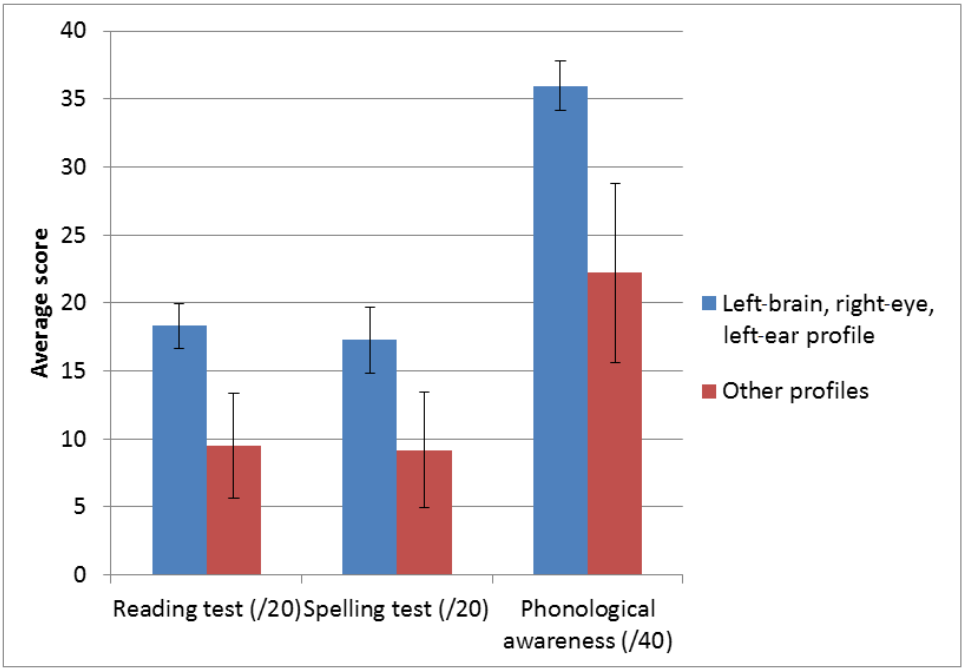


Figure 4.7 Average scores in each of three tests of components of literacy, subjects with a left brain-, right eye- and left ear-dominant profile, compared to all other profiles. Error bars show standard deviation.

4.9 CONCLUSION

In this chapter, I made a number of assertions to answer the research questions. I supported these by referring to data from the study and existing literature. These assertions are that phonological awareness is a good indicator of reading and spelling skills, reading and spelling skills are related, left-brain dominance appears to be associated with a literacy skill advantage, while right-eye dominance appears to be associated with literacy skill advantage. There is no significant correlation between hand dominance and literacy skills. Left-ear dominance appeared to be associated with literacy skill advantage, and the profile of left-brain, right-eye, and left-ear dominance appears to be associated with literacy skill advantage. This dissertation is ended by giving a summary of the study and a discussion of its implications for research and practice. This follows in the final chapter.

CHAPTER 5
SUMMARY AND IMPLICATIONS FOR RESEARCH AND PRACTICE

The purpose of the study was to determine whether there is a relationship between the various components of literacy (phonological awareness, reading and spelling), and between various dominances (brain, eye, ear and hand dominance) and literacy skills. This study was based on a positivistic paradigm with a quantitative approach, using a cross-sectional correlation research methodology. The aim was to answer questions objectively according to measurable variables in order to explain a phenomenon. Data analysis was guided by the following research question and sub-questions:

1. Which relationship exists between the various components of literacy (phonological awareness, reading and spelling)?
   - What is the relationship between spelling and reading skills?
   - What is the relationship between phonological awareness and literacy skills?
2. Which relationships exist between literacy skills and various body dominances in Grade 2 learners in a KZN school?
   - What is the relationship between brain dominance and literacy skills?
   - What is the relationship between eye dominance and literacy skills?
   - What is the relationship between hand dominance and literacy skills?
   - What is the relationship between ear dominance and literacy skills?
3. Which body dominance profile is associated with high literacy skills?

In Chapter 2, I reviewed literature relevant to the study, and in Chapter 3, I described and motivated the research design that was used. In the previous chapter, I made a number of assertions, in response to the research questions. I supported these with reference to my data and relevant literature. These assertions are repeated below. I then comment on limitations of this study and the implications of the study for further research and practice.

5.1 SUMMARY OF ASSERTIONS

In answer to the research questions, I made the following assertions:

- Phonological awareness is a good indicator of reading and spelling skills.
- Reading and spelling skills are related.

- Left-brain dominance appears to be associated with a literacy skill advantage.
- Right-eye dominance appears to be associated with literacy skill advantage.
- There is no significant correlation between hand dominance and literacy skills.
- Left-ear dominance appears to be associated with literacy skill advantage.
- The profile of left-brain, right-eye, and left-ear dominance appears to be associated with literacy skill advantage.

5.2 LIMITATIONS

This study provided insight into the relationship between the various components of literacy (phonological awareness, reading and spelling), and between various dominances (brain, eye, ear and hand dominance) and literacy skill. Most of the assertions I have made are consistent with existing literature. The finding that ear dominance is correlated to literacy skill is contrary to existing literature, and the finding that a particular dominance pattern (left brain, right eye and left ear) was strongly correlated to literacy skills, is also not covered in literature. I have suggested some explanations for these findings. However, one of the limitations of this study was that these findings seem to require neurological explanations, which are beyond the scope of this dissertation.

Additionally, various factors should be taken into consideration when assessing the generalisability of these findings to the larger population. These include factors which could not be controlled due to use of a convenience sample. These include home language, socio-economic background and gender. All the testing was done in English since the language of teaching and instruction is English. It should also be noted that the correlations found do not necessarily imply causation.

5.3 IMPLICATIONS

This study was important because it provided some answers to questions concerning the relationship between the various components of literacy (phonological awareness, reading and spelling), and between various dominances (brain, eye, ear and hand dominance) and literacy skills.

The results of the study have implications for literacy instruction in the Foundation Phase. A strong correlation exists between phonological awareness and performance in literacy (reading and spelling). Reading is a complicated process that requires instruction in phonological awareness, letter-knowledge, phonics, spelling, strategy development, vocabulary, grammatical awareness, and comprehension strategies. Foundation Phase

teachers should teach these skills explicitly and include elements such as letters, sounds, syllables and words, in order to guide learners to be good readers who can read with comprehension. It is also important that young learners develop the ability to decode single words accurately and fluently into sound (phonemes) before progressing to more and more challenging examples and concepts.

Phonological awareness (awareness of phonological units) and the ability to manipulate such phonological units) should be facilitated frequently through syllables, onsets and rhymes, rhyming words as well as phonemic awareness. An awareness of phonemes is necessary to grasp the alphabetic principle that underlies our system of written language (Adams, 1990, Ehri et al., 2001). Young learners should understand that words can be divided into individual phonemes and that phonemes can be blended into words to be able to use letter-sound knowledge to read and build words. Phonological awareness is also an important aspect for reading comprehension.

Phonological awareness not only plays an important role in learning to read, but also in spelling. It is important that learners understand the rules of spelling and that they be given opportunities to practise these rules. However, where the English writing system is inconsistent and where English deviates systematically from the alphabetic principle, learners should practise these examples consistently. With much practise, learners should learn these examples by heart, which should lead to the transfer of learnt spelling skills into reading and writing. Furthermore, identifying specific phonological awareness factors and patterns that relate to spelling ability can provide teachers with the ability to target those learners who are at risk of becoming poor spellers. Early identification and remedial instruction to learners at risk should be a priority for all Literacy teachers. Teachers should be encouraged to put in extra effort to help learners with learning difficulties, instead of ascribing these learners' poor performance to laziness and poor attitudes.

The relationship between phonological awareness and literacy skill performance can also be understood in terms of the information processing model (IPM) of learning. This process involves stimulation in multiple parts of the brain and several developmental stages through which every beginner reader should progress. Phonological awareness can be viewed as a kind of procedural knowledge of how to manipulate sounds (Fletcher-Flinn & Thompson, 2000). Proficiency in this procedural knowledge can also be viewed as reducing cognitive load during reading and spelling, therefore improving literacy performance. This view supports the importance of good phonological skills to give young learners the opportunity to focus on other processes during the reading process.

The study also emphasised that reading and spelling skills are related and that better readers are better spellers and vice versa. Proficiency in morphological competence plays an essential role in acquiring reading and spelling skills. Morphological competence is needed in precise expression and comprehension because of its links to phonological, orthographic and syntactic components. Therefore, it can be accepted that once a learner can spell and pronounce words correctly, he or she would read with greater confidence.

A complex inter-relationship between reading and spelling is therefore evident and cannot be overlooked. This is why literacy instruction in a balanced approach is advocated. The balanced method of teaching reading incorporates the most effective strategies from both the whole-language and the phonetic methods. Thus, the balanced method is a truly comprehensive programme for teaching reading to children since one reading skill is used to help develop the others.

The study also shed light on the relationship between brain dominance and literacy skills. Left-brain dominant learners scored higher in phonological awareness, reading and spelling, than right-brain dominant learners. These findings can be understood in terms of the literacy centre being in the left side of the brain as well as the analytical characteristics of left-brain dominant people which incline them to focus on detail. This explains why left-brain dominant learners may possibly experience less difficulty in acquiring literacy skills. Educational systems tend to neglect to consider the needs of right-brain dominant individuals, since teachers tend to teach mainly using words, whereas these learners tend to think in pictures (Freed & Parsons, 1998). This may cause teachers to diagnose right-brain dominant learners as functionally illiterate, when perhaps the learners' literacy levels could be improved if the teacher were to change his/her teaching approach. It is therefore important to understand brain dominance, so that the teacher may accommodate different teaching methods in order to accommodate the different brain profiles. Unfortunately, right-brain dominant learners often suffer in the left-brain-orientated school system. Learners are very different and unique and all learners have their own preferred learning styles. Teachers should know that learners learn in different ways and should accommodate the diverse learning styles of all learners when facilitating literacy instruction.

Furthermore, teachers should be aware of their own thinking patterns which are determined by their personal brain- dominance profiles and the tendency to teach accordingly. Learners with similar brain-dominance profiles automatically understand the teacher better. However, learners with different brain-dominance profiles may not feel comfortable in the teaching and learning process since it does not suit their thinking styles

and therefore these learners may perform below their full potential. For example, the left hemisphere of the brain tends to be rational, critical, analytical, focused on detail and preferring facts and rules. In the school environment, this child prefers a formal quiet working and learning environment. On the other hand, the right hemisphere tends to be more holistic and intuitive, responsive to visual images, flexible, emotional, using imagination and fantasy. A learner having a right-dominant brain would typically prefer hands-on activities in a relaxed classroom environment. All these characteristics have an immense impact on literacy development, and the effect on literacy development should not be underestimated.

This study also suggested that some learners are disadvantaged in their learning of literacy by their body-dominance profile, and therefore may need special attention. Cognitive pre-requisites, be it visual, auditory or more specifically linguistic, are all components of the reading system. Any disruption in any of these cognitive pre-requisites may prevent normal reading acquisition.

The study indicated that right-eye dominance appears to be associated with literacy skill advantage. Foundation Phase teachers should be conscious of the fact that a failure to develop consistent dominance of the eye's ocular motor signals could cause confusion about where exactly words and letters are on a page, resulting in reading and spelling problems. A study conducted by Cockcroft (2008) explains that a learner's dominant eye plays a vital role in his or her ability to read and spell accurately. Squinting eyes, or difficulty giving attention to close work may also be an eye-dominance problem (Beechick, 2009). Early identification and remedial activities for at-risk learners, or learners displaying any of the mentioned tendencies during literacy instruction, may be beneficial.

After intensive research, it is now commonly accepted that eye and hand movements are highly coordinated both spatially and temporally and it is therefore better if the eye and hand on the same side of the body are dominant. Researchers believe that, when the dominant eye, ear, hand and foot are not on the same side of the body, this condition, called cross dominance, may cause co-ordination problems which may influence learning (Dane & Gumustekin, 2002; De Jager, 2006; Hannaford, 1995, 1999; Harp, 2009; Herrmann, 1996; Kokot, 2010). Cross dominance may contribute to a condition in which learners write back to front, also known as "mirror writing" (Doidge, 2007). An understanding of brain dominance and body laterality might be valuable to teachers in the early years. Teachers and parents should also understand that body laterality plays an important role in the learning process. Awareness that learners with cross dominance

might be at risk, may be beneficial for early identification and remediation of literacy problems.

Handedness of a human being is an expression of an inborn lateralisation of the cerebral hemispheres where one side dominates. Thus, it is commonly accepted that a dominant right cerebral hemisphere results in a dominant left hand, and a dominance of the left cerebral hemisphere is responsible for right-handedness (Herrmann, 1996). Clarifying the relationship between handedness and functional brain specialisation may shed valuable light on issues such as dyslexia, stuttering, comparative brain research, developmental neurobiology of the brain and the origins of human language (Kokot, 2009).

Problems with hearing quality, auditory processing and dominance can result in attention problems and difficulty following instructions, behavioural problems and possible psychological problems, problems with speech quality and long-term memory and therefore poor academic achievement. However, once the cause of the problem is identified, the cause can be eliminated with treatment and normal function can be achieved.

An auditory processing deficit can interfere directly with acquiring literacy skills. When instruction in school relies primarily on spoken language, the individual with an auditory processing disorder may have serious difficulty understanding the lessons and instructions (Lerner, 1989). The literacy teacher should plan effective intervention to compensate for specific areas of need and build on a learner's strengths.

A simple accommodation like backing up verbal directions with visual or written cues may make a huge difference in the learner's performance (Lovett, 2011). Simplifying verbal instructions, speaking at a slower rate and excluding as much distractions as possible can also make a difference in the learner's performance. The teacher could also plan activities that could help build auditory processing skills, for example rhyming games may help build phonological awareness as well as discriminating between similar and different sounds.

This study has confirmed that there is a relationship between brain dominance and literacy skills as well as a relationship between body laterality, brain dominance and literacy skill. It is now important to research possible ways of assisting learners who do not have a left-brain, right-eye, left-ear dominance profile to develop good literacy skills, despite them having a dominance profile which appears to disadvantage them. It may not be healthy to try and change these learners' dominance profiles, since additional problems

may occur (Hannaford, 1999). However, possible intervention may stimulate the non-dominant parts of the brain and the non-dominant eye and ear. It may be very beneficial if the brain could learn to work together with both eyes and ears at the same time. This may overcome the disadvantages of the eye and ear dominance not being part of the beneficial profile. The Nasa EEG Neuro Feedback therapy claims to develop the weaker, non-dominant waves of the brain, which will stimulate functions in both sides of the body simultaneously (Pope & Bogart, 1982). This may be the type of intervention learners need to overcome the disadvantages of their eye and ear dominance not being part of the beneficial dominance profile.

5.4 CONCLUSION

In this chapter, I summarised the assertions I have made in this study and suggested explanations for these. This was done in answer to the research questions. The central thesis I make is that brain dominance and body laterality play an important role in how well learners acquire literacy skills. This contributes towards the research base about literacy education in the following ways. The finding that phonological awareness and spelling skill are both related to reading skill confirms existing literature. The finding that when the left brain is dominant, the learner acquires literacy skills easier also confirms existing literature. The finding that left-ear dominance is associated with an increased likelihood of high literacy skill extends existing literature and suggests that further research is necessary to search for an explanation why this might be so.

REFERENCES

Adams, M. J. (1990). *Beginning to read: Thinking and learning about print*. Cambridge, MA: MIT Press.

Adams, M. J., Foorman, B., Lundberg, I., & Beeler, T. (1998). *Phonemic awareness in young children*. Baltimore: Brookes.

Adams, M. J. (1998). The three-cueing system. In F. Lehr & J. Osborn (Eds.), *Literacy for all: Issues in teaching and learning.*New York: Guilford.

Addison, J. T. (1992). Urie Bronfenbrenner. *Human Ecology, 20*(2), 16-20.

Aidinis, A., & Nunes, T. (2001). The role of different levels of phonological awareness in the development of reading and spelling in Greek. *Reading and Writing, 14*, 145-177.

Allington, R. (2001). *What really matters for struggling readers*. New York: Longman.

Ambidextrous. (2012). In *Dictionary.com.* (10th ed.).Retrieved fromhttp://www.dictionary.reference.com/ambidextrous

Amos, J. F., Bartlett, J. D., & Eskridge, J. B. (1991). *Clinical Procedures in Optometry*. Philadelphia: Lippincott.

Anderson, J. M., & Ewen, C. J. (1987). *Principles of dependency phonology*. Cambridge: Cambridge University Press.

Annett, M. (1998). Handedness and cerebral dominance:The right side shift theory. *Journal of Neuropsychiatry, 10*, 459-469.

Annett, M. (2000). Predicting combinations of left and right asymmetries. *Cortex, 36*, 485-505.

Annett, M. (2009). The Genetic Basis of Lateralization. *British Language lateralization and psychosis, 5*, 73-86.

Anthony, J. L., & Lonigan, C. J. (2004). The nature of phonological awareness: Converging evidence from four studies of preschool and early grade school children. *Journal of Educational Psychology, 96*, 43-55.

Anthony, J. L., Lonigan, C. J., Burgess, S. R., Driscoll, K., Phillips, B. M., & Cantor, B. G. (2002). Structure of preschool phonological sensitivity: Overlapping sensitivity to rhyme, words, syllables, and phonemes. *Journal of Experimental Child Psychology, 82*, 65-92.

Apel, K., & Masterson, J. J. (2001). Theory-guided spelling assessment and intervention: A case study. *American Speech-Language-Hearing Association, 32*, 182-195.

Armbruster, B., Lehr, F., Osborn J. (2010). *Put reading first. The research building blocks for teaching children to read* (3rd ed.). Washington, DC: National Institute for Literacy.

Asmal, K. (2003, October.) *Speech by Minister of Education: The foundation phase systemic evaluation report.* Paper presented at the colloquium by the department of education, Cape Town, SA.

Auger, W. F., & Rich, S. J. (2007). *Curriculum theory and methods*. Ontario: John Wiley.

Aygul, R., Dane, S., & Ulvi, H. (2005). Handedness, eyedness, and crossed hand-eye dominance in male and female patients with migraine with and without aura: A pilot study. *Perceptual and Motor Skills, 100*, 1137-1142.

Aziz-Zadeh, L., Wilson, S. M., Rizzolatti, G., & Iacoboni, M. (2006). Congruent embodied representations for visually presented actions and linguistic phrases describing actions. *Current Biology, 16*, 1818-1823.

Badenhorst, F.H. (1975).*'n Rorschachstudie van regssydiges en linksluisteraars met gemengde laterale voorkeure.* (Unpublished Masters thesis). Potchefstroom University for CHE: Potchefstroom.

Bain, K. (2004). *What the best college teachers do.* Cambridge, MA: Harvard University Press.

Bak, N. (2012). *Completing your thesis: A practical guide.* Kaapstad, Van Schaick.

Ball, E. W., & Blachman, B. A. (1991). Does phoneme awareness training in kindergarten make a difference in early word recognition and developmental spelling? *Reading Research Quarterly, 24*, 49-66

Banks, M. S., Ghose, T., & Hillis, J. M. (2004). Relative image size, not eye position, determines eye dominance switches. *Vision Research, 44*(3), 229-234.

Barbeito, R. T., & Simpson, T. L. (1991). The relationship between eye position and egocentric visual direction. *Perception Psychophys, 50*, 373-382.

Basic, S., Hajnsek, S., Poljakovic, Z., Basic, M., Culic, V., & Zadro, I. (2004). Determination of cortical language dominance using functional transcranial Doppler sonography in left-handers. *Clinical Neurophysiology, 115*, 154-160.

Beatty, A., Neisser, U., Trent, W. T., & Heubert, J. P. (2001). *Understanding dropouts: statistics, strategies, and high-stakes testing. Washington, DC:*the National Academy Press.

Beck, I. L., & Juel, C. (1992). The role of decoding in learning to read. In S. J. Samuels, , & A. E. Farstrup. *What Research has to say about reading instruction*. Newark, DE: International Reading Association.

Beechick, R. (2009). *Cure your child's reading problem.* Retrieved from http://creation.com

Bekkering, H., & Sailer, U. (2002). Commentary: Coordination of eye and hand in time and space. *Progress in Brain Research, 104*, 365-373.

Bellamy, C. (1999). *The state of the world's children.* Retrieved from http://www.unicef.org/sowc99/index.html

Bellis, T. J. (2002). Developing deficit-specific intervention plans for individuals with auditory processing disorders. *Seminars in Hearing, 23*(4), 287-295.

Belmont, J. M., Butterfield, E. C., & Ferretti, R. P. (1982). To secure transfer of training instruct self-management skills. In D. K. Detterman & R. J. Sternberg (Eds.), *How and how much can intelligence be increased?* Norwood, NJ: Ablex.

Benson, R. R., FitzGerald, D. B., LeSueur, L. L., Kennedy, D. N., Kwong, K. K., & Buchbinder, B. R. (1999). Language dominance determined by whole brain functional MRI in patients with brain lesions. *Neurology, 52*, 798-809.

Bereiter, C. (2002). *Education and Mind for the Knowledge Age.* Mahwah, NJ: Erlbaum.

Berens, C., & Zerbe, J. (1953). A new pinhole test and eye-dominance tester. *Journal of Ophthalmology, 36*(7), 980-981.

Berk, L. E. (2000). *Child development* (5th ed.). Boston: Allyn and Bacon.

Berk, L. E., & Spuhl, S. T. (1995). Maternal interaction, private speech, and task performance in preschool children. *Early Childhood Research Quarterly, 10*, 145-169.

Bertelson, P., De Gelder, B., & Van Zon, M. (1997). Explicit speech segmentation and syllabic onset structure. *Psychological Research, 60*(183-191).

Blachman, B. (1997). *Foundations of reading acquisition and dyslexia: Implications for early intervention.* Mahwah: Erlbaum.

Blaiklock, K. E. (2004). The importance of letter knowledge in the relationship between phonological awareness and reading. *Journal of Research in Reading, 27*, 36-57.

Bloom, J. (1990). *Help me to help my children: A sourcebook for parents of learning disabled children.* Waltham, MA: Little Brown.

Boder, E. (1973). Developmental dyslexia: A diagnostic approach based on three atypical reading-spelling patterns. *Developmental Medicine and Child Neurology, 15*, 663-687.

Bogen, J. E. (1975). The other side of the brain: Some educational aspects of hemispheric specialization. *U.C.L.A. Educator, 17*, 24-32.

Booij, G. (2005). *The grammar of words*. Oxford, UK: Oxford University Press.

Booth, J. R., Burman, D. D., Van Santen, F. W., Harasaki, Y., Gitelman, D. R., & Parrish, T. B. (2001). The development of specialized brain systems in reading and oral-language. *Neuropsychology Developmental Cognition, 7*(3), 119-141.

Boulenger, V., Roy, A. C., Paulignan, Y., Déprez, V., Jeannerod, M., & Nazir, T. A. (2006). Cross-talk between language processes and overt motor behavior. *Journal of Cognitive Neuroscience, 18*(10), 1607-1615.

Bourassa, D. C., McManus, I. C., & Bryden, M. P. (1996). Handedness and eye dominance: A meta-analysis of their relationship. *Laterality, 1*, 5-34.

Bovee, O. (1972). Which method of teaching reading is the best? *Educational Leadership, 92*(3), 1-13.

Bouers, P. G. (1993). Text reading and rereading: Determinants of fluency beyond word recognition. *Journal of Reading Behavior, 25*, 133 -153.

Bowey, J. A., & Francis, J. (1991). Phonological analysis as a function of age and exposure to reading instruction. *Applied Psycholinguistics, 12*, 91-121.

Bowman, M., & Treiman, R. (2002). Relating print and speech: The effect of letter names and word position on reading and spelling performance. *Journal of Experimental Child Psychology, 82*, 305–340.

Bowman, M., & Treiman, R. (2004). Stepping stones to reading. *Theory Into Practice, 43*(4), 19-36.

Bradley, L. L., & Bryant, P. E. (1985). *Rhyme and reason in reading and spelling*. Ann Arbour: University of Michigan Press.

Brady, J. P., & Berson, J. (1978). Stuttering, dichotic listening, and cerebral dominance. *PubMed*, 21(6), 53-64.

Bransford, J., Brown, A., & Cocking, R. (2000). *How people learn*. Washington DC: National Academy Press.

Brennan, F., & Ireson, J. (1997). Training phonological awareness: A study to evaluate the effects of a program of metalinguistic games in kindergarten. *Reading and Writing, 9*, 241-263.

Brinkley, M., & Kelly, D. L. (2003). A Comparison of the NAEP and PIRLS fourth grade reading assessments. Retrieved from http://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=200310

Britto, P. R., & Brooks-Gunn, J. (2001). Beyond shared book reading: Dimensions of home literacy and low-income African American preschoolers' skills. *New Directions For Child and Adolescent Development, 92*, 73-89.

Britto, P. R., Brooks-Gunn, J., & Griffin, T. (2006). Maternal reading and teaching patterns: associations with school readiness in low-income African American families. *Reading Research Quarterly, 41*(1), 68-89.

Bronfenbrenner, U. (1979). *The ecology of human development*. Cambridge, MA: Harvard University Press.

Bronfenbrenner, U. (1986). Ecology of the family as a context for human development: Research perspectives. *Developmental Psychology, 22*(6), 723-742.

Bronfenbrenner, U. (1990). *Discovering what families do.* Retrieved from http://www.montana.edu/www4h/process.html

Bronfenbrenner, U. (1994). Ecological models of human development. In *International encyclopedia of Education* (Vol. 3, pp. 1643-1647). Oxford: Elsevier.

Brown, D., & Ellis, N. C. E. (1991). *Handbook of Spelling: Theory, Process and Intervention*. Chichester, England: John Wiley.

Brown, J. S., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational Researcher, 18*(1) 32–42.

Brown, W. E., Eliez, S., Menon, V., Rumsey, J. M., White, C. D., & Reiss, A. L. (2001). Preliminary evidence of widespread morphological variations of the brain in dyslexia. *Neurology, 56*(6), 781-783.

Browne, A. (1998). *A practical guide to teaching reading in the early years.* London: Paul Chapman.

Bruck, M., & Treiman, R. (1990). Phonological awareness and spelling in normal children and dyslexics: The case of initial consonant clusters. *Journal of Experimental Child Psychology, 50*, 156-178.

Bruck, M., & Waters, G. (1988). An analysis of the spelling errors of children who differ in their reading and spelling skills. *Applied Psycholinguistics, 9*, 77-92.

Bruner, J. S. (1960). *The process of education*. Cambridge, MA: Harvard University Press

Bruner, J. S. (1996). *The culture of education*. Cambridge, MA: Harvard University Press.

Bruner, J. S. (1961). The act of discovery. *Harvard Educational Review, 31*, 21-32.

Bruner, J. S., & Goodman, C. C. (1947). Value and need as organizing factors in perception. *Journal of Abnormal and Social Psychology, 42*, 33-44.

Bruner, J. S., & Postman, L. (1949). On the perception of incongruity: A paradigm. *Journal of Personality, 18*, 206-223.

Brunswick, N., McCrory, E., Price, C. J., Frith, C. D., & Frith, U. (1999). Explicit and implicit processing of words and pseudowords by adult developmental dyslexics: A search for Wernicke's Wortschatz? *Brain, 122*, 1901-1917.

Bryant, P. E., MacLean, M., Bradley, L. L., & Crossland, J. (1990). Rhyme and alliteration, phoneme detection and learning to read. *Developmental Psychology, 26*, 429-438.

Bryden, M. P. (1982). *Laterality: Functional asymmetry in the intact brain.* New York: Academic Press.

Bryden, M. P., Munhall, K., & Allard, F. (1983). Attentional biases and the right-ear effect in dichotic listening. *Brain and Language, 18*(2), 236-248.

Bryner, J. (2010). *Ambidextrous children may have more problems in school.* Retrieved from http://www.livescience.com/8044-ambidextrous-children-problems-school.html

Buccino, G., Riggio, L., Melli, G., Binkofski, F., Gallese, V., & Rizzolatti, G. (2005). Listening to action-related sentences modulates the activity of the motor system: a combined TMS and behavioral study. *Cognitive Brain Research, 24*(3), 355-363.

Burgess, S. R. (2002). The influence of speech perception, oral language ability, the home literacy environment, and pre-reading knowledge on the growth of phonological sensitivity: A one-year longitudinal investigation. *Reading and Writing, 15*, 709-737.

Bybee, R. W. (1982). *Piaget for educators*. Columbus: Charles E. Merrill.

Byrne, B. (1992). Studies in the acquisition procedure for reading: Rationale, hypotheses, *and data*. Hillsdale: NJ: Erlbaum.

Byrne, B., & Fielding-Barnsley, R. (1989). Phonemic awareness and letter knowledge in the child's acquisition of the alphabetic principle. *Journal of Educational Psychology, 81*, 313-321.

Byrne, B., & Fielding-Barnsley, R. (1991). Evaluation of a program to teach phonemic awareness to young children. *Journal of Educational Psychology, 83*, 451-455.

Cabeza, R., & Nyberg, L. (2000). Imaging cognition II: An empirical review of 275 PET and fMRI studies. *Journal of Cognitive Neuroscience, 12*, 1-47.

Cacace, A. T., & McFarland, D. J. (1998). Central auditory disorder in school-aged children: A critical review. *Journal of Speech, Language and Hearing Research, 41*, 355-373.

Calfee, R. C., Lindamood, P., & Lindamood, C. (1973). Acoustic-phonetic skills and reading: Kindergarten through twelfth grade. *Journal of Educational Psychology, 64*, 293-298.

Campbell, J. R., Kelly, D. L., Mullis, I. V. S., Martin, M. O., & Sainsbury, M. (2001). *International reading literacy study, PIRLS assessment framework.* Retrieved from http://timssandpirls.bc.edu/pirls2001i/PIRLS2001_Pubs_AF.html

Carlisle, J. F. (1988). Knowledge of derivational morphology and spelling ability in fourth, sixth, and eighth graders. *Applied Psycholinguistics, 9*, 247-266.

Carnie, A. (2006). *Syntax: A generative introduction* (2nd ed.). Oxford: Wiley-Blackwell.

Carroll, J. M. (2004). Letter knowledge precipitates phoneme segmentation, but not phoneme invariance. *Journal of Research in Reading, 27*, 212-225.

Carston, R. (2002). *Thoughts and utterances: The pragmatics of explicit communication.* Oxford: Blackwell.

Castiglioni-Spalten, M. L., & Ehri, L. C. (2003). Phonemic awareness instruction: Contribution of articulatory segmentation to novice beginners' reading and spelling. *Scientific Studies of Reading, 7*, 25-52.

Castles, A., Holmes, V. M., Neath, J., & Kinoshita, S. (2003). How does orthographic knowledge influence performance on phonological awareness tasks? *Quarterly Journal of Experimental Psychology, 56*, 445-467.

Catts, H. W., Frey, M. E., Tomblin, J. B., & Zhang, X. (2002). A longitudinal investigation of reading outcomes in children with language impairments. *Journal of Speech and Hearing Research, 45*, 1142-1157.

Catts, H. W., & Kamhi, A. G. (1987). Intervention for reading disabilities. *Journal of Childhood Communication Disorders, 11*(1), 67-79.

Catts, H. W., & Kamhi, A. G. (1999). *Language and reading disabilities*. Needham Heights, MA: Allyn and Bacon.

Cazden, C.B. (2001). *Classroom discourse: The language of teaching and learning*. Portsmouth, NH: Heinemann.

Chall, J. S. (1967). *Learning to read: The great debate*. New York: McGraw-Hill.

Chall, J. S., Roswell, F. G., & Blumenthal, S. H. (1963). Auditory blending ability: A factor in success in beginning reading. *The Reading Teacher, 17*, 113-118.

Chard, D. J., & Dickson, S. V. (1999). Phonological awareness: instructional and assessment guidelines: Intervention in schools and clinics. *SAGE Journals*, *34*(5), 261-270.

Chard, D. J., Simmons, D. C., & Kameenui, E. J. (1998). Word recognition: Research bases. In D. C. Simmons & E. J. Kameenui (Eds.), *What reading research tell us*

about children with diverse learning needs bases and basics (Vol. 18, pp. 141-168). Mahwah, NJ: Erlbaum.

Cheng, C. Y., Yen, M. Y., Lin, H. Y., & Hsia, W. W. (2004). Association of ocular dominance and anisometropic myopia. *Investigating Visual Sciences, 45*(8), 2856-2860.

Chisholm, L. (2003, September). *The politics of curriculum review and revision in South Africa.* Paper presented at the Oxford International Conference on Education and Development, University of Oxford, U.K.

Chisholm, L. (2005). The politics of curriculum review and revision in South Africa in regional context. *A Journal of Comparitive Education, 35*(1), 79-100.

Chomsky, C. (1979). Approaching reading through invented spelling. In L. B. Resnick & P. A. Weaver (Eds.), *Theory and practice of early reading* (Vol. 2, pp. 43-65). Hillsdale: NJ: Earlbaum.

Chomsky, N. (1965). *Aspects of the theory of syntax*. Cambridge: Mass MIT Press.

Chomsky, N. (1986). *Knowledge of language: Its nature, origin and use.* New York: Praeger.

Chomsky, N. (2000). *New Horizons in the Study of Language and Mind*. New York: Cambridge University Press.

Chomsky, N., & Halle, M. (1968). *The sound pattern of English*. New York: Harper & Row.

Chudler, E. H. (2011). *One brain or two?* Retrieved from http://faculty.washington.edu/chudler/split.html

Clark, J., & Yallop, C. (1990). *An introduction to phonetics and phonology*. Oxford, England: Blackwell.

Clarke-Klein, S. M. (1994). Expressive phonological dificiencies: Impact on spelling development. *Topics in Language Disorders, 14*(2), 40-55.

Clay, M. (2005). *Literacy lessons designed for individuals*. Portsmouth: NH: Heinemann.

Cockcroft, H. (2008). *Barriers to reading and spelling.* Retrieved from www.mindmoves.co.za

Cobb, P. (1994). *Where Is the mind?* Constructivist and sociocultural perspectives on mathematical development. *Educational Researcher, 23*, 13–20.

Cohen, M. A., & Horowitz, T. S. (2002). What should teachers know about bilingual learners and the reading process? *Literacy and the Second Language Learner, 1,* 29-52.

Cole, M. (2005). *The development of children*. New York: Worth Publishers.

Compton-Lilly, C. (2006). Identify childhood culture and literacy learning: A case study. *Journal of Early Childhood Literacy, 6*(1), 57-76.

Coolican, H. (1994). *Research methods and statistics in psychology* (2nd ed.). London: Hodder & Stoughton.

Cooperstein, S. E. & Weidinger,E. (2003). *Beyond active learning: a constructivist approach to learning, 32*(2), 141-148.

Coulmas, F. (1996). *The Blackwell Encyclopedia of Writing Systems.* Oxford: Blackwell.

Coxhead, A. (2000). A new academic word list. *TESOL Quarterly, 34*(2), 213-238.

Crawford, J. D., Medendorp, W. P., & Marotta, J. J. (2004). Spatial transformations for eye-hand coordination. *Journal of Neurophysiology, 92*, 10-19.

Crawford, K. (1996). Vygotskian approaches to human development in the information era. *Educational Studies in Mathematics, 31*, 43-62.

Cresswell, J. (1994). *Research design: Qualitative and quantitative approaches* (1st ed.). Thousand Oaks, CA: Sage.

Cresswell, J. W., & Plano, C. V. L. (2007). *Designing and conducting mixed methods research.* Thousand Oaks, CA: SAGE Publications.

Crewther, S., Lawson, M., Bello, K., & Crewther, D. (2007). The visual attentional blink reflects constraints on temporal visual processing, not just a lapse of visual memory. *Clinical and Experimental Optometry, 90*(4), 282 - 289.

Cummings, R. L. (1986). An evaluation of the Tomatis listening training program. *Dissertation Abstracts International, 47*, 858-859.

Cummins, J. (1984). Linguistic interdependence and the educational development of bilingual children. *Review of Educational Research, 49*, 134-144.

Dane, S., & Gumustekin, K. (2002). Correlation between hand preference and distance of focusing points of two eyes in the horizontal plane. *International Journal of Neuroscience, 112*, 1141-1147.

Deno, S. L. & Mirkin, P. K. (1977). *Data-based program modification: A manual.* Reston, VA: Council for Exceptional Children.

Dawson, J. L. M. B. (1977). Alaskan eskimo hand, eye, auditory dominiance and cognitive style. *Psychologia, 20*, 121-135.

De Jager, M. (2006). *Mind moves - remove the barriers to learning*. Johannesburg: The ConneXion.

De Lacy, P. (2007). *The Cambridge handbook of phonology*. Cambridge: Cambridge University Press.

De Witt, M. W., Lessing, A. C., & Dicker, A. (1998). The comparison of reading skills of non-mother tongue learners with those of mother-tongue learners. *South African Journal of Education, 18*(2), 118-123.

De Witt, M. W., Lessing, A. C., & Lenayi, E. M. (2008). An investigation into the state of early literacy of preschool learners. *Journal for Language Teaching, 42*(1), 38-47.

Deardorff, D. S. (2005). An exploratory case study of leadership influences on innovative culture: A descriptive study dissertation [Abstract]. *The Society for Engineering Abstracts, 66*, 2338.

Decker, M. (2007). *To read or not to read: A comprehensive study of effective reading and methods of teaching reading.* Lynchburg, VA:Liberty University.

Dehaene, S., Cohen, L., Sigman, M., & Vinckier, F. (2005). The neural code for written words: A proposal. *Trends in cognitive sciences, 9*(7), 335-341.

Deppe, M., Knecht, S., Papke, K., Lohmann, H., Fleischer, H., & Heindel, W. (2000). Assessment of hemispheric language lateralization: a comparison between fMRI and fTCD. *Journal of Cerebral Blood Flow, 20*, 263-268.

Derwing, B. L., & Neary, T. M. (1991). *The vowel-stickiness phenomenon: Three experimental sources of evidence.* Paper presented at the Twelfth International Congress of Phonetic Sciences.Aix-en-Provence, France.

DeWald, R. E. (1989). *Relationships of MBTI types and HBDI preferences in a population of student program managers.* Kalamazoo, MI: Western Michigan University.

Dewey, J. (1969). *Experience and education*. New York: Macmillan/Collier Books.

Dirks, A. L. (1998). *Constructivist pedagogy, critical thinking, and the role of authority.* Retrieved from http://webhost.bridgew.edu/adirks/ald/papers/constr.htm

Dodd, B., & Carr, A. (2003). Young children's letter-sound knowledge. *Language, Speech, and Hearing Services in Schools, 34*, 128-137.

Doidge, N. (2007). *The brain that changes itself, stories of personal triumph from the frontiers of brain science.* New York: Viking Penguin.

Dorsaint-Pierre, R., Penhune, V. B., Watkins, K. E., Neelin, P., Lerch, J. P., & Bouffard, M. (2006). Asymmetries of the planum temporale and Heschl's gyrus: Relationship to language lateralization. *Brain, 129*, 1164-1176.

Du Plessis, E. (2001). *A conceptual framework for accelerating emergent literacy skills of disadvantaged pre-schoolers.* University of Pretoria, Pretoria.

Dubin, F., & Bycina, D. (1991). Academic reading and esl/efl teacher. In M. Celce-Murcia (Ed.), *Teaching English as a second or foreign language* (pp. 195-215). Boston: Heinle & Heinle Publishers.

Dynamic Indicators of Basic Early Literacy Skills. (2009). *Teaching and Learning.* Retrieved from https://dibels.uoregon.edu/resources.php

Efron, R., Koss, B., & Yund, E. W. (1983). Brain and language. *Ear dominance-spatial and temporal complexity, 19*(2), 264-282.

Ehrenstein, W. H., Arnold-Schulz-Gahmen, B. E., & Jaschinski, W. (2005). Eye preference within the context of binocular functions. *Clinical Experimentsin Ophthalmology, 243*(9), 926-932.

Ehri, L. C. (1986). Sources of difficulty in learning to spell and read. In M. L. Wolraich & D. Routh (Eds.), *Advances in developmental and behavioral pediatrics* (Vol. 7, pp. 121-195). Greenwich, CT: JAI Press.

Ehri, L. C. (2000). Learning to read and learning to spell: Two sides of a coin. *Topics in Language Disorders, 20*(3), 19-36.

Ehri, L. C., Nunes, S. R., Willows, D. A., Schuster, B. V., Yaghoub-Zadeh, Z., & Shanahan, T. (2001). Phonemic awareness instruction helps children learn to read: evidence from the National Reading Panel's meta-analysis. *Reading Research Quarterly, 36*, 250-287.

Ehri, L. C., & Wilce, L. S. (1980). The influence of orthography on readers' conceptualization of the phonemic structure of words. *Applied Psycholinguistics, 1*, 371-385.

Ehri, L. C., & Wilce, L. S. (1985). Movement into reading: Is the first stage of printed word learning visual or phonetic? *Reading Research Quarterly, 20*, 163-179.

Elliott, D. B. (2003). *Clinical Procedures in Primary Eye Care.* Butterworth-Heineman. Oxford.

Ellis, N., & Cataldo, S. (1990). The role of spelling in learning to read. *Language and Education, 4*, 1-27.

Engelbrecht, P., Green, L., Naicker, S., & Engelbrecht, L. (1999). *Inclusive Education in Action in South Africa*. Hatfield, Pretoria: Van Schaik Publishers.

Ericksen, S. C. (1978). *The lecture.* Ann Arbor,University of Michigan.

Eser, I., Durrie, D. S., Schwendeman, F., & Stahl, J. E. (2008). Association between ocular dominance and refraction. *Journal of Refractive Surgery*, *12*, 685-689.

Esgate, A., Burton, A., & Burton, E. (1996). Lateral advantage in same-different comparison of two-note, dichotically presented chords to a successively-presented probe. *Neuropsychologia, 35*(2), 177-182.

Esterhuyse, K. G. F., Beukes, R. B. I., & Heyns, P. M. (2002). The development of the ESSI-reading and spelling test. *South African Journal of Education, 22*(2), 83-91.

European Review. (2005). Symmetry and asymmetry in the human brain. *Academia Europaea, 13*(2), 119-133.

Evans, M. A., & Saint-Aubin, J. (2005). What children are looking at during shared book reading: Evidence from eye movement monitoring. *Psychological Science, 16*, 913-920.

Evans, M. A., Shaw, D., & Bell, M. (2000). Home literacy activities and their influence on early literacy skills. *Canadian Journal of Experimental Psychology, 54*, 65-75.

Experience Project. (2012). The real meaning of orthography defined. Retrieved from http://www.experienceproject.com/dictionary/definition-of/Orthography

Fabbro, F. (1994). Left and right in the Bible from a neuropsychological perspective. *Brain Cognition, 24*, 161-183.

Ferreiro, E., & Teberosky, A. (1982). *Literacy before schooling*. New York: Heinemann.

Fink, A. (2005). Eyes: myths and facts. Retrieved from http://www.healthylens.com

Fink, G. R., Marshall, J. C., Halligan, P. W., Frith, C. D., Driver, J., Frackowiack, R. S. J., & Dolan, R. J. (1999). The neural consequences of conflict between intention and the senses. *Brain, 122*, 497-512.

Finn, E. (2011). *Dyslexia independent of IQ*. Retrieved from http://web.mit.edu/newsoffice/2011/dyslexia-iq-0923.html

Finucci, J. M., Isaacs, S. D., Whitehouse, C. C., & Childs, B. (1983). Classification of spelling errors and their relationship to reading ability, sex, grade placement, and intelligence. *Brain and Language, 20*, 340-355.

Fisher, R. S., Alexander, M. P., Gabriel, C., Gould, E., (1991). Reversed lateralization of cognitive functions in right handers. *Brain, 114*, 245-261.

Fite, G. (2002). Reading and Maths: What is the Connection? *Kansas Science Teacher, 14*(2), 139-142.

Fletcher, J. M., Lyon, G. R., Fuchs, L. S., & Barnes, M. W. (2007). *Learning disabilities: from identification to intervention*. New York: The Guildford Press.

Fletcher-Flinn, C. M., & Thompson, G. B. (2000). Learning to read with underdeveloped phonemic awareness but lexicalized phonological recoding: A case study of a 3-year-old. *Cognition, 74*(2), 177-208.

Flora, A., Beck, I., Farr, R., Strickland, D., Hudson, R., & McKeown, R. (2009). *Harcourt Storytown*. New York: Harcourt School Publishers.

Foorman, B. R., Chen, D. T., Carlson, C., Moats, L., David, J. F., & Jack, M. F. (2003). The necessity of the alphabetic principle to phonemic awareness instruction. *Reading and Writing, 16*, 289-324.

Foundas, A. L., Eure, K. F., Luevano, L. F., & Weinberger, D. R. (1998). MRI asymmetries of Broca's area: The pars triangularis and pars opercularis. *Brain and Language. 64*, 282-296.

Foundas, A. L., Leonard, C. M., Gilmore, R. L., Fennell, E. B., & Heilman, K. M. (1996). Pars triangularis asymmetry and language dominance. *Proceedings of the National Academy of Sciences, 26*, 219-722.

Fowler, C. A., Treiman, R., & Gross, J. (1993). The structure of English syllables and polysyllables. *Journal of Memory and Language, 32*, 115-140.

Fox, B., & Routh, D. K. (1975). Analysing spoken language into words, syllables and phonemes: A developmental study. *Journal of Psycholinguistic Research, 4*, 331-342.

Fox, B., & Routh, D. K. (1976). Phonemic analysis and synthesis as word-attack skills. *Journal of Educational Psychology, 68*, 70-74.

Freed, J., & Parsons, L. (1998). *Right-brained children in a left-brained world*. New York: Simon & Schuster.

Freidin, R., & Howard, L. (2006). *Syntax: Critical concepts in linguistics*. New York: Routledge.

Frost, J. (2001). Phonemic awareness, spontaneous writing, and reading and spelling development from a preventive perspective. *Reading and Writing in the Content Areas, 14*(5-6), 487-513.

Frost, J. A., Binder, J. R., Springer, J. A., Hammeke, T. A., Bellgowan, P. S., & Rao, S. M. (1999). Language processing is strongly left lateralized in both sexes: Evidence from functional MRI. *Brain, 122*, 199-208.

Galaburda, A. M., Sherman, G. F., Rosen, G. D., Aboitiz, F., & Geschwind, N. (1985). Developmental dyslexia: four consecutive patients with cortical anomalies. *Annual Neurological Journal, 18*(2), 222-233.

Gardner, H. (2001). Bruner' in J. A. Palmer (ed.). *Fifty modern thinkers on education: From Piaget to the present*. London: Routledge.

Gay, L. R., & Airasian, P. (2003). *Educational research: Consequences for analysis and applications* (7th ed.). Upper Saddle River, NJ: Pearson.

Gazzaniga, M. S. (1988). *Mind Matters: How mind and brain interact to create our conscious lives.* Boston: Houghton Mifflin.

Gazzaniga, M. S. (2000). Cerebral specialization and interhemispheric communication: Does the corpus callosum enable the human condition? *Brain, 123*, 1293-1326.

Gazzaniga, M. S. (2004). *The Cognitive Neurosciences* (3rd ed.). Cambridge, MA: MIT Press.

Gazzaniga, M. S. (2009). *Human: The science behind what makes us unique*. New York: Harper Perennial.

Gentry, J. R. (1982). An analysis of developmental spelling. *The Reading Teacher, 36*, 192-200.

Gerace, W. J. (1992). *Contributions from cognitive research to mathematics and science education.* Paper presented at the Workshop on Research in Science and Mathematics Education, Cathedral Peak.

Giannini, A. J. (2010). Semiotic and Semantic Implications of "Authenticity". *Psychological Reports, 106*(2), 611-612.

Gick, M. L., & Holyoak, K. J. (1983). Schema induction and analogical transfer. *Cognitive Psychology, 15*, 1-38.

Gilbertson, M., & Bramlett, R. K. (1998). Phonological awareness screening to identify at-risk readers: Implications for practitioners. *Language, speech and hearing services in schools. 29*, 109-116.

Gillon, G. T. (2004). *Phonological awareness: From research to practice*. New York: Guilford Press.

Ginsburg, H., & Opper, S. (1979). *Piaget's theory of intellectual development* (2nd ed.). Englewood Cliffs, NJ: Prentice-Hall.

Girstenbrey, W. (1981). The different faces of the hemispheres. The presentation of the Nobel Prize for Medicine and Physiology 1981 to the neurobiologists Sperry, Hubel and Wiesel. *Fortschritte der Medizin, 99*(47-48), 1978-1982.

Goikoetxea, E. (2005). Levels of phonological awareness in preliterate and literate Spanish-speaking children. *Reading and Writing, 18*, 51-79.

Goin, R. P., Nordquist, V. M., & Twardose, S. (2004). Parental accounts of home-based literacy process: Contexts for infants and toddlers with developmental delays. *Early Education and Development, 15*(2), 187-214.

Goldberg, M. (2001). Balanced optimism: An interview with Linda Darling-Hammond. *Phi Delta Kappan, 82*(9), 687.

Goldberg, R. F., Perfetti, C. A., & Schneider, W. (2006). Perceptual knowledge retrieval activates sensory brain regions. *Journal of Neuroscience, 26*(18), 4917-4921.

Goleman, D. (1995). *Emotional intelligence: Why it can matter more than IQ.* New York: Bantam Books.

Goswami, U. (1986). Children's use of analogy in learning to read: A developmental study. *Journal of Experimental Child Psychology, 42*, 73-83.

Goswami, U. (1988). Orthographic analogies and reading development. *Quarterly Journal of Experimental Psychology, 40*, 239-268.

Goswami, U. (1993). Orthographic analogies and reading development. *The Psychologist: Bulletin of the British Psychological Association, 6*, 312-316.

Goswami, U. (1998). Rime-based coding in early reading development in English: Orthographic analogies and rime neighbourhoods. In C. Hulme & R. M. Joshi (Eds.), *Reading and spelling: Development and disorders* (pp. 69-86). Mahwah, NJ: Erlbaum.

Goswami, U. (1999). Causal connections in beginning reading: The importance of rhyme. *Journal of Research in Reading, 22*, 217-240.

Goswami, U., & East, M. (2000). Rhyme and analogy in beginning reading: Conceptual and methodological issues. *Applied Psycholinguistics, 21*, 63-93.

Goswami, U., & Mead, F. (1992). Onset and rime awareness and analogies in reading. *Reading Research Quarterly, 27*, 152-162.

Gough, P. B., Ehri, L. C., & Treiman, R. (1992). *Reading acquisition.*Hillsdale, NJ: Erlbaum.

Gough, P. B., Larson, K. C., & , & Yopp, H.(1996). *The structure of phonemic awareness.* Retrieved from www.psy.utexas.edu/psy/klarson/recife.html

Gough, P. B., & Tunmer, W. E. (1986). Decoding, reading, and reading disability. *Remedial and Special Education, 7*, 6-10.

Goulandris, N. K. (1994). Teaching spelling: Bridging theory and practice. In Brown, D. A., & Ellis, N. C. Handbook of spelling: Theory, process and intervention. Chichester, England: John Wiley.

Grabe, W., & Stoller, F. L. (2002). *Teaching and researching reading*. Harlow: Pearson Education Limited.

Grapheme. (1997). In *Cambridge Encyclopedia of Language*. Retrieved from www.cambridge.org/uk/catalogue/catalogue.asp?isbn=0521559677

Greeno, J. G., Smith, D. R., & Moore, J. L. (in press). Transfer of situated learning. In: Detterman D, Sternberg R (Eds.) (in press) *Transfer on trial.* Norwood, NJ: Ablex.

Gregory, A. H., Efron, R., Divenyi, P. L.,& Yund, E. W. (1983). Central auditory processing.Ear dominance: a perceptual or an attentional asymmetry?*Brain and Language, 19*, 225-236.

Gregson, J. (2001). System, environmental, and policy changes: Using the social-ecological model as a framework for evaluating nutrition education and social marketing programs with low-income audiences. *Journal of Nutrition Education, 33*(1), 4-15.

Griffith, P. L. (1991). Phonemic awareness helps first graders invent spelling and third graders remember correct spelling. *Journal of Reading Behaviour, 23*, 215-233.

Gruber, H. E. & Voneche, J. J. (1995). *The essential Piaget.* Northvale, NJ: Jason Aronson

Gunn, B., Smolkowski, K., Biglan, A., Black, C. **(**2002). Supplemental Instruction in decoding skills for hispanic and non-hispanic students in early elementary school.*The Journal of special education, 36*(2),69-79.

Gutierrez-Clellen, V. F. (1999). Language choice in intervention with bilingual children. *American Journal of Speech-Language Pathology, 8*, 291-302.

Hagan, J. C. (2008). *Eye patches cure astigmatism in children?* Retrieved from http://www.medhelp.org/doctor_profiles/show/233488

Halonen, A., Aunola, K., Ahonen, T., & Nurmi, J. (2006). The role of learning to read in the development of problem behaviour: a cross-lagged longitudinal study. *British Journal of Educational Psychology, 76*(3).

Hamilton, C. R. (1998). Paths in the brain, actions of the mind: Special issue in honor of Roger W. Sperry. *Neuropsychologia, 36*(10) 111- 130.

Hammer, C. S., & Miccio, A. W. (2004). *Home literacy experiences of Latino families*. Mahwah, NJ: Lawrence Erlbaum.

Hancock, L., & Wingert, P. (1996). If you can read this... . *Newsweek, 127*(20), 75. Retrieved from http://search.ebscohost.com.ezproxy.liberty.edu:2048/login.aspx?direct=true&db

Hand dominance. (2012). In *American Heritage Dictionar.* Retrieved fromhttp://www.thefreedictionary.com/handdominance

Hannaford, C. (1995). *Smart Moves: Why learning is not all in your head*. Virginia: Great Ocean Publishers.

Hannaford, C. (1999). *The Dominance Factor*. Virginia: Great Oceans Publishers.

Harp, L. (2009). *About Neuro-Sensory Educational Therapy.*Retrieved fromhttp://www.selfgrowth.com/experts/lisa_harp

Harris, L. J. (1993). Broca on cerebral control for speech in right-handers and left-handers: a note on translation and some futher comments. *Brain Lang, 45*, 108-120.

Harris, T., & Hodges, R. E. (1995). *The literacy dictionary*.Newark, DE: International Reading Association.

Haspelmath, M. (2002). *Understanding Morphology*. London: Arnold.

Hauk, O., Johnsrude, I., & Pulvermüller, F. (2004). Somatotopic representation of action words in human motor and premotor cortex. *Neuron, 41*, 301-307.

Hauslein, P. L., & Smith, M. U. (1995). Knowledge structures and successful problem solving. In D. R. Lavoie (Ed.), *Towards a cognitive-science perspective for scientific problem solving: A monograph of the National Association for Research in Science Teaching, 6*, 51-79. Manhattan, KS: Ag Press.

Hayden, A. H., Smith, R. K., von Hippel, C. S., & Baer, S. A. (1986). Mainstreaming Preschoolers: Children with learning disabilities. *US Department of Health and Human Services*, *48,* 207-214.

Healey, J. M. (1987). *Your child's growing mind*. Toronto: Doubleday.

Hearing. (2012). *In Dictionary of the English Language.* Retrieved from http://dictionary.reference.com/browse/hearing

Hearing. (2012). *In Collins English Dictionary.* Retrieved from http://www.collinsdictionary.com/dictionary/english/hearing

Heilman, A. W. (1998). *Phonics in proper perspective*. Columbus, OH: Merrill.

Hellige, J. B. (2001). *Hemispheric asymmetry: What's right and what's left*. Boston, MA: Harvard University Press.

Henderson, E. (1985). *Teaching spelling*. Boston: Houghton Mifflin.

Henderson, R. A. (1989). Delivery of special education in Australia, New Zealand and the United States: Similarities and differences. *International Journal of Special Education, 4*, 25-32.

Herrmann, N. (1996). *The Whole Brain Business Book*. New York: McGraw-Hill.

Higbee, K. L. (1993). *Your Memory: How it works and how to improve it*. (2nd ed.). New York: Paragon House.

Hindson, B., Byrne, B., Fielding-Barnsley, R., Newman, C., Hine, D. W., & Shankweiler, D. (2005). Assessment and early instruction of preschool children at risk for reading disability. *Journal of Educational Psychology, 97*, 687-704.

Hines, T. (1985). Left brain, right brain: Who's on first? *Training & Development Journal, 39*(11), 32-34.

Hiscock, M., & Kinsbourne, M. (1978). Ontogeny of cerebral dominance: Evidence from time-sharing asymmetry in children. *Developmental Psychology, 14*(4).

Hiscock, M., & Kinsbourne, M. (2011). Attention and the right-ear advantage: What is the connection? *Brain and Cognition, 76*(2), 263-275.

Hoien, T., Lundberg, I., Stanovich, K. E., & Bjaalid, I. K. (1995). Components of phonological awareness. *Reading and Writing, 7*, 171-188.

Holder, M. K. (1997). Why are more people right-handed? *Scientific American Inc, second edition*, *4*(3), 309-318.

Holder, M. K. (2003). Teaching left-handers how to write. *Handedness Research Institute papers7*(4), 110-124.

Holligan, C., & Johnston, R. S. (1991). Spelling errors and phonemic segmentation Ability: The nature of the relationship. *Journal of Research and Reading, 14*(21-32).

Honig, B. (2001). Teaching our children to read: The components of an effective, comprehensive reading program. *Thousand Oaks, CA: Corwin*.

Hoover, W., & Gough, P. B. (1990). The simple view of reading. *Reading and Writing: An Interdisciplinary Journal, 2*, 127-160.

Huck, S. W. (2008). Reading statistics and research (5th ed.). Boston, MA: Pearson.

Huddleston, R., & Pullum, G. K. (2002). *The Cambridge grammar of the English language*. Cambridge, UK: Cambridge University Press.

Hudson, G. (2000). *Essential introductory linguistics*. Malden, MA: Blackwell.

Hugdahl, K. (1995). Dichotic listening: Probing temporal lobe functional integrity, in R.J. Davidson and K. Hugdahl. Cambridge, MA: MIT Press.

Hugdahl, K. (2005). Symmetry and asymmetry in the human brain.*Academia Europaea,* Vol. 13(2) 119–133.Retrieved from http://www.acadeuro.org/fileadmin/user_upload/publications/ER_Symmetry_supplement/Hugdahl.pdf

Hulme, C. (2002). Phonemes, rimes, and the mechanisms of early reading development. *Journal of Experimental Child Psychology, 82*, 58-64.

Huysamen, G. K. (1996). Psychological measuremnet: an introduction with South African examples (2nd ed.). Pretoria: Van Schaick.

International Phonetic Association. (1999). *Handbook of the International Phonetic Association: a guide to the use of the international phonetic alphabet.* Cambridge: Cambridge University Press.

International Reading Association. (2003). *Standards for Reading Professionals*. New York, DE: Author.

Jackson, S. R., Newport, R., Mort, D., & Husain, M. (2005). Where the eye looks, the hand follows; limbdependent magnetic misreaching in optic ataxia. *Current Biology, 15*, 42-46.

Jansen, J. D., Maqutu, T., Sookrajh, R., Khumalo, L., Kisten, A., Dube, A., ... Mbanjwa, S. (1999). *A Very Noisy OBE: A report on the implementation of OBE inside Gr 1 classrooms.* University of Durban, Westville Campus, Durban.

Jensen, E. (1998). *Teaching with the brain in mind*. Alexandria, VA: Association for Supervision and Curriculum Development.

Jensen, E. (2000). *Brain-based Learning: The new science of teaching and training.*San Diego: Corwin Press.

Jensen, E. (2008). *Brain-based learning : The new paradigm of teaching*. Thousand Oaks, CA: Corwin Press.

Jeynes, W., & Littell, S. (2000). A meta-analysis of studies examining the effect of whole language instruction on the literacy of low SES students. *Elementary School Journal, 101*(1), 21.

Johansson, R. S., Westling, G., Backstrom, A., & Flanagan, J. R. (2001). Eye-hand coordination in object manipulation. *Journal of Neuroscience, 21*, 6917-6932.

Johnson, A. M., Barnes, M. A., & Desrochers, A. (2008). Reading comprehension: Developmental processes, individual differences, and intervention. *Canadian Psychology, 40*, 125-132.

Juel, C. (1994). *Learning to read and write in one elementary school.*Retrieved from http://www.balancedreading.com/juel.html

Juel, C., & Cupp-Minden, C. (2000). Learning to read words: Linguistic units and instructional strategies. *Reading Research Quarterly, 35*(4), 458-492.

Kamhi, A. G., & Beasley, D. S. (1985). Central auditory processing disorders: Is it a meaningful construct or a 20th century unicorn? *Journal of Childhood Communication Disorders, 9*(1), 5-13.

Kamhi, A. G., & Catts, H. W. (1991). *Reading disabilities: A developmental language perspective.*Boston: College Hill Press.

Katz, K. J., & Wilde, L. (1994). Auditory processing disorders. In Katz, J. (Ed). *Handbook of Clinical Audiology* (4th ed). Baltimore, MD: Williams and Wilkins.

Kershner, J. R. (1986). Evaluation of the Tomatis listening program. *Canadian Journal of Special Education, 2*, 1-32.

Kessler, B., & Treiman, R. (2001). Relationship between sounds and letters in English monosyllables. *Journal of Memory and Language, 44*, 592-617.

Khan, A. Z., & Crawford, J. D. (2001). Ocular dominance reverses as a function of horizontal gaze angle. *Vision Research, 41*(14), 1743-1748.

Khedr, E. M., Hamed, E., Said, A., & Basahi, J. (2002). Handedness and language cerebral lateralization. *European Journal of Applied Physiology, 87*, 469-472.

Kieler, H., Axelsson, O., Haglund, B., Nilsson, B. S., & Salvesen, K. A. (1998). Routine ultrasound screening in pregnancy and children's subsequent handedness. *Early Human Development, 50*(2), 233-245.

Kilpatrick, J., Swaffod, J., & Findell, B. (Eds.). (2001). *Adding it up: Helping children learn mathematics*. Washington DC: National Academy Press.

Kimura, D. (1961). Cerebral dominance and the perception of verbal stimuli. *Canadian Journal of Psychology, 15*, 166-171.

Kimura, D. (1993). *Neuromotor Mechanisms in Human Communication*. Oxford: Oxford University Press.

Kirschner, P. A., &Sweller, J., & Clark, R. E. (2006). Why minimal guidance during instruction does not work: An analysis of the failure of constructivist, discovery, problem-based, experiential, and inquiry-based teaching. *Educational Psychologist, 41*(2), 75-86.

Kirtley, C., Bryant, P., Maclean, M., & Bradley, L. (1989). Rhyme, rime, and the onset of reading. *Journal of Experimental Child Psychology, 48*, 224-245.

Klar, A. (2012). *Gene regulation and chromosome biology.* Retrieved from http://ccr.cancer.gov/staff/staff.asp?profileid=569

Klein, C., & Millar, R. R. (1990). *Unscrambling Spelling*. Kent: Hodder & Stoughton.

Klein, P. S., & Alony, S. (1993). Immediate and sustained effects of maternal mediating behaviours on young children. *Journal of Early Intervention, 17*(2), 177-193.

Knapp, T. R. (1998). *Quantitative Nursing Research.* Thousand Oaks, Sage.

Knecht, S. (2000). Handedness and hemispheric language dominance in healthy humans. *Journal of Neurology. 18*(7), 39-54.

Knecht, S., Deppe, M., Dräger, B., Bobe, L., Lohmann, H., & Ringelstein, E. (2000). Language lateralization in healthy right-handers. *Brain, 123*, 74-81.

Knecht, S., Deppe, M., Drager, B., Bobe, L., Lohmann, H., Ringelstein, E., & Henningsen, H. (2000). Language lateralization in healthy right-handers. *Brain, 123*(4). Retrieved from http://brain.oxfordjournals.org/content/123/1/74.full.pdf

Knecht, S., Dräger, B., Deppe, M., Bobe, L., Lohmann, H., & Flöel, A. (2000). Handedness and hemispheric language dominance in healthy humans. *Brain, 123*, 2512-2518.

Knecht, S., Henningsen, H., Deppe, M., Huber, T., Ebner, A., & Ringelstein, E. B. (1996). Successive activation of both cerebral hemispheres during cued word generation. *Neuroreport, 7*, 820-824.

Kokot, J. S. (2010). *Unravelling causes of learning and behaviour difficulties.* Retrieved from http://www.ilt.co.za/

Kokot, S. (2009). *Is your child gifted?* Retrieved 20 August 2011, from http://www.health24.com/child/Parenting/833-852,42246.asp

Krause, S. E. (2005). Research paradigms and meaning making: A primer. *Qualitative Report, 10*, 758–770.

Kriegler, S., & Farman, R. (1994). Redistribution of special education resources in South Africa: Beyond mainstreaming towards effective schools for all. *International Journal of Special Education, 9*(1), 1-13.

Korf, L. (2004). Updated research report: Validity and reliability of the Neethling Brain Instrument. Retrieved from

Land, M. F., & Furneaux, S. (1997). The knowledge base of the oculomotor system. *Philosophical Transactions of the Royal Society of London: Biological Sciences, 352*, 1231-1239.

Land, M. F., & Hayhoe, M. (2001). In what ways do eye movements contribute to everyday activities? *Vision Research, 41*(3559-3565).

Lane, H. B., Pullen, P. C., Eisle, M. R., & Jordan, L. (2002). Preventing reading failure: phonological awareness assessment and instruction. *Preventing School Failure, 46*(3), 101-110.

Langer, E. J. (1989). *Mindfulness and reading*. Massachusetts: Addison-Wesley.

Language. (n.d.). In *The Random House Dictionary.*Retrieved from http://dictionary.reference.com/browse/language

Lappin, S. (Ed.). (1996). *The handbook of contemporary semantic theory.* Cambridge, MA: Blackwell Publishing.

Larkin, J. H. (1985). Understanding, problem representations, and skill in physics. In S. F. Chipman, J. W. Segal & R. Glaser (Eds.), *Thinking and learning skills,*(pp. 141-159). London: Lawrence Erlbaum Associates.

Lave, J. (1988). *Cognition in practice*. New York: Cambridge University Press.

Lavine, L. O. (1977). Differentiation of letterlike forms in prereading children. *Developmental Psychology, 13*, 89-94.

Leedy, P. D., & Ormrod, J. E. (2001). *Practical Research: planning and design* (7th ed). Upper Saddle River: Merril Prentice Hall.

Lenchner, O., Gerber , M. M., & Routh, D. K. (1990). Phonological awareness tasks as predictors of decoding ability: Beyond segmentation. *Journal of Learning Disabilities, 23*(4), 240-247.

Lerner, J. (1989). *Learning disabilities: Theories. diagnosis. and teaching strategies* (6th ed.). Boston, MA: Houghton Mifflin.

Levin, I., Patel, S., Margalit, T., & Barad, N. (2002). Letter names: Effect on letter saying, spelling, and word recognition in Hebrew. *Applied Psycholinguistics, 23*, 269-300.

Levine, M. (1990). *Keeping ahead in school*. Cambridge, MA: Educators Publishing Services.

Levy, B. A., Gong, Z., Hessels, S., Evans, M. A., & Jared, D. (2006). Understanding print: Early reading developments and the contributions of home literacy experiences. *Journal of Experimental Child Psychology, 93*, 63-93.

Lewis, M. (1997). *Implementing the lexical approach.* Hove, England: Language Teaching Publications.

Lewkowicz, N. K. (1980). Phonemic awareness training: What to teach and how to teach it. *Journal of Educational Psychology, 72*, 686-700.

Liberman, A. M., Cooper, F. S., Shankweiler, D. P., & Studdert-Kennedy, M. (1967). Perception of the speech code. *Psychological Review, 74*, 431-457.

Liberman, I. Y., & Liberman, A. M. (1990). Whole language vs. code emphasis: Underlying assumptions and their implications for reading instruction. *Annals of Dyslexia, 40*, 51-76.

Liberman, I. Y., & Shankweiler, D. (1991). Phonology and beginning reading: A tutorial. In L. Rieben & C. A. Perfetti (Eds.), *Learning to read: Basic research and its implications* (pp. 3-17). Hillsdale, NJ: Erlbaum.

Liberman, I. Y., Shankweiler, D., Fischer, F. W., & Carter, B. (1974). Explicit syllable and phoneme segmentation in the young child. *Journal of Experimental Child Psychology, 18*, 201-212.

Liberman, Y., Shankweiler, D., & Liberman, A. M. (1989). The alphabetic principle and learning to read. In D. Shankweiler, & I. Y. Liberman (Eds.), *Phonology and reading disability: Solving the reading puzzle.* Ann Arbor: University of Michigan Press.

Lidz, C. S. (2003). *Early childhood assessment*. Hoboken, NJ: John Wiley & Sons.

Listen. (2012). In *Dictionary of the English Language.*Retrieved fromhttp://www.thefreedictionary.com/listen

Listen. (2012). In *Online Etymology Dictionary*. Retrieved from http://dictionary.reference.com/browse/listen

Literacy. (2012). In Online Etymology Dictionary. Retrieved from http://dictionary.reference.com/browse/literacy

Lombard, A. (2007). *Sensory Integration - Why it matters more than IQ an EQ.* Welgemoed: Metz Press.

Lombardi, S. M. (2011). *Internet activities for a preschool technology education program guided by caregivers.* North Carolina State University, North Carolina.

Lombardino, L. J., Bedford, T., Fortier, C., Carter, J., & Brandi, J. (1997). Invented spelling: Developmental patterns in kindergarten children and guidelines for early literacy intervention. *Language, Speech and Hearing Services in Schools, 28*, 333-343.

Lombroso, C. (1903). Left-handedness and left-sidedness. *PubMed, The North American Review* 177, 440-444.

Lonigan, C. J., Burgess, S. R., Anthony, J. L., & Barker, T. A. (1998). Development of phonological sensitivity in 2- to 5-year-old children. *Journal of Educational Psychology, 90*, 294-311.

Lovett, B. J. (2011). Auditory processing disorder: School psychologist beware? *Psychology in the Schools, 48*, 855-867.

Lundberg, I., Frost, J., & Peterson, I. (1988). Effects of an extensive program for stimulating phonological awareness in preschool children. *Reading Research Quarterly, 23*, 263-284.

Luria, A. R. (1976). *Cognitive development: Its cultural and social foundations*. Cambridge, MA: Harvard University Press.

Lyon, G. R. (1994). *Research in learning disabilities at the NICHD*. New York: Teachers College Press.

MacDonald, G. W., & Cornwall, A. (1995). The relationship between phonological awareness and reading and spelling achievement eleven years later. *Journal of Learning Disabilities, 28*, 523-527.

MacLean, M., Bryant, P., & Bradley, L. (1987). Rhymes, Nursery Rhymes, and Reading in Early Childhood. *Merrill-Palmer Quarterly, 33*, 255-281.

MacLeod, C. (1995). The challenges to mainstreaming in rural South Africa. *International Journal of Special Education, 10*(2), 72-91.

MacLeod, C. (1998). The construction of learning disablement in South Africa: Two case studies. *International Journal of Special Education, 13*(1), 18-29.

Magill-Evans, J., & Harrison, M. J. (2001). Parent-child interactions, parenting stress, and developmental outcomes at 4 years. *Children's Health Care, 30*(2), 135-150.

Maharaj, C. (2007). *Teaching reading in the early grades. A teacher's handbook.* Retrieved from http://www.education.gov.za

Mahoney, G. J., & MacDonald, J. (2003). *Responsive teaching: Parent-mediated developmental intervention*. Baltimore: Paul Brookes.

Mahony, D., Singson, M., & Mann, V. (2000). Reading ability and sensitivity to morphological relations. *Reading and Writing: An Interdisciplinary Journal, 12*, 191-218.

Mahony, G., Boyce, G., Fewell, R., Spiker, D., & Wheeden, C. A. (1998). The relationship of parent-child interaction to the effectiveness of early intervention services for at-risk children and children with disabilities. *Topics in Early Childhood Special Education, 18*(1), 5-17.

Mann, V. A., Cowin, E., & Schoenheimer, J. (1989). Phonological processing, language comprehension, and reading ability. *Journal of Learning Disabilities, 22*(2), 76-89.

Maree, D., & Ford, M. (1998). *Ready to read*. Florida Hills: Smile Education Systems.

Maree, K. (2010). *First steps in Research* (5th ed). Pretoria: Van Schaik.

Marsh, C. (1996). *Handbook for beginning teachers*. Melbourne, Australia: Addison Wesley Longman.

Martin, A. (2007). The representation of object concepts in the brain. *Annual Review of Psychology, 58*, 25-45.

Martin, A., Wiggs, C. L., Ungerleider, L. G., & Haxby, J. V. (1996). Neural correlates of category-specific knowledge. *Nature, 37*(66), 649-652.

Maugin, E., & Loeber, R. (1996). Academic performance and delinguency. In M. Tonry, (Ed). *Crime and Justice: A review of research, 20,* 145-264.

Mayer, R. E. (1988). Learning strategies: An overview. In C. E. Weinstein, E. T. Goetz & P. A. Alexander (Eds.), *Learning and study strategies* (pp. 11-22). San Diego: Harcourt Brace Jovanovich.

Mayer, R. E. (2004). Should there be a three-strikes rule against pure discovery learning? The case for guided methods of instruction. American Psychologist,59(1) 14–19.

McBride-Chang, C. (1995). What is phonological awareness? *Journal of Education Psychology, 87*(2), 179-192.

McCandliss, B. D., Cohen, L., & Dehaene, S. (2003). Visual word form area: expertise for reading in the fusiform gyrus. *Trends in Cognitive Science, 7*, 293-299.

McCombs, B. L., & Whisler, J. S. (1997). *The learner-centered classroom and school: Strategies for increasing student motivation and achievement.* San Francisco: Jossey-Bass.

McConnell, S. R., & Rabe, H. L. S. (1999). *Home and community factors that promote early literacy development for preschool-aged children.* Retrieved from http: //www.extention.umn.edu/distribution/familydevelopment/components/7286-05.html

McCutchen, D., Abbott, R. D., & Green, L. B. (2002). Beginning literacy: Links among teacher knowledge, teacher practice, and student learning. *Journal of Learning Disabilities, 35*, 69-86.

McCutchen, D., & Berninger, V. (1999). Those who know teach well: Helping teachers master literacy-related content knowledge. *Learning Disabilities Research and Practice, 14*, 215-226.

McGee, L., & Richgels, D. (1990). *Literacy's beginnings*. Needham Heights: MA: Allyn & Bacon.

McGee, L., & Schickedanz, J. (2007). Repeated interactive read-alouds in preschool and kindergarten. *The Reading Teacher, 60*(8), 742-751.

McKeown, M. G., & Beck, I. L. (2004). Transforming knowledge into professional development resources: Six teachers implement a model of teaching for understanding text. *Elementary School Journal, 104*(5), 453-467.

McLeod, S. A. (2009). *Simply Psychology: Piaget's cognitive stages of development.* Retrieved from http://www.simplypsychology.org/piaget.html

Mechado, M. J. (2009). Early Childhood Experiences in Language Art. *Early Literacy*, 22(7), 557-559.

Miles, W. R. (1930). Ocular dominance in human adults. *Journal of General Psychology, 3*, 412-420.

Miller, C. A. (2011). Auditory processing theories of language disorders: Past, present, and future. *Language Speech and Hearing Services in Schools, 42*(3), 309-319.

Miller, L. (2008). Raising Cognitive Capacity. *Professionally Speaking*, *12*(4), 199-208.

Miller, P., & Limber, J. (1985, October). *The acquisition of consonant clusters: A paradigm problem*. Paper presented at the Boston University Conference on Language Development,Boston, MA.

Milner, B., Taylor, L., & Sperry, R. W. (1968). Lateralized suppression of dichotically presented digits after commissural section in man. *Science, 161*, 184-186.

Milsom, L. (2007). *Mixed Handedness.* Retrieved from http://www.lefthandersday.com/

Milsom, L. (2010). Your Left-handed Child: making things easy for left-handers in a right-handed world. Retrieved from http://www.kidsonthecoast.com.au

Moats, L. C. (1994). The missing foundation in teacher education: Knowledge of the structure of spoken and written language. *Annals of Dyslexia, 44*, 81-102.

Moats, L. C. (2000). *Speech to print: Language essentials for teachers.* Baltimore, MD: Paul Brookes.

Moats, L. C., & Foorman, B. R. (2003). Measuring teachers' content knowledge of language and reading. *Annals of Dyslexia, 53*, 23-45.

Moffat, S. D., Hampson, E., & Lee, D. H. (1998). Morphology of the planum temporale and corpus callosum in left-handers with evidence of left and right hemisphere speech representation. *Brain, 121*, 2369-2379.

Moore, D. R. (2002). Auditory development and the role of experience. *British Medical Bulletin, 63*, 171-181.

Moore, D. R. (2007). Auditory processing disorders: acquisition and treatment. *Journal of Commen Disorders, 40*(4), 295-304.

Morais, J., Cary, L., Alegria, J. & Bertelson, P. (1979). Does awareness of speech as a sequence of phones arise spontaneously? *Cognition, 7*, 323-331.

Morris, D. & Perney, J. (1984). Developmental spelling as a predictor of first-grade reading achievement. *Elementary School Journal, 84*(4), 441-458.

Munro, J. (1998). *Phonological assessment and teaching*. Melbourne: ACER.

Mussen, P. (1983). Handbook of Child Psychology. (4th ed.). New York: Wiley.

Muter, V., Hulme, C., & Snowling, M. (1997). *Phonological abilities test*. London: The Psychological Corporation.

Muter, V., Hulme, C., Snowling, M., & Taylor, S. (1998). Segmentation, not rhyming, predicts early progress in learning to read. *Journal of Experimental Child Psychology, 71*, 3-27.

Naicker, S. M. (1999). *Inclusive education in South Africa*. Pretoria: Van Schaik Publishers.

Naidoo, K. (2002). Case finding in the clinic: Refractive errors. *Eye Health, 15*(43), 39-40.

National Assessment of Adult Literacy. (2003). *A nationally and continuing assessment of English language literacy skills of American adults.* Retrieved from http://nces.ed.gov/naal/

National Center for Learning Disabilities. (2003). Visual processing disorders. Retrieved from http://www.ncld.org

National Institute of Child Health and Human Development. (2000). Early Child Care Research Network. The Relation of Child Care to Cognitive and Language Development. *Child Development, 71*, 958-978.

National Institutes of Health. (2010). *Learning Disorders.*Retrieved from http://www.nih.gov/

National Reading Panel. (2000). *Report of the subgroups: National reading panel*. Washington, DC: National Institute of Child Health and Development.

National Reading Panel. (2000b). *Teaching children to read: An evidence-based assessment of the scientific research literature on reading and its implications for reading instruction.* Retrieved from http://www.nichd.nih.gov/publications/nrp.report.htm

Neethling, K. (2000). *Whole Brain Practitioner Training Manual*. Randburg, South Africa: Solutionsfinding.

Neggers, S. F., & Bekkering, H. (2001). Gaze anchoring to a pointing target is present during the entire pointing movement and is driven by a non-visual signal. *Journal of Neurophysiology, 86*, 961-970.

Nel, C., & Malda, M. (2011). *Reading literacy assessment within Foundation Phase teacher preparation programmes*. Paper presented at the International Conference on Research, Development and Training in Early Childhood/Foundation Phase Education. North West University, Potchefstroom.

Nelson, H. E. (1980). Analysis of spelling errors in normal and dyslexic children. In U. Frith (Ed.), *Cognitive processes in spelling* (pp. 475-493). London: Academic Press.

Neuman, W. L. (2000). *Social research methods qualitative and quantitative approaches.*(4th ed.). Boston: Allyn and Bacon.

Niaz, M., & Logie, R. H. (1993). Working memory, mental capacity and science education: Towards an understanding of the "working memory overload hypothesis". *Oxford Review of Education, 19*(4), 511-521.

Nicholson, T. (1997). Phonological awareness and learning to read. In L. van Lier & D. Corson (Eds.), *Encyclopedia of language and education* (Vol. 6, pp. 53-61). Dordrecht: Kluwer Academic.

Nicholson, T. (2000). *Reading the writing on the wall*. Palmerston North, NZ: Dunmore Press.

Niles, J. A., Grunder, A., & Wimmer, C. (1977). The effects of grade level and school setting on the development of sensitivity to orthographic structure. In P. D.

Pearson & J. Hansen (Eds.), *Reading: Theory, research, and practice* (pp. 183-186). Clemson, SC: National Reading Conference.

Novak, J. D., & Gowin, D. B. (1984). *Learning how to learn*. New York: Cambridge University Press.

Nuttall, C. (1982). *Teaching Reading Skills in a Foreign Language*. London: Heinemann Educational Books.

O'Connor, R. E., Jenkins, J. R., Leicester, N., & Slocum, T. A. (1993). Teaching phonological awareness to young children with learning disabilities. *Exceptional Children, 59*, 532-546.

O'Connor, R. E. (1999). Teachers' learning ladders to literacy. *Learning Disabilities Research and Practice.14*, 203-214.

Odenthal, D. (1963). Perception and neural representation of simultaneous pure tone stimuli. *Acta Physiologica et Pharmacologica Neerlandica, 12*, 453-496.

Oldfield, R. C. (1971). The assessment and analysis of handedness: The Edinburgh inventory. *Neuropsychologia, 9*, 97-114.

Oliveri, M., Finocchiaro, C., Shapiro, K., Gangitano, M., Caramazza, A., & Pascual-Leone, A. (2004). All talk and no action: a transcranial magnetic stimulation study of motor cortex activation during action word production. *Journal of Cognitive Education Neuroscience, 16*(3), 374-381.

Ono, H., & Barbeito, R. T. (1982). The cyclopean eye vs. the sighting-dominant eye as the center of visual direction. *Perceptual Psychophysics, 32*, 201-210.

Ornstein, R. (1977). *The Psychology of consciousness*. New York: Harcourt Brace Jovanovich.

Ornstein, R. E.& Galin, D. (1973). *Physiological Studies of Consciousness.* London: The Institute for Cultural Research.

Ornstein, R.E. & Thompson, R. (1984). *The Amazing Brain.* Boston: Houghton, Mifflin Company.

Orthography. (2009). In *American Heritage Dictionary.*Retrieved from http://www.thefreedictionary.com/orthography

Orthography. (n.d.). In *Collins English Dictionary.* Retrieved from http://www.collinsdictionary.com/dictionary/english/orthography

Orthography.(2012). In *Dictionary.com.* (10th ed.). Retrieved from http://www.dictionary.reference.com/ortography

Orthography. (2012). In *Online Etymology Dictionary.*Retrieved from http://dictionary.reference.com/browse/orthography

Ortiz, R. W. (2004). Hispanic/Latino fathers and children's literacy development: Examining involvement practices from a sociocultural context. *Journal of Latino and Education, 3*, 165-180.

Ortiz, R. W., & Ordonez-Jasis, R. (2005). Leyendo juntos (reading together): New directions for Latino parents' early literacy involvement. *Reading teacher, 59*, 110-121.

Oudeans, M. K. (2003). Integration of letter sound correspondence and phonological awareness skills of blending and segmenting: A pilot study examining the effects of instructional sequence on word reading for kindergarten children with low phonological awareness. *Learning Disability Quarterly, 26*, 258-280.

Owen, M. J., Gardillo, G. (1984). The relative roles of vowels and consonants in discriminating talker identity versus meaning. *Journal of the Acoustic Society of America, 119*, 1727-1739.

Papathanassiou, D., Etard, O., Mellet, E., Zago, B., Mazoyer, B., & Tzourio-Mazoyer, N. (2000). A common language network for comprehension and production: A contribution to the definition of language epicenters with PET. *Neuroimage*, *14*(6), 347-357.

Paquette, C., Bourassa, M., & Peretez, I. (1996). Left ear advantage in pitch perception of complex tones without energy at the fundamental frequency. *Neuropsychologia, 34*(2), 153-157.

Parent Journal. (1995). *Central Auditory Processing Disorder*. San Mateo, CA: Parents' Educational Resource Center.

Parker-Pope, T. (2008). For lazy eye, drops instead of a patch. Retrieved from http://www.nytimes.com/

Paterson, F. (2002). The politics of phonics. In R. L. Allingon (Ed.), *Big brother and the national reading curriculum* (pp. 109-136). Portsmouth: NJ: Heinemann.

Paulesu, E., Démonet, J.-F., Fazio, F., McCrory, E., Chanoine, V., & Brunswick, N. (2001). Dyslexia: cultural diversity and biological unity. *Science*, 13(8), 2165-2167.

Payne, M. (1987). Impact of cultural pressures on self-reports of actual and approved hand use. *Neuropsychologia, 25(1B)*, 247-304.

Pea, R. D., & Kurland, D. M. (1984). On the cognitive effects of learning computer programming. *New Ideas in Psychology, 2*(2), 137-168.

Peat, J. (2000). *Health service research: A handbook of quantitative methods.* London, Sage.

Perez, B. (2004). *Sociocultural context of language and literacy*. New Jersey, Lawrence Erlbaum Associates.

Perfetti, C. A. (1985). *Reading ability*. New York: Oxford Press.

Perfetti, C. A., Beck, I., Bell, L. C., & Hughes, C. (1987). Phonemic knowledge and learning to read are reciprocal: A longitudinal study of first grade children. *Merrill-Palmer Quarterly, 33*, 283-319.

Perie, M., Moran, R., & Lutkus, A. D. (2005). *NAEP 2004 trends in academic progress: Three decades of student performance in reading and mathematics*. Retrieved from nces.ed.gov/ssbr/pages/trends.asp

Perkins, D. N., & Salomon, G. (1988). Teaching for transfer. *Educational Leadership, 46*(1), 22-32.

Perkins, D. N., & Salomon, G. (1992) The science and art of transfer. In A. L. Costa, J. Bellanca, & R. Forgarty (Eds.). *If minds matter: A foreword to the future.(*Vol 1, pp. 201-210). Palatine, IL: Skylight Publishing.

Petzold, A. (2002). *Lateralized head turning bias in humans: Cues to the development of human cerebral asymmetries*(Bachelor's Thesis). University of Osnabrück: Osnabrück.

Piaget, J. (1926). *The language and thought of the child*. London: Routledge & Kegan Paul.

Piaget, J. (1936). *Origins of intelligence in the child*. London: Routledge & Kegan Paul.

Piaget, J. (1945). *Play, dreams and imitation in childhood*. London: Heinemann.

Piaget, J. (1955). *The language and thought of a child*. Cleveland: OH: World.

Piaget, J. (1957). *Construction of reality in the child*. London: Routledge & Kegan Paul.

Piaget, J., & Inhelder, B. (1969). *The psychology of the child*: Basic Books.

Pinker, S. (1999). *Words and Rules: The Ingredients of Language.* New York: Basic Books.

Pintrich, P. R., & Schunk, D. H. (2002). *Motivation in education: theory, research, and applications* (2nd ed.). Upper Saddle River, NJ: Merrill Pentrice Hall.

Pipe, M. E. (1988). Atypical laterality and retardation. *Psychological Bulletin, 104*(3), 343-347.

PIRLS. (2006). PIRLS of wisdom: the what, where, when and how of the international reading literacy study in South Africa. Pretoria: Author.

Porac, C., & Coren, S. (1975). Is eye dominance a part of generalized laterality? *Perception Motor Skills 40*(3), 763-769.

Porac, C., & Coren, S. (1976). The dominant eye. *Psychological Bulletin, 83*, 880-897.

Potts, C. (2005). The logic of conventional implicatures: Oxford studies in theoretical linguistics. Oxford: Oxford University Press.

Powell, H. W., Parker, G. J. M., Alexander, D. C., Symms, M. R., Boulby, P. A., & Wheeler-Kingshott, C. A. M. (2006). Hemispheric asymmetries in language-related pathways: A combined functional MRI and tractography study. *Neuroimage, 32*, 388-399.

Previc, F. H. (1991a). A general theory concerning the prenatal origins of cerebral lateralization in humans. *Psychological Review, 98*(3), 299-334.

Previc, F. H. (1991b). A general theory concerning the prenatal origins of cerebral lateralization in humans. *Psychological Review, 98*, 299-334.

Previc, F. H., & Saucedo, J. C. (1992). The relationship between turning behavior and motoric dominance in humans. *Perceptual and Motor Skills, 75*, 935-944.

Pulvermüller, F. (2005). Brain mechanisms linking language and action. *Nature Reviews Neuroscience, 6*, 576-582.

Pumfrey, P. (2001). *Improving children's reading in the junior school: Challenges and responses.*New York: Cassell.

Pumfrey, P. & Reason, R. (1991). *Specific learning difficulties (dyslexia): challenges and responses.*Windsor: NFER-Nelson.

Rack, J., Hulme, C., Snowling, M., & Wightman, J. (1994). The role of phonology in young children learning to read words: The direct-mapping hypothesis. *Journal of Experimental Child Psychology Child Psychology, 57*, 42-71.

Rae, C., Lee, M. A., Dixon, R. M., Blamire, A. M., Thompson, C. H., & Styles, P. (1998). Metabolic abnormalities in developmental dyslexia detected by 1H magnetic resonance spectroscopy. *Lancet, 351*(119), 1849-1852.

Ramoroka, J. (2006). *Educators understanding the premises underpinning Outcomes-Based Education and its impact on their classroom assessment*(Unpublished doctoral thesis). University of Pretoria, Pretoria.

Ramsden, P., Beswick, D., & Bowden, J. (1989). Effects of Learning Skills Intervention on First Year Students' Learning. *Human Learning, 5*, 151-164.

Ramus, F. (2003). Developmental dyslexia: specific phonoligical deficit or general sensori-motor dysfunction? *Current opinion in Neurobiology, 13*(2), 212-218

RAND Reading Study Group. (2002). *Reading for Understanding.* Prepared for the Office of Educational Research and Improvement (OERI). Retrieved from http://www.rand.org/.

Ransil, B. J., & Schachter, S. C. (1994). Test-retest reliability of the Edinburgh handedness inventory and global handedness preference measurements, and their correlation. *Perceptual Motor Skills, 79*, 1355-1372.

Rasmussen, T., & Milner, B. (1977). The role of early left-brain injury in determining lateralization of cerebral speech functions. *Annual N Y Academic Sciences 299*(7), 355-369.

Read, C. (1975). *Children's categorization of speech sounds in English.* Urbana, IL: National Council of Teachers of English.

Read, C. (1986). *Children's creative spelling*. London: Routledge and Kegan Paul.

Reese, L., & Gallimore, R. (2000). Immigrant Latinos cultural model of literacy development: An evolving perspectives on home-school discontinuities. *American Journal of Education, 108*, 103-134.

Reid, H. M., & Norvilitis, J. M. (2000). Evidence for anomalous lateralization across domain in ADHD children as well as adults identified with the Wender Utah rating scale. *Journal of Psychiatric Research, 34*(4-5), 311-316.

Reiss, M. R., & Reiss, G. (1997). Ocular dominance: some family data. *Laterality, 2*(1), 7-16.

Rittle-Johnson, B., & Siegler, R. S. (1999). Learning to spell: Variability, choice, and change in children's strategy use. *Child Development, 70*, 332-348.

Rohl, M., & Pratt, C. (1995). Phonological awareness, verbal working memory and the acquisition literacy. *Reading and Writing in the Content Areas, 7*, 327-360.

Rombouts, S. A. R. B., Barkhof, F., Sprenger, M., Valk, J., & Scheltens, P. (1996a). The functional basis of ocular dominance: Functional MRI (fMRI) findings. *Neuroscience Letters, 221*, 1-4.

Rosen, S, & Manganari, E. (2001). Is there a relationship between speech and non-speech auditory processing in children with dyslexia? *Journal of Speech, Language and Hearing Research, 44*(4), 720-736.

Rosinski, R. R., & Wheeler, K. E. (1972). Children's use of orthographic structure in word discrimination. *Psychonomic Science, 26*, 97-98.

Rosner, J., & Simon, D. P. (1971). The auditory analysis test: An initial report. *Journal of Learning Disabilities, 4*, 40-48.

Roth, H. L., Lora, A. N., & Heilman, K. M. (2002). Effects of monocular viewing and eye dominance on spatial attention. *Brain, 125*(9), 2023–2035.

Rvachew, S. (2006). Longitudinal Predictors of Implicit Phonological Awareness Skills**.** *American Journal of Speech Language Pathology, 15*(2), 165-176.

Safra, D. (1989). The "Ring Test" for evaluating eye dominance (in German). *Klinische Monatsblatter fur Augenheilkunde, 195*(1), 35-36.

Sailer, U., Eggert, T., Ditterich, J., & Straube, A. (2000). Spatial and temporal aspects of eye-hand coordination across different tasks. *Experimental Brain Research, 134*, 163-173.

Sala, S. D. (1999). Mind myths: Exploring popular assumptions about the mind and brain. New York: J. Wiley & Sons.

Salomon, G., & Perkins, D. N. (1989). Rocky roads to transfer: Rethinking mechanisms of a neglected phenomenon. *Educational Psychologist, 24*(2), 113-142.

Samuels, S. J. (2006). Reading fluency: Its past, present & future. In T. Rasinsky, C. Blachowicz, & Lems, K. (Eds.) *Fluency instruction: Research-based best practices.* New York: The Guilford Press.

Santrock, J. W. (2004). *Life-span development* (9th ed.). Boston, MA: McGraw-Hill College.

Santrock, J. W. (2008). *Motor, sensory, and perceptual development*. Boston, MA: McGraw-Hill Higher Education.

Santrock, J. W. (2008). *A topical approach to life span development*. New York, NY: McGraw-Hill.

Schatschneider, C., Francis, D. J., Foorman, B. R., Fletcher, J. M., & Mehta, P. (1999). The dimensionality of phonological awareness: An application of item response theory. *Journal of Educational Psychology, 91*, 439-449.

Schepers, J. M. (1992). *Toetskonstruksie: teorie en praktyk.* Johannesburg: RAU drukkers.

Schiller, F. (1979). *Paul Broca: Founder of French anthropology, explorer of the brain.* Berkeley, CA: University of California Press.

Schlaggar, B. L., Brown, T. T., Lugar, H. M., Visscher, K. M., Miezin, F. M., & Petersen, S. E. (2002). Functional neuroanatomical differences between adults and school-age children in the processing of single words. *Science, 296*(5572), 1476-1479.

Schneider, W., Kuspert, P., Roth, E., Vise, M., & Marx, H. (1997). Short- and long-term effects of training phonological awareness in kindergarten: Evidence from two German studies. *Journal of Experimental Child Psychology, 66*, 311-340.

Schuele, M., & Boudreau, D. (2008). Phonological awareness intervention: beyond the basics. *American Speech-Language-Hearing Association, 39*, 3-20.

Schwanenflugel, P. J., Hamilton, A. M., Kuhn, M. R., Wisenbaker, J. M., & Stahl, S. (2004). Becoming a fluent reader: Reading skill and prosodic features in the oral reading of young readers. *Journal of Educational Psychology, 96*, 119 -129.

Scott, C. M. (2000). Principles and methods of spelling instruction: Applications for poor spellers. *Topics in Language Disorders, 20*(3), 66-82.

Scribner, S., & Cole, M. (1981). *The psychology of literacy*. Cambridge, MA: Harvard University Press.

See. (n.d.). *In Dictionary of the English Language.* Retrieved from http://www.thefreedictionary.com/see

See. (n.d.). In Online Etymology Dictionary. Retrieved from http://dictionary.reference.com/browse/see

Senechal, M., Lefevre, J. A., Thomas, E. M., & Daly, K. E. (1998). Differential effects of home literacy experiences on the development of oral and written language. *Reading Research Quarterly, 33*, 96-116.

Shankweiler, D., Crain, S., Katz, L., Fowler, A., Liberman, A., Brady, S., Thornton, R., Lindquist, E., Dreyer, L., Fletcher, J., Stuebing, K. (1995). Cognitive profiles of reading-disabled children: Comparisons of language skills in phonology, morphology and syntax. *Psychological Science, 6*, 149-156.

Shankweiler, D. P., & Liberman, I. Y. (1972). Misreading: A search for causes. In J. F. Kavanagh, J.F. & Mattingly, I.G. (Eds.), *Language by ear and by eye: The relationships between speech and reading*. Cambridge: MA: MIT Press.

Shapleske, J., Rossell, S. L., Woodruff, P. W. R., & David, A. S. (1999). The planum temporale: A systematic, quantitative review of its structural, functional and clinical significance. *Brain Research Review, 29*, 26-49.

Share, D. L. (1995). Phonological recoding and self-teaching: sine qua non of reading acquisition. *Cognition, 55*(2), 151-218.

Share, D. L., & Stanovich, K. E. (1995). Cognitive processes in early reading development: A model of acquisition and individual differences. *Educational Psychology, 1*, 157-174.

Shaw, D., & McManus, I. C. (1993). The handedness of Kerrs and Carrs. *British Journal of Psychology, 84*(4), 545-551.

Shaywitz, B. A., Shaywitz, S. E., Pugh, K. R., Mencl, W. E., Fulbright, R. K., & Skudlarski, P. (2002). Disruption of posterior brain systems for reading in children with developmental dyslexia. *Biology Psychiatry, 52*(2), 101-110.

Shaywitz, S. E. (2003). On the mind of a child: A Conversation with Sally Shaywitz. *Educational Leadership, 60*(7), 6-10.

Shaywitz, S. E., Morris, R., & Shaywitz, B. A. (2008). The education of dyslexic children from childhood to young adulthood. *Annual Review of Psychology, 59*, 451-475.

Shaywitz, S. E., & Shaywitz, B. A. (2005). Dyslexia (specific reading disability). *Biology Psychiatry, 57*, 1301-1309.

Shaywitz, S. E. (1998). Current concepts: dyslexia. *New England Journal of Medicine, 338*, 307-312.

Shore, R. (1997). *Rethinking the brain: New insights into early development*. New York: Families and Work Institute.

Silva, C., & Alves-Martins, M. (2002). Phonological skills and writing of presyllabic children. *Reading Research Quarterly, 37*, 466-483.

Silva, C., & Alves-Martins, M. (2003). Relations between children's invented spelling and the development of phonological awareness. *Educational Psychology Review, 23*, 3-16.

Simos, P. G., Fletcher, J. M., Bergman, E., Breier, J. I., Foorman, B. R., & Castillo, E. M. (2002). Dyslexiaspecific brain activation profile becomes normal following successful remedial training. *Neurology, 58*(8), 1203-1213.

Simos, P. G., Fletcher, J. M., Foorman, B. R., Francis, D. J., Castillo, E. M., & Davis, R. N. (2002). Brain activation profiles during the early stages of reading acquisition. *Journal of Child Neurology, 17*(3), 159-163.

Singh, R. J. (2009). *Creating a Foundation phase classroom that promotes reading amongst children* (Unpublished doctoral thesis). University of Limpopo, Limpopo.

Skotten, B. C. (2000). The mangnocellular deficit theory of dyslexia: the evidence from contrast sensitivity. *Vision Research, 40*(1), 111-127.

Skunk, D. H. (1996). *Learning Theories.* Englewood Cliffs, Prentice-Hall, Inc.

Smith, C. (1997). *Visual Processing and learning Disabilities*(Doctoral thesis). Retrieved from *www.greatervalleyvision.com/custom/*

Smith, M. K. (2002). Bruner and the process of education. *Encyclopedia of informal education.* Retrieved from http://www.infed.org/thinkers/bruner.htm.

Snow, C. E., Burns, M. S., & Griffin, P. (1998). *Preventing reading difficulties in young children*. Washington: DC: National Academy Press.

Snowling, M. J. (1994). Towards a model of spelling acquisition: The development of some component skills. In G. D. A. Brown & N. C. Ellis (Eds.), *Handbook of spelling: Theory, process and intervention.* Chicester, England: Wiley.

Snowling, M. T. (2000). *Dyslexia*. Maiden: Blackwell Publishers.

Song, J. H., & McPeek, R. M. (2009). Eye–hand coordination during target selection in a pop-out visual search. *Journal of Neurophysiology, 102*, 2681-2692.

South Africa. Department of Education. (1997). Education white paper 3: A programme for transformation of higher education. Government Gazette, No 18207. Pretoria, Government Printer.

South Africa. Department of Education. (2001). Manifesto of Values, Education and Democracy. Pretoria, Government Printer.

South Africa. Department of Education (2002). *Revised National Curriculum Statement: Grade R-9 (Schools). Languages. Afrikaans - First additional language.* Retrieved fromhttp://*www.education.gov.za*

South Africa. Department of Education (2003). *Revised National Curriculum Statement Grades R-9 (Schools).*Retrieved fromhttp://*www.education.gov.za*

South Africa. Department of Education. (2006). *Annual Report 2005-2006.* Retrieved from*www.info.gov.za/view/DownloadFileAction?id=67636*

South Africa. Department of Education. (2008). *Foundations for learning:Assessment framework foundation phase.* Retrieved from http://www.thutong.doe.gov.za

South Africa. Department of Education (2009). *Annual Report*. Retrieved from http://www.education.gov.za

South Africa. Department of Education (2011). *Annual Report*. Retrieved from http://www.education.gov.za

Spache, G. D., & Spache, B. E. (1969). *Reading in the elementary school*. Boston: Allyn & Bacon.

Sparks, R., & Geschwind, N. (1968). Dichotic listening in man after section of neocortical commissures. *Cortex, 4*, 3-16.

Spelling. (2012). *In Collins English Dictionary.* (10th ed.). Retrieved from http://dictionary.reference.com/browse/spelling

Sperry, R. W. (1961). Cerebral Organization and Behavior: The split brain behaves in many respects like two separate brains, providing new research possibilities. *Science, 133*(3466), 1749-1757.

Sprenger-Charolles, L., & Casalis, S. (1995). Reading and spelling acquisition in French first graders: Longitudinal evidence. *Reading and Writing, 7*, 39-63.

Sprenger-Charolles, L., & Siegel, L. (1997). A longitudinal study of the effects of syllabic structure on the development of reading and spelling skills in French. *Applied Psycholinguistics, 18*, 485-505.

Springer, S., & Deutsch, G. (1997). *Left Brain, Right Brain*. San Francisco: Freeman.

Sprugevica, I., & Hoien, T. (2003). Early phonological skills as a predictor of reading acquisition: A follow-up study from kindergarten to the middle of grade 2. *Scandinavian Journal of Psychology, 44*, 119-124.

Stackhouse, J., Wells, B., Pasce, M., & Rees, R. (2002). From phonological therapy to phonological awareness. *Seminars in Speech and Language, 23*(1), 27-42.

Stahl, S. A., & Nagy, W. (2006). *Teaching word meanings*. Portsmouth, NH: Lawrence Erlbaum Associates.

Stahl, S. A., & Murray, B. A. (1994). Defining phonological awareness and its relationship to early reading. *Journal of Educational Psychology, 86*, 221-234.

Stainthorp, R., & Hughes, D. (1999). *Learning from children who read at an early age.*London: Routledge.

Stanovich, K. E., West, R., & Cunningham, A. (1991). Beyond phonological processes: Print exposure and orthographic processing. In S. Brady, & D. Shankweiler (Eds.). Phonological processes in literacy (pp. 219-235). Hillsdale, NJ: Lawrence Erlbaum.

Stanovich, K. E. (2000). *Progress in understanding reading: Scientific foundations and new frontiers.*New York: Guilford Press.

Stanovich, K. E., Cunningham, A. E., & Cramer, B. B. (1984). Assessing phonological awareness in kindergarten children: Issues of task comparability. *Journal of Experimental Child Psychology, 38*, 175-190.

Stanovich, K. E., & Siegel, L. S. (1994). Phenotypic performance profile of children with reading disabilities: A regression-based test of the phonological-core variable-difference model. *Journal of Educational Psychology, 86*(1), 24-53.

Stanton, M. (1990). Students' alternative conceptions of the DC circuit - 1. *Spectrum, 28*(2), 28-33.

Stauffer, R. G. (1970). *The language-experience approach to the teaching of reading.* New York: Harper & Row.

Stein, J. (2001). The magnocellular theory of developmental dyslexia. *Dyslexia, University Laboratory of Physiology,7*(1), 12-36.

Stein, J. F., Talcott, J., & Walsh, V. (2000b). Controversy about the visual magnocellular deficit in developmental dyslexics. *Trends in Cognitive Sciences, 4*(6), 209-211.

Stevenson, R. J., & Palmer, J. A. (1994). *Learning principles, process and practices*. London: Cassel.

Sticht, T. G., & James, J. H. (1984). Listening and reading. In Pearson, P.D.; Barr, R.; Kamil, M. & Mosenthal, P.(Eds.), *Handbook of reading research.* New York: Longman.

Stout, D. E., & Ruble, T. L. (1994). A reassessment of the Role of the Learning Style Inventory in Accounting Education Research. *Journal of Accounting Education, 12*(2), 89-104.

Stout, J. P. (2005). *Writing in the Real World.* Retrieved from www.highbeam.com/doc/1G1-153900505.html

Sylwester, R. & Choo, J. Y. (1992). What Brain Research Says about Paying Attention. *Educational Leadership*, *50*, 71-75.

Swank, L. K. (1994). Phonological coding abilities: Identification of impairments related to phonologically based reading problems. *Topics in Language Disorders, 14*(2), 56-71.

Swank, L. K., & Catts, H. W. (1994). Phonological awareness and written word decoding. *Language, Speech and Hearing Services in Schools, 25*, 9-14.

Szaflarski, J. P., Binder, J. R., Possing, E. T., McKiernan, K. A., Ward, B. D., & Hammeke, T. A. (2002). Language lateralization in left-handed and ambidextrous people: fMRI data. *Neurology, 59*, 238-244.

Tager-Flusberg, H. (2001). Putting words together: Morphology and syntax in the preschool years. In J. Berko-Gleason (ed.). *The development of language* (pp. 148–190). New York: Allyn & Bacon.

Tallal, P. (1980). Auditory temporal perception, phonics, and reading disabilities in children. *Brain and Language, (2)*, 182-190.

Temple, E. (2002). Brain mechanisms in normal and dyslexic readers. *Current Opinion In Neurobiology, 12*(2), 178-183.

Tan, U. (1988). The distribution of hand preference in normal men and women. *International Journal of Neuroscience, 41*, 35-55.

Temple, E., Poldrack, R. A., Salidis, J., Deutsch, G. K., Tallal, P., & Merzenich, M. M. (2001). Disruptedneural responses to phonological and orthographic processing in dyslexic children: an fMRI study. *Neuroreport, 12*(2), 299-307.

Templeton, S. (1992). Theory, nature, and pedagogy of high-order orthographic development in older students. In S. Templeton & D. R. Bear (Eds.) *Development of orthographic knowledge and the foundations of literacy* (pp. 253-277). Hillsdale, NJ: Erlbaum.

Tettamanti, M., Buccino, G., Saccuman, M. C., Gallese, V., Danna, M., Scifo, P., Fazio, F., Rizzolatti, G., Cappa, S. F., & Perani, D. (2005). Listening to action-related sentences activates fronto-parietal motor circuits. *Journal of Cognitive Neuroscience, 17*, 273-281.

The American Heritage Dictionary.(Vols. 4th Ed). Houghton Mifflin Company.

The Learning Center Foundation. (2012). *Visual Perceptual Disabilities*. Retrieved from http://thelearningcenter.net/visual_perceptual_disabilities

The Learning Disabilities Council. (1991). *Understanding learning disabilities: A parent guide and workbook*. Richmond, VA: Author.

Thorne, B. M., & Henley, T. B. (1997). *Connections in the history and systems of psychology*. New York: Houghton Mifflin Company.

Toga, A. W., Thompson, P. M. (2003). Mapping brain asymmetry. Nature Reviews Neuroscience,4(1) 37–48.

Tolchinsky-Landsmann, L., & Levin, I. (1985). Writing in preschoolers: An age related analysis. *Applied Psycholinguistics, 6*, 319-339.

Tomatis, A. A. (1996). *The Ear and Language*. Ontario: Moulin.

Torgesen, J. K., Rashotte, C. A., & Alexander, A. W. (2001). Principles of fluency instruction in reading: Relationships with established empirical outcomes. In M. A. Wolf (Ed.). *Dyslexia, fluency and the brain.* Parkton, MD: York Press.

Torgesen, J. K., Wagner, R. K., & Rashotte, C. A. (1997). The prevention and remediation of severe reading disabilities: Keeping the end in mind. *Scientific Studies of Reading, 1*, 217-234.

Treiman, R. (1985). Phonemic awareness and spelling: Children's judgments do not always agree with adults. *Journal of Experimental Child Psychology, 39*, 182-201.

Treiman, R. (1992). The role of intrasyllabic units in learning to read and spell. In P. B. Gough, L. Ehri, & R. Treiman (Eds.), *Reading acquisition* (pp.65-106). Hillsdale: NJ: Erlbaum.

Treiman, R. (1993). *Beginning to spell: A study of first-grade children*. New York: Oxford University Press.

Treiman, R. (1994). Use of consonant letter names in beginning spelling. *Developmental Psychology, 30*, 567-580.

Treiman, R. (2000). The foundations of literacy. *Current Directions in Psychological Science, 9*, 89-92.

Treiman, R., Berch, D., Tincoff, R., & Weatherston, S. (1993b). Phonology and spelling: The case of syllabic consonants. *Journal of Experimental Child Psychology, 56* 267-290.

Treiman, R., & Bourassa, D. C. (2000). The Development of Spelling Skill. *Topics in Language Disorders, 20*, 1-18.

Treiman, R., & Cassar, M. (1997). Spelling acquisition in English. In C.A. Perfetti, L. Rieben., & M. Fayol (Eds.), *Learning to spell: Research theory, and practice across languages.* Mahwah: NJ: Erlbaum.

Treiman, R., Cassar, M., & Zukowski, A. (1994). What types of linguistic information do children use in spelling? The case of flaps. *Child Development, 65*, 1310-1329.

Treiman, R., Goswami, U., Tincoff, R., & Leevers, H. (1997). Effects of dialect on American and British children's spelling. *Child Development, 68*, 229-245.

Treiman, R., & Rodriguez, K. (1999). Young children use letter names in learning to read words. *Psychological Science, 10*, 334-338.

Treiman, R., Sotak, L., & Bowman, M. (2001). The role of letter names and letter sounds in connecting print and speech. *Memory and Cognition, 29*, 860-873.

Treiman, R., & Zukowski, A. (1996). Children's sensitivity to syllables, onsets, rimes, and phonemes. *Journal of Experimental Child Psychology, 61*, 193-215.

Treiman, R., Zukowski, A., & Richmond-Welty, E. D. (1995). What happened to the "n" of sink? Children's spellings of final consonant clusters. *Cognition, 55*, 1-38.

Tunmer, W. E., & Chapman, J. W. (2007). Conflicting theories on the developmental progression of phonological awareness in children: A further test of the psychological processing account. In C. M. Fletcher-Flinn & G. M. Haberman (Eds.), Cognition and language: Perspectives from New Zealand. Bowen Hills, QLD: Australian Academic Press.

Tunmer, W. E., & Rohl, M. (1991). Phonological awareness in reading: In Sawyer, D. J., & Fox, B. J. The evolution of current perspectives in phonological awareness and reading acquisitionives. New York: Springer-Verlag.

Turkeltaub, P. E., Gareau, L., Flowers, D. L., Zeffiro, T. A., & Eden, G. F. (2003). Development of neural mechanisms for reading. *Neuroscience, 6*(7), 767-773.

Turner, J. C., & Meyer, D. K. (2000). Studying and understanding the instructional contexts of classrooms: Using our past to forge our future. *Educational Psychologist, 35*(2), 69-85.

Tzuriel, D., & Weiss, S. (1998). Cognitive modifiability as a function of mother-child mediated learning strategies, mother's acceptance-rejection and children's personality. *Early Development and Parenting, 7*, 79-99.

Uhry, J. K. (1999). Invented spelling in kindergarten: The relationship with finger-point reading. *Reading and Writing: An Interdisciplinary Journal, 11*, 441-464.

UNESCO. (United Nations Educational, Scientific and Cultural Organisation). (2000). Final report of the world educational forum. Dakar, Senegal.

UNESCO. (United Nations Educational, Scientific and Cultural Organisation). (2003). *Literacy in adults and youth.* Retrieved from http://www.uis.unesco.org/literacy/Pages/Literacy-adult-youth-2011.aspx

Vallandigham, P. H. (2001). *Eye Dominance and Your Body*. Alberta, Canada: Anthropology Information File.

Van Bon, W. H. J., & Uit de Haag, I. J. C. A. F. (1997). Difficulties with consonants in the spelling and segmentation of CCVCC pseudowords: Differences among Dutch first graders. *An Interdisciplinary Journal, 9*, 363-386.

Van Wyk, E. M. (1974). *'n Ondersoek na ouditiewe dominansie by 'n groep hakkelaars.* Unpublished doctoral thesis. Potchefstroom Universiteit vir CHO, Potchefstroom.

Vandervelden, M. C., & Siegel, L. S. (1995). Phonological recoding and phoneme awareness in early literacy : A developmental approach. *Reading Research Quarterly, 3*(14), 854 - 875.

Varnhagen, C. K., McCallum, M., & Burstow, M. (1997). Is children's spelling naturally stage-like? *Reading and Writing: An Interdisciplinary Journal, 9*, 451-481.

Velay, J. L., Roll, R., Lennerstrand, G., & Roll, J. P. (1994). Eye proprioception and visual localization in humans: Influence of ocular dominance and visual context. *Visual Research, 43*, 2169-2176.

Vellutino, F. R., Scanlon, D. M., & Tanzman, M. S. (1988). Lexical memory in poor and normal readers: Developmental differences in the use of category cues. *Canadian Journal of Psychology, 42*, 216-241.

Venezky, R. L. (1970). *The structure of English orthography*. The Hague: Mouton.

Vernooij, M. W., Smits, M., Wielopolski, P. A., Houston, G. C., Krestin, G. P., & Van der Lugt, A. (2007). Fiber density asymmetry of the arcuate fasciculus in relation to functional hemispheric language lateralization in both right and left handed healthy subjects. *A combined fMRI and DTI study. Neuroimage, 35*, 1064-1076.

Vygotsky, L.S. (1962). *Thought and language*. Cambridge: MA: MIT Press.

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Cambridge: CA: Harvard University Press.

Wagner, R. K., & Torgesen, J. K. (1987). The nature of phonological processing and its causal role in the acquisition of reading skills. *Psychological Bulletin, 101,* 192-212.

Wagner, R. K., Torgesen, J. K., Rashotte, C. A., Hecht, S. A., Barker, T. A., Burgess, S. R.,… Garon, T. (1997). Changing causal relations between phonological processing abilities and word-level reading as children develop from beginning to fluent readers: A five-year longitudinal study. *Developmental Psychology*, *33*, 468-479.

Walker, B. J. (2000). *Diagnostic teaching of reading*. Columbus: OH: Merrill.

Walker, R., Young, A. W., & Lincoln, N. B. (1996). Eye patching and the Reabilitation of Visual Neglect. *Neuropsychological Rehabilitation, 6*(3), 219-231.

Walley, A. C., Metsala, J. L., & Garlock, V. M. (2003). Spoken vocabulary growth: Its role in the development of phoneme awareness and early reading ability. *Reading & Writing, 16*, 5-20.

Washington, J. A. (2001). Early literacy skills in African-American children: Research considerations. *Learning Disabilities Research & Practice, 16*(4), 213-221.

Waters, G. S., Bruck, M., & Malus-Abramovitz, M. (1988). The role of linguistic and visual information in spelling: A developmental study. *Journal of Experimental Child Psychology, 45*, 400-421.

Wearmouth, J. (2004). Issues in addressing children's difficulties in literacy development through family-school partnerships. *The Curriculum Journal, 15*(1), 5-17.

Weigel, D. J., Martin, S. S., & Bennett, K. K. (2005). Contributions of the home literacy environment to preschool-aged children's emerging literacy and language skills. *Early Child Development and Care, 176*, 357-378.

Wertsch, J. V., & Sohmer, R. (1995). Vygotsky on learning and development. *Human Development, 38*, 332-351.

Weyandt, L. (2005). *The Physiological Bases of Cognitive and Behavioral Disorders.* Hillsdale, NJ: Lawrence Erlbaum Associates.

White, T., Power, M., & White, S. (1989). Morphological analysis: Implications for teaching and understanding vocabulary growth. *Reading Research Quarterly, xxiv*(3), 283-304.

Wilhelm, J. (2001). *Improving comprehension with think-aloud strategies*. New York: Scholastic Professional Books.

Williams, J. D., & Snipper, G. C. (1990). *Literacy and Bilingualism*. New York: Longman White Plains.

Willis, D. (1993). Learning and assessment: Exposing the inconsistencies of theory and practice. *Oxford Review of Education, 19*(3), 393-401.

Willows, D. M., & Scott, R. (1994). Spelling processes of the reading disabled. In D. A. Brown., & N. C. Ellis. *Handbook of Spelling: Theory, Process and Intervention.* Chichester, England: John Wiley and Sons.

Winch, G., Johnston, R. R., Holliday, M., Ljungdahl, L., & March, P. (2001). *Literacy: Reading, Writing, and Children's Literature*. South Melbourne, Australia: Oxford University Press.

Wittrock, M. C. & Wiley, D. E. (Eds.). (2008). *The evaluation of left-brain right-brain* (3rd ed.). New York: *W. H. Freeman.*

Wolfe, P. (2001). *Brain matters: Translating research into classroom practice*. Alexandria: VA: Association for Supervision and Curriculum Development.

Wood, J., & McLemore, B. (2001). Critical components in early literacy: Knowledge of letters of the alphabet and phonics instruction. *The Florida Reading Quarterly, 38*, 14-18.

Woods, R. P., Dodrill, C. B., & Ojemann, G. A. (1988). Brain injury, handedness, and speech lateralization in a series of amobarbital studies. *Annual Neurological Journal, 23*, 510-518.

World Literacy Foundation. (2012). *The Oxford Declaration.* Retrieved from http://www.worldliteracyfoundation.org/

Write Express Corporation. (2011). *Literacy Statistics.* Retrieved from http://www.begintoread.com/research/literacystatistics.html

Wysocki, K., & Jenkins, J. (1987). Deriving word meanings through morphological generalization. *Reading Research Quarterly Quarterly, xxii*(1), 66-81.

Xue, Y., & Meisels, S. J. (2004). Early literacy instruction and learning in kindergarten: Evidence from the early childhood longitudinal study - kindergarten class of 1998-1999. *American Educational Research Journal, 41*, 191-229.

Yardley, M. (2012). *Eye Dominance.* Retrieved from http://www.basc.org.uk/en/how-to/shooting/eye-dominance-test.cfm2012

Yavas, M., & Goldstein, B. (1998). Phonological assessment and treatment of bilingual speakers. *American Journal of Speech-Language Pathology, 7*(2), 49-60.

Yopp, H. K., & Yopp, R. (2000). Supporting phonemic awareness development in the classroom. *The Reading Teacher, 54*(2), 130-143.

Yopp, H. K. (1988). The validity and reliability of phonemic awareness tests. *Reading Research Quarterly, 23*, 159-177.

Yopp, H. K. (1992). Developing Phonemic Awareness in Young Children. *Reading Teacher, 45*(9), 696-703.

Yund, W., & Efron, R. (1977). A model for the relative salience of the pitch of pure tones presented dichotically. *Journal of the Acoustical Society of America, 62*, 617-632.

Zambrana-Ortiz, N. Z., & Lidz, C. S. (1995). The relationship between Puerto Rican mothers' and fathers' mediated learning experiences and the competence of their preschool children. *Journal of Cognitive Education, 4*(1), 17-31.

Ziegler, J. C., Perry, C., Jacobs, A. M., & Braun, M. (2001). Identical words are read differently in different languages. *Psychological Science, 12*(5), 379-384.

Ziegler, J. C., Stone, G. O., & Jacobs, A. M. (1997). A database for computing feedforward and feedback consistency in English. *Behavior Research Methods, Instruments and Computers, 29*(4), 600-618.

Zinn, S. (2000). *Information literacy in South Africa: Making strides with Information and communication technology.* Retrieved from http://www.iasl-slo.org/zinn2000.html

Zohar, A. (1999). Teachers' metacognitive knowledge and the instruction of higher order thinking. *Teaching and Teacher Education, 15*, 413-429.

Zucker, N. (2011). *Creative Research Systems.* Retrieved from http://www.surveysystem.com/correlation.htm

APPENDICES

Appendix A: Consent Obtained from Parents

5 March 2011

Dear Parent/Caregivers

National systemic evaluations conducted by the Department of Education to establish literacy and numeracy levels in primary schools revealed shockingly low levels of reading ability across the country. In 2004, the evaluation of Grade 3 learners indicated that 54% of learners tested below their chronological age in reading competency. The results emphasized that only 36% of all Grade 3 learners in South Africa were able to read and write with understanding and that 64% of learners who attended school for three years still did not read on an appropriate level.

Researchers are currently looking at ways to tackle reading and spelling difficulties worldwide. I am specifically focusing on Grade 2 learners. In my research, I will be testing your child's dominant part of his/her brain, dominant eye, ear and dominant hand. I will also test some Literacy skills. Usually, the children experience this as a pleasant activity. However, participation is voluntary and children may at any stage, refuse to participate and or withdraw at any time.

Parents of participants will receive a free printout of their children's brain profiles with a report attached explaining each individuals scores. To have such profiles done elsewhere are usually rather expensive.

I would like to stress that your child's results will be handled sensitively. It will only be used together with the results of the other children and will be kept anonymous. Only by looking at the results of a large group of children, we would be able to draw reliable information. Your child's participation will therefore be much appreciated.

The principal and the Gr 2 teachers have kindly agreed that the research may be conducted during school hours.

I trust that your child will be able to participate in the research project. If so, kindly fill in the permission slip below, which your child should return to his/her teacher. Thank you very much in advance!

If you have any questions, please do not hesitate to contact Mrs Esther Marloth (cell phone: 073 147 5649)

Kind Regards

Esther Marloth

I give permission for my child _____(name of child) to participate in the research project that will take place at the School.

Date:_____ Signature:_____

Appendix B: Institution/Principal consent of participation

STUDY TITLE:

The relationship between phonological awareness, mixed dominance and spelling in Grade 2 learners.

STUDY PURPOSE AND RATIONALE:

The purpose of the study is to (determine):

- What the relationship is between phonological awareness, spelling and an informal assessment of brain, eye and hand dominance;
- Develop guidelines and suggest activities that address phonological awareness, mixed dominance and spelling in Grade 2 learners

INCLUSION/EXCLUSION CRITERIA:

Participants consist of Grade 2 learners in a school in the Umzinyati District in the KwaZulu-Natal Education Department.

PARTICIPATION PROCEDURES AND DURATION:

The Neethling brain instrument called “the Young Child Indicator” will be used to determine each participant’s brain dominance. This test takes between 5–10 min depending on the child.

Each child’s dominant eye will be determined by asking the child to peep through an empty toilet roll, a keyhole in a door and by using the near-far alignment test. This should take approximately 2 min.

Each child’s dominant hand will be determined by asking with which hand they write and colour in. He/she will be asked to pretend drinking from a cup and brushing their teeth.

Each participant will complete a standardised ESSI reading test of approx 1 min.

Each participant will complete a standardised ESSI spelling test of approx 3 min. This will be done as a group and not individually.

Each participant will complete a phonically awareness test, approximately 5 minutes.

DATA CONFIDENTIALITY OR ANONYMITY:

All data will be maintained as confidential and no identifying information such as names will appear in any publication or presentation of the data.

STORAGE OF DATA:

Paper data will be locked away and will be destroyed after all studies are completed. The data will also be entered into a software program and stored on the researcher's password-protected computer for as long as needed and then deleted. Only members from the research team will have access to the data.

RISKS OR DISCOMFORTS:

No possible risks to participants are envisaged. However, in the event of questions that may be perceived as threatening or causing discomfort, participants may decline to answer such questions without providing any reason for doing so.

BENEFITS:

Each participant will receive a printout of his/her brain profile with a report attached explaining his/her personal scores.

VOLUNTARY PARTICIPATION:

Participation in this research is completely voluntary. Participants may at any stage refuse to participate and or withdraw at any time.

CONTACT INFORMATION:

The research is conducted by M.Ed. student, Esther Marloth, under the supervision of Prof. Carisma Nel, as well as Dr Audrey Klopper from the School of Educational Sciences: North-West University, Potchefstroom Campus. Prof. Nel can be reached at 018 299 4739 (o/h) and Dr. Klopper can be reached at 018 299 4328 (o/h) for questions regarding this research project. This research has been ethical approved by the North-West Ethics Committee.

CONSENT:

I, _____ principal of _____ School, agree that this research project entitled The relationship between brain dominance, body laterality and literacy skills in Grade 2 learners in a school in KZN may take place at my school. I have read the description of this study, I have also had the study explained to me and my questions have been answered to my satisfaction. I understand that I will receive copies of all the letters of informed consent to keep for future references.

_____ _____

Name Signature

_____

Date

Appendix C: Oral Consent of Learners

(Since the learners are only in Grade 2, the researcher will explain one concept at a time and ask for an answer from the learner)

- I am going to do three little tasks with you to see which eye is your strongest eye.

Is that fine with you? Yes ☐ No ☐

- I am going to do three little tasks with you to see which ear is your strongest ear.

Is that fine with you? Yes ☐ No ☐

After that, I am going to test which hand is your dominant hand by asking you write your name and asking you to do two things for me.

Is that fine with you? Yes ☐ No ☐

- I am going to ask you to look at pictures and tell me which pictures you like best.

Is that fine with you? Yes ☐ No ☐

- I am going to ask you to write down words which I will read to you. It does not matter if you can't write all of them correctly. You can just try and do your best.

Is that fine with you? Yes ☐ No ☐

- I am going to ask you to read some words to me. It does not matter if you can't read all of them. You can just read what you can and try your best.

Is that fine with you? Yes ☐ No ☐

- Lastly, I am going to do a little test with you to see if you can recognise sounds and letters. I will explain every step of the test as we go along. It is not difficult and it doesn't matter if you cannot do everything. Just try your best and we'll see how it goes.

Is that fine with you? Yes ☐ No ☐

- This participant agreed to participate in all the aspects of the research.

Yes ☐ No ☐

Appendix D: ESSI Reading Test

The learner should be able to recognise these words quickly (automatically). This reading test therefore aims to determine the sight word vocabulary of the learners. If he/she uses sounds to recognise a word, the word is not part of his/her sight word vocabulary. The learner is expected to read one word per second without using any analysis techniques. Every word read without hesitation will receive 1 mark.

Words

1. look
2. jump
3. swim
4. lunch
5. money
6. because
7. carpet
8. ladder
9. kite
10. picnic
11. towel
12. noise
13. study
14. breath
15. tune
16. huge
17. creature
18. courage
19. especially
20. language

Appendix E: ESSI Spelling Test

Explain to the learners that they should relax and try their best, but they shouldn't worry if they cannot write all the words correctly. Learners should write the words in the correct order in which it is read to them. The facilitator should pronounce the words clearly, however, parts of words should not be stressed unnaturally. Every correct word will receive 1 mark and wrong words will receive no marks.

Words

1. hunt
2 drum
3. ship
4. door
5. stick
6. apple
7. mouth
8. fork
9. bread
10. table
11. sound
12. belt
13. plate
14. rang
15. please
16. beside
17. nail
18. near
19. puzzle
20. thumb

Appendix F: Phonological Awareness Test: Grade 2

Blending

I'm going to sound out a word slowly. I want to see if you can guess the word I'm trying to say. For example, if I say /b/ *(pause)* /a/ (pause) /g/, I want you to say BAG. Okay? Let's try another one.

Can you guess this word?

Practice items
a. /a/ pause /n/ -an
b. /s/ pause /a/ pause /t/ -sat
c. /r/ pause /oa/ pause /d/ -road

For each practice item, if incorrect or no response:

I said "/./(*pause) /./(pause) /./"* and you should say which word we get when we put these sounds together. Let's try again: "/./*(pause) /./ (pause) /./"*

If incorrect response:

Well done! Let's try another one.

Test items

Stimulus	Response	
1. of	_____	
2. fat	_____	
3. tin	_____	
4. me	_____	
5. ox	_____	
6. mint	_____	
7. bus	_____	
8. mad	_____	
9. glad	_____	
10. junk	_____	(____/10)

Segmentation
I'm going to say a word and I want you to break the word apart. You are going to say the word slowly by telling me each sound in the word in order. For example, if I say "old": you should say /o/ *(pause) /l/ (pause) /d/.* Let's try a few words together.

Practice items
a. it
b. gun
c. chat

If incorrect response:
Test examiners may gently provide the correct answer to the child after incorrect response. For example:

- If a child responds with a partial segmentation (/m/(pause)/an/, the examiner should say something like: "That's close, but you only separated some of the sounds. Please separate all of them like this: man is /m/ *(pause) /a/ (pause) /*n/". Let's try again.

- If a child restates the word, encourage separation of sound saying: "Yes, the word is "man". Can you tell me all the sounds you hear in the word "man"?

- If the child responds by spelling the word, say "Wow! You spelled that word! Very good, but what I am asking you to do is tell me all of the sounds, not the letters in the word. *"Let the child try again.*

- If a child shrugs, restate the item and encourage a response: I said "man", so you should say *"/m/ (pause) /a/ (pause) /n/ ".* Let's try again. "man".

If correct response:

Well done! Let's try another one.

Test items

(The student's score on the test is the number of items correctly segmented into all constituent phonemes. No partial credit is given. For instance, if a student says "/c/-/at/" instead of "/c/-/a/-/t/," the response may be noted on the blank line following the items but is considered incorrect for the purposes of scoring. Correct responses are only those that involve articulation of each phoneme in the target word.)

Stimulus	Response	
1. bee	_____	
2. do	_____	
3. all	_____	
4. odd	_____	
5. job	_____	
6. flush	_____	
7. risk	_____	
8. swing	_____	
9. priest	_____	
10.my	_____	(____/10)

<u>Phoneme deletion</u>

This task is all about changing one word into another word. Repeat what I say: "RUGBY". *If the child repeats the word correctly, say:* "Okay, now we're going to make a different word. Say "RUGBY" again, but <u>without</u> "RUG". (*If the child gives the incorrect response then explain until the child gives the correct response /bee/and understands).* Let's try another one.

Practice items

- **a.** baby (without /bay/)
- **b.** picnic (without/nic/)
- **c.** meal (without/m/)
- **d.** beam (without/m/)

For each practice item, if incorrect or no response:

I asked you to say "…" without the "/./". So you should say "…". Let's try again: "…".

If correct response:

Well done! Let's try another one.

Test items

Stimulus				Response
1.	mat	without the	/m/	_____
2.	chair	without the	/ch/	_____
3.	bike	without the	/k/	_____
4.	trade	without the	/tr/	_____
5.	boil	without the	/b/	_____
6.	same	without the	/m/	_____
7.	float	without the	/fl/	_____
8.	pile	without the	/l/	_____
9.	steal	without the	/st/	_____
10.	wild	without the	/ld/	_____
11.	film	without the	/m/	_____
12.	snow	without the	/s/	_____
13.	plane	without the	/p/	_____
14.	steer	without the	/s/	_____
15.	blue	without the	/l/	_____
16.	mist	without the	/t/	_____
17.	act	without the	/k/	_____
18.	first	without the	/st/	_____
19.	locks	without the	/ks/	_____
20.	fly	without the	/f/	_____(____/20)

Total:_____/40

Appendix G: Personal Information of Child

Name & Surname of child:_____

Gender: M F

Age:_____

Date of Birth:_____

Home Language:_____

Birth weight of child (in kg):_____

Duration of pregnancy:_____

Siblings (please mention ages, no names needed):
_____

Did your child attend Nursery School? Yes No

If yes, how long?_____

How long has your child been in his/her current school?
_____

Has he/she had ear infection? Yes No

If yes, approximately how many
times?_____

Please circle what is applicable to your child's handedness:

- ✓ Always left
- ✓ Usually left
- ✓ No preference
- ✓ Always right
- ✓ Usually right

Has your child had any therapeutic intervention? Yes No

If yes, please circle the appropriate therapy:

- ✓ Speech Therapy
- ✓ Occupational Therapy
- ✓ Remedial Therapy
- ✓ Other Therapy (please specify)_____

Please shortly describe the reason for the
intervention:_____

_____

Does your child use medication for attention or concentration? Yes No

If yes, name of drug:_____

For how long has your child use this drug?_____

Does your child enjoy reading? _____

Would you like to add anything regarding your child?_____

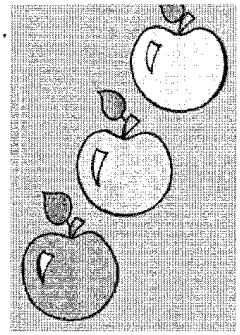
_____

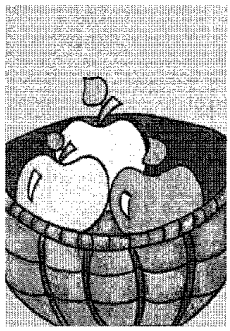
Thank you for your time!

Appendix H: Neethling Brain Instrument: Young Child Indicator

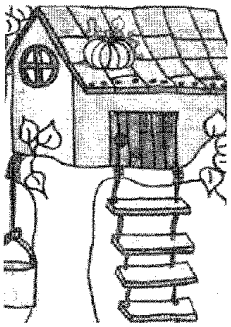
Twenty sets of pictures will be used. This sample includes 3 of the sets of pictures. In every set the child chooses the one he/she likes most. This test is done online and the results are automatically determined at head office.

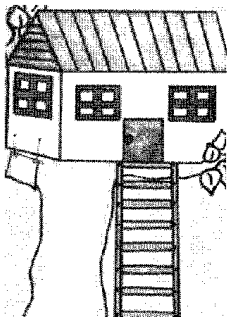
1.



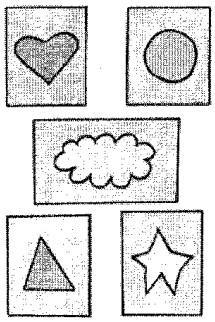


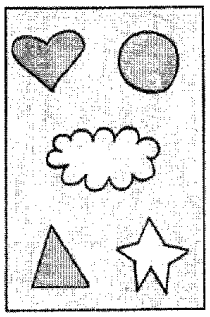
2.





3.





Appendix I: Application for Permission to Conduct Research

kzn education
Department:
Education
KWAZULU-NATAL

Application for Permission to Conduct Research in KwaZulu Natal Department of Education Institutions

1. Applicants Details

Name Of Applicant(s): Esther Marloth

Tel No: 073 147 5649 Fax: _____ Email esther.marloth@gmail.com

Address: Kwa Sizabantu Mission, Silverstream farms, KZN

2. Proposed Research Title:

The relationship between phonological awareness, mixed dominance and spelling in Grade 2 learners.

3. Have you applied for permission to conduct this research or any other research within the KZNDoE institutions? Yes ~~No~~

If "yes", please state reference Number: –

4. Is the proposed research part of a tertiary qualification? Yes No

If "yes"

Name of tertiary institution: North West University

Faculty and or School: Education Sciences

Qualification: M Ed.

Name of Supervisor: Prof. C. Nel Dr A. Klopper **Supervisors Signature** _____

If "no", state purpose of research: _____

n/a

5. Research Background:

Of all things children have to learn when they get to school, reading and writing are the most basic, the most central and the most essential. Each year many children experience significant problems learning to read. Educators in South Africa are concerned that many learners are not learning to read and spell adequately. It is feared that this will result in a general demise of the reading and spelling standards in the average public school.
Phonological awareness has been identified as an important component in children's literacy development overall, especially in spelling and reading performance.
In addition, research indicates that a correlation exists between learners with reading and spelling problems and mixed dominance.

6. What is the main research question(s) :

What is the relationship between phonological awareness, mixed dominance (brain, eye and hand) and spelling in Grade 2 learners in KZN?

7. Methodology including sampling procedures and the people to be included in the sample:

A total of 135 children will be tested. Schools in the Umzinyathi area will be contacted. Totals of Gr 2 learners will be added up until the total of 135 have been reached.
Each participants dominant eye and hand will be determined as well as the dominant side of the brain. Literacy skills will be tested such as phonological awareness, reading and spelling.

8. **What contribution will the proposed study make to the education, health, safety, welfare of the learners and to the education system as a whole?:**

This study aims to answer some of the questions pertaining to reading and spelling difficulties in the Foundation Phase.

9. **KZN Department of Education Districts from which sample will be drawn (please tick) –** *Please attach the list of all schools*

Amajuba		**Umlazi**		**Sisonke**	
Othukela		**Pinetown**		**Ugu**	
Zululand		**Ilembe**		**Umgungundlovu**	
Obonjeni		**Empangeni**		**Umzinyathi**	✓

10. **Research data collection instruments**: *(Note: a list and only a brief description is required here - the actual instruments must be attached)*:

(1) Phonological Awareness test – test blending, segmentation, phoneme deletion ability
(2) ESSI reading test – grade 2 level
(3) ESSI spelling test – grade 2 level
(4) Neethling Brain Instruments : Young child Indicator – to determine if the child is left or right brain dominant.

11. **Procedure for obtaining consent of participants and where appropriate parents or guardians:**

Letters for obtaining consent from parents / guardians will be completed
Letters will explain the research project clearly.
Participation will be voluntary.

12. Procedure to maintain confidentiality (if applicable):

All data will be maintained as confidential and no identifying information such as names will appear in any publication or presentation of the data.

13. Questions or issues with the potential to be intrusive, upsetting or incriminating to participants (if applicable): n/a

14. Additional support available to participants in the event of disturbance resulting from intrusive questions or issues (if applicable):

n/a

15. Research Timelines :

This will depend on principals of the schools and the times they will make available for the research.

16. Declaration

I Esther Marloth declare that the above information is true and correct

E Marloth — 10 May 2011

Signature of Applicant **Date**

17. Agreement to provide and to grant the KwaZulu Natal Department of Education the right to publish a summary of the report.

I/We agree to provide the KwaZulu Natal Department of Education with a copy of any report or dissertation written on the basis of information gained through the research activities described in this application.

I/We grant the KwaZulu Natal Department of Education the right to publish an edited summary of this report or dissertation using the print or electronic media.

E Marloth — 10 May 2011

Signature of Applicant **Date**

Return a completed form to:
Sibusiso Alwar
Research Unit
Resource Planning
KwaZulu Natal Department of Education

Hand Delivered:
Office G25; 188 Pietermaritz Street
Pietermaritzburg 3201
Or
Ordinary Mail
Private Bag X9137
Pietermaritzburg
3200
Or
Email
sibusiso.alwar@kzndoe.gov.za or smiso.sikhakhane@kzndoe.gov.za

Appendix J: Permission to Conduct Research

kzn education
Department:
Education
KWAZULU-NATAL

ESTHER MARLOTH
KWA SIZABANTU MISSION
SILVERSTREAM FARM
KWAZULU-NATAL

Enquiries: Sibusiso Alwar
Date: 01 June 2011
Reference: 2/4/8/5

PERMISSION TO CONDUCT RESEARCH IN THE KZN DEPARTMENT OF EDUCATION INSTITUTIONS

PROPOSED RESEARCH TITLE: The relationship between phonological awareness, mixed dominance and spelling in Grade 2 learners.

Your application to conduct research in the KwaZulu Natal Department of Education Institutions has been approved. The conditions of the approval are as follows:

1. The researcher will make all the arrangements concerning the research and interviews.
2. The researcher must ensure that Educator and learning programmes are not interrupted.
3. Interviews are not conducted during the time of writing examinations in schools.
4. Learners, educators, schools and institutions are not identifiable in any way from the results of the research.
5. A copy of this letter is submitted to District Managers, Principals and Head of Institutions where the intended research and interviews are to be conducted.
6. The period of investigation is limited to the period: From 01 June 2011 to 31 June 2012.
7. Your research and interviews will be limited to the schools you have proposed and approved by the Superintendent General. Please note that Principals, Educators, Departmental Officials and Learners **are under no obligation to participate or assist you in your investigation.**
8. Should you wish to extend the period of your survey at the school(s) contact Mr Alwar at the contact numbers below.
9. Upon completion of the research, a brief summary of the findings, recommendations or a full report/dissertation/thesis must be submitted to the research office of the Department. Address to: The Director: Resource Planning; Private Bag X9137; Pietermaritzburg; 3200

The Department of Education in KwaZulu Natal fully supports your commitment toward research and wishes you well in your endeavours. It is hoped that you will find the above in order.

Nkosinathi SP Sishi, PhD
Head of Department: Education

3/6/2011
Date

...dedicated to service and performance beyond the call of duty.

KWAZULU-NATAL

POSTAL: Private Bag X9137, Pietermaritzburg, 3200, KwaZulu-Natal, Republic of South Africa
PHYSICAL: Office G25; 188 Pietermaritz Street; Metropolitan Building; PIETERMARITZBURG 3201
TEL: Tel: +27 33 341 8610 | Fax: +27 33 341 8612 | E-mail:

kzn education
Department:
Education
KWAZULU-NATAL

ESTHER MARLOTH
KWA SIZABANTU MISSION
SILVERSTREAM FARM
KWAZULU-NATAL

Enquiries: Sibusiso Alwar
Date: 01 June 2011
Reference: 2/4/8/5

PERMISSION TO CONDUCT RESEARCH IN THE KZN DEPARTMENT OF EDUCATION INSTITUTIONS

PROPOSED RESEARCH TITLE: The relationship between phonological awareness, mixed dominance and spelling in Grade 2 learners.

Your application to conduct research in the KwaZulu Natal Department of Education Institutions has been approved. The research and interviews will be limited to the following Schools and Institutions:

1. Domino Servite School
2. Hermansburg School
3. Wembley School
4. Greytown Primary School
5. Umhlali Primary School

Regards,

Nkosinathi SP Sishi, PhD
Head of Department : Education

3/6/2011
Date

...dedicated to service and performance beyond the call of duty.

KWAZULU-NATAL DEPARTMENT OF EDUCATION
POSTAL: Private Bag X9137, Pietermaritzburg, 3200, KwaZulu-Natal, Republic of South Africa
PHYSICAL: Office G25; 186 Pietermaritz Street; Metropolitan Building; PIETERMARITZBURG 3201
TEL: Tel: +27 33 341 8610 | Fax: +27 33 341 8612 | E-mail: