THE DEVELOPMENT AND EVALUATION OF A METACOGNITIVE PROGRAMME FOR YOUNG LEARNERS IN THE SOUTH AFRICAN CONTEXT

Louis Benjamin

A thesis submitted in completion of the requirements for the degree of Doctor of Philosophy in the Faculty of Education, University of the Western Cape.

Supervisors:
Prof. Lena Green
Mrs. Lilian Lomofsky

May 2005

DECLARATION

I, the undersigned, hereby declare that *The Development and Evaluation of a Metacognitive Programme for Young Learners in the South African Context* is my own work, and has not been submitted before for any degree or examination at any other university. The sources I have used or quoted have been indicated and acknowledged by complete references.

Louis Benjamin **Date: 16.05.2005**

Signed:…………………………

‘The effort of acting upon Man allows one to be better acquainted with him.’

(Hadji, 2000:31)

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KEYWORDS

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Dynamic assessment

ABSTRACT

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L. Benjamin

Ph.D. thesis, Faculty of Education, University of the Western Cape.

The Basic Concepts Mediated Learning Programme (BCMLP) was developed to enhance the cognitive and scholastic functioning of learners who experience barriers to learning in the early years of schooling in the South African context. The study aimed to initiate a process of evaluation of the efficacy of this metacognitive programme with Grade 2 learners from the 'Cape Flats', an historically disadvantaged community in Cape Town. The study was conducted simultaneously in two local education authorities by independent teams of fieldworkers in each of the education authorities. This quantitative, quasi-experimental, non-equivalent comparison group design study was implemented with learners who were equally assigned to an Experimental group (N=54) or Comparison group (N=55). English home-language and Bilingual (English and Afrikaans) learners made up a majority of the study sample. The study was conducted in English.

Extensive pre-test and post-test batteries consisting of cognitive (information-processing), cognitive modifiability (dynamic assessment), and scholastic tests were used to collect data. A number of structured interview schedules including post-intervention teacher rating scales were also used for the purpose of data gathering. The results from the parametric and non-parametric methods of data analysis selected, revealed a pattern of significant pre- to post-study cognitive and scholastic gains in scores for learners in both the Experimental and

Comparison groups ($p<0.05$). In addition, it was found that the study participants, irrespective of their designation to the Experimental or Comparison group became more modifiable and demonstrated enhanced information-processing abilities at the end of the study. Significantly greater gains were, however, attained by learners in the Experimental group in a majority of the areas assessed (7 out of 12) ($p<0.05$). Learners in the Experimental group were also found to be more responsive to instruction and modifiable than learners in the Comparison group.

Learners who participated in the BCMLP were found to benefit with respect to their knowledge of basic concepts, cognitive and scholastic functioning. However, it was not possible to infer from the current study that findings were attributable to any one specific procedure (mediational teaching, concept teaching, vocabulary teaching and teaching to enhance information-processing) or process (Basic Concept Teaching Model) of this metacognitive programme. Furthermore, the study had a number of limitations and findings should be regarded with some caution until replication studies can be completed and the long-term effects of the study can be evaluated.

The study provides some evidence for the efficacy of short-term, small group intervention programmes implemented by Learning Support Teachers within disadvantaged communities. The study also provides some initial evidence for the efficacy of the BCMLP (a specially designed metacognitive programme). The BCMLP was found to be both appropriate and manageable for Learning Support Teachers to implement in the South African context.

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ii) Learning Support Teachers and Class Teachers at schools in the above-mentioned EMDCs during the Pilot Study and Main Study.

iii) Learners who participated in the study.

iv) Staff at the University of the Western Cape.

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ABBREVIATIONS USED IN THE TEXT

African National Congress ……………………………….(ANC)

Analytic Coding ………………………………………….. (AC)

Basic Concepts Mediated Learning Programme ……..(BCMLP)

Basic Concept Session …………………………………(BCS)

Boehm Test of Basic Concepts- Revised………………(BTBC-R)

Bright Start ………………………………………………. (BS)

Cognitive Assessment System ………………………….(CAS)

Children's **I**nferential Thinking Modifiabilty Test ………(CITM)

Concept Teaching ………………………………………..(CT)

Cognitive Acceleration …………………………………...(CA)

Cognitive Acceleration Through Science ………………(CASE)

Concept Teaching Model ………………………………..(CTM)

Curriculum 2005 …………………………………………(C2005)

Early Childhood Development …………………………..(ECD)

Education Management and Development Centre ….. (EMDC)

Learning Support Facilitator …………………………….(LSF)

Learning Support Teacher ……………………………….(LST)

Mediated Learning Experience …………………………(MLE)

Outcomes Based Education …………………………….(OBE)

Planning, Attention, Simultaneous and Successive …..(PASS)

Revised National Curriculum Statement ………………(RNCS)

Selective Association …………………………………… (SA)

Selective Discrimination …………………………………(SD)

Selective Generalisation …………………………………(SG)

South Africa ………………………………………………(SA)

Specialized Learner and Educator Support …………...(SLES)

United Kingdom ………………………………………….. (UK)

United States …………………………………………….. (US)

Zone of Proximal Development …………………………(ZPD)

CHAPTER ONE

INTRODUCTION

1.1 AIMS OF THE STUDY

The study aims to outline the development of the **Basic Concepts Mediated Learning Programme** (a metacognitive educational [1]programme) and to explore the effects of this programme on the cognitive and scholastic functioning of young learners in South Africa who experience barriers to learning (learning difficulties). The study principally attempts to investigate the efficacy of the Basic Concepts Mediated Learning Programme (BCMLP) for [2]Foundation Phase learners from schools in disadvantaged communities. The programme was developed with the intention of addressing a number of complex issues and challenges that are part of teaching-learning in South Africa (SA), in order to improve the cognitive and scholastic functioning of learners who make slow school progress.

This study investigates: -

- The effects of the BCMLP on the development and construction of learners' knowledge of basic conceptual systems.
- The effects of the BCMLP on the development and construction of learners' higher cognitive functioning.
- The effects of the BCMLP on the development and construction of learners' scholastic functioning and ability to transfer learning.

[1] The term programme in this study refers to a comprehensive set of procedures that aim to enhance thinking and learning processes. The term programme thus does not refer to a prescribed curriculum. (See Chapter Four.)
[2] Foundation Phase: learners in Grade R to Grade 3. This study focussed on Grade 2 learners but the curriculum was designed for all Foundation Phase learners.

1.2 RATIONALE OF THE STUDY

The BCMLP was developed to address deficits in the knowledge of basic conceptual systems and to enhance the cognitive functioning of learners in the Foundation Phase in the South African context. These learners often do not make adequate school progress and are consequently identified as learners who experience barriers to learning. It is estimated that up to half of the learner population in South African experiences barriers to learning (Donald, 1993). It is contended that the incidence of learners who experience barriers to learning in SA is higher than in other countries (Du Toit, 1991; HSRC, 1981). In addition, it is argued in this study, teachers in the South African context are faced with unique and enormous challenges. The intervention programme (a short-term, small group programme) was therefore designed to consider the local education environment and to be used by Class Teachers and Learning Support Teachers (remedial teachers) working with mainstream learners. Furthermore, to ensure that such a programme was relevant to teachers and schools, the Revised National Curriculum Statement (RNCS) needed to be considered in designing the programme content (Department of Education, 2002). The programme is fully described in Chapter Four.

The BCMLP aimed not only to establish an important knowledge base consisting of basic conceptual systems (viz. colour, shape, size, position, number and letter), but also to establish higher cognitive functions required for reading, spelling and mathematics. The BCMLP, modelled on three similar and well-researched, theoretically grounded metacognitive programmes (Bright Start, Cognitive Acceleration Through Science & Concept Teaching) drew upon the insights and the strengths of these programmes. These metacognitive educational programmes are explored and critically examined in Chapter Three.

The scope of the study was limited to exploring the effects of the BCMLP on the development of basic conceptual systems and cognitive and scholastic functioning of the learner-participants. No further evaluation of the BCMLP was possible during the current study. A quantitative, quasi-experimental research design was selected for this study in order to obtain baseline data, deemed important in such a preliminary study. If the results of such a study were suggestive of gains for the study participants, then more detailed and comprehensive evaluations would be warranted, including those of a qualitative nature. The researcher, however, is aware of the limitations of using only quantitative methods of data gathering as such methods on their own may not always capture all the effects (which may include exploring the process of application) of intervention programmes (Fox & Prilleltensky, 1997; Hadji, 2000). Furthermore, it has been argued by Burden (1990) that the process-based nature of cognitive change necessitates a more process-based methodology to investigate it. The validity of the aforementioned process-based research approaches does not, however, refute the need to also measure the effects of such programmes. The value of this initial study lies in its investigation of the measurable effects (associated with mean gain scores) of the BCMLP on the cognitive and scholastic functioning of learners who experience barriers to learning.

1.3 EDUCATION IN THE SOUTH AFRICAN CONTEXT

1.3.1 Historical overview

South Africa has only recently (1994) joined the family of democratic nations and is currently engaged in a process of significant societal transformation. These changes are aimed at developing a unitary SA that seeks to include and provide opportunities to all who inhabit this country, most eloquently stated in the preamble of the Constitution of the Republic of South Africa (1996:1): -

'…we …adopt this Constitution as the supreme law of the Republic so as to heal the divisions of the past and establish a society based on democratic values, social justice and fundamental human rights; improve the quality of life for all citizens and free the potential of each person; and build a united democratic South Africa able to take its rightful place as a sovereign state in the family of nations'.

Educational reform since 1994 has made significant attempts to address the imbalances of the past. This process was initiated through the provision of a set of policy and legislative frameworks. These frameworks all articulate the new goals of equity, redress, quality, efficiency and the right of all learners to equal access to the widest possible educational opportunities. These principles are embedded in the following documents: - White Paper on Education and Training (Department of Education, 1995), South African Schools Act (Republic of South Africa, 1996), White Paper on an Integrated National Disability Strategy (Department of Education, 1997), Education White Paper 5 on Early Childhood Development (Republic of South Africa, 2001), and Education White Paper 6 on Inclusive Education (Department of Education, 2001).

On examining numerous sources on the history of South African education (ANC Policy Framework, 1994; Chisholm, 1993; Enslin, 1990; Hartshorne, 1992; Hofmeyer, 1993; NEPI, 1992) it becomes clear that a doctrine of fundamental pedagogics had profoundly detrimental effects on educational practices in SA. Beard and Morrow (1981) contended that fundamental pedagogics was the dominant theoretical discourse in education departments at South Africa's black universities and colleges. It is argued that the greatest impact of this system of education was on teachers, their thinking and their practice (Taylor & Vinjevold, 1999). Fundamental pedagogics was based on the premise of the teacher, as knowing adult, leading the child to maturity. However, it was the interpretation of this philosophy that resulted in its authoritarian nature. Teaching was primarily concerned with the transmission of information, and learning with the retention of facts. Enslin (1990:83) therefore contended that fundamental pedagogics *'heads off the possibility of critical reflection on that system by making reflection illegitimate'*.

The decision to utilize an Outcomes Based Education (OBE) approach to propel the new curriculum (Curriculum 2005) was deliberately intended to overturn the legacy of apartheid and to advance South African education into the Twenty First Century. OBE was deemed appropriate *'to move from the educator as banker to dialogical learner' (WCED, 2000:5)*, that is, where educators and learners become jointly responsible for teaching-learning encounters. This is consistent with the contention that learning encounters in a 'liberation project' (such as SA) should engage with issues of dialogue and conscientization (Freire, 1972). OBE is also consistent with constructivist educational perspectives, which recommended a shift from teacher-centred practices to learner-centred practices. This version of OBE also found favour with the then Minister of Education's call to action. He referred to active learning, a term which embraced *'…the capacity of learners to think for themselves, to learn from the environment … (and) teachers who value creativity and self-motivated learning' (Asmal, 1999:9)*. A reading of the Critical Outcomes of Curriculum 2005 (C2005) indicates large areas of overlap with the goals of cognitive education. The Critical Outcomes, which remain in the Revised National Curriculum Statement, aim to develop people who: - can communicate, can solve problems, are confident, can work with others, have life skills, can be reflective, and can be critical, independent thinkers (Department of Education, 2002). The influence of [3]Spady (an American educationalist) cannot be underestimated in shaping South African OBE. Spady & Marshall's (1991) 'Transformational OBE' does not promote subject areas but focuses on developing higher order cognitive abilities required to perform the complex roles needed for authentic living in society. Spady (1994) thus proposed that there are broader competencies (viz. affective, motivational, critical thinking, communication, problem-finding, problem-solving, planning) which are required in all learning situations.

[3] Spady has distanced himself from what passes as OBE in SA (A report of the review committee on Curriculum 2005, 2000).

However, the South African model of OBE has also included a strong focus on curriculum content together with the previously mentioned competencies. This emphasis on curriculum outcomes has resulted in a curriculum that stresses observable behaviour. The curriculum therefore does not aim to practice full Transformational OBE.

The introduction of the new curriculum has not been without criticism, however. Jansen (1998, 1999) who is most reflective of the contrary views held regarding OBE, has been one of the most outspoken critics of OBE. Jansen argued that the strongest influence for adopting OBE in SA originated from the Trade Union Movement (COSATU) which supported a [4]competency-based education model. It was argued that this policy was developed in the political context of a post-communist world where there was a demand for a highly skilled labour force. The critics of OBE thus contend that: *'…this is little more than economic rationalism unleashed on schools and a new kind of state control'* (cited in Fleisch, 2002:117). This critical perspective has itself been criticized for presenting a monolithic analysis based on the functional application of theories of the labour process (Hargreaves & Moore, 2000). However, other concerns regarding C2005 have also been raised from a broad cross section of governmental and non-governmental educational institutions. These have resulted in its re-evaluation and in the formulation of the RNCS (Department of Education, 2002).

[4] Competency-Based Education started in the early 1970's as an educational initiative for a more effective and practically useful curriculum. Broadly speaking, competency-based education is an educational reform that seeks a closer fit between education and the needs of society for both skilled employees and capable citizens (Evers, Rush & Berdrow, 1998).

1.3.2 Current concerns

1.3.2.1 Teacher and curriculum issues

Pertinent to the current study were the following findings from the C2005 evaluation report (submitted to the Minister of Education) which served to highlight a set of central questions, discussions and debates in South African education: -

'The most unequivocal findings about teachers is that a poor grasp on the part of teachers of the fundamental concepts in the knowledge areas they are responsible for is a major problem in disadvantaged classrooms. This results in a number of problems that are experienced in classes: learning topics are dealt with at a low level of conceptual knowledge, tasks are set at a low level of challenge, children hardly ever read and write. The conditions in the schools …stray far from those conducive to learning for substantial periods of time.' (Taylor & Vinjevold, 1999:166--167)

The report questioned whether there are cognitive thresholds beyond which teachers are not able to provide formal cognitive development for learners (Taylor & Vinjevold, 1999:239). Jansen (1998:7) questioned the practicality of introducing OBE in the South African context which he argued would *'aggravate the crisis of confidence and competence in many South African classrooms'*. He listed the main barriers to implementation as: - firstly, the limited capacity to implement the new curriculum, secondly, the limited finances available to implement the curriculum, and thirdly, the jargon and complexity of the new curriculum (Jansen, 1997, cited in Christie, 1997). Naicker (2000) contended that many educators in SA still remain under the influence of the old paradigm (fundamental pedagogics). *'The question therefore is do educators understand the implications of the old paradigm and what is required to make the shift to the demands of a more emancipatory discourse'* (Naicker, 2000:8)*?*

The above questions and issues are indicative of the challenges that lie ahead in the South African education sector. There is broad consensus regarding the need for transformation of education, however, there are concerns regarding the capacity of the education system to manage the scale of the changes that are required and especially the capacity of educators to implement such ideas (Jansen, 1999). There appears to be a general understanding that teachers are central to any change initiative and that attention to this component is essential if improvements are to be effected in the education system. Furthermore, if we accept the analyses of many educational theorists about the complexity and extreme demands placed on teachers by constructivist epistemologies (e.g. Bernstein, 1996; Darling-Hammond, 1997; Gardner, 1991), then the task that confronts those concerned with the process of educational transformation in SA is that much larger. Teachers are therefore in urgent need of support during this important period of educational transformation.

1.3.2.2 Insufficient early childhood education

The South African education system has grown significantly (from an estimated 3.5 million learners in 1976 to 12 million learners in 1996) since the introduction of compulsory schooling for all learners (6yrs-16yrs) post-1994 (Taylor & Vinjevold, 1999). This has created the enormous challenge of educating an increased number of learners who come from diverse backgrounds. However, the White Paper on Early Childhood Development (2001) elucidates that five million children (out of an estimated six million children) still do not have access to any type of early childhood education provision. The introduction of a compulsory pre-school year ([5]Grade R) was an attempt to address this area of deficiency, however, this has not been without its difficulties. The main problems have been cited as a *'lack of funding as well as a crisis in leadership'* (Atmore, 2004, cited in Scott, 2004). Only one percent of the Department of Education budget is spent on early childhood education (Scott, 2004). Furthermore, a grant issued from the national treasury in 2001 for Grade R learners came to an end in 2004.

The extent of the difficulties experienced by learners during the Early Childhood Development (ECD) phase is reflected in the sheer number of children in Grade 1 who are at risk of retention. Liddell and Kemp (1995) contended that a quarter-of-a-million South African children in Grade 1 were retained annually. These findings correspond with the pre-1994 findings of Taylor (1989) that: *'for more than a generation the [6]retention rates in Grade 1 classes averaged 25%, making it amongst the highest in the world'*. The latter is of concern because of the correlation of early academic failure with the increased risk of subsequent retention (Entwisle & Alexander, 1993; Reynolds, 1992; Temple, Renolds & Miedel, 2000). A study implemented in South Africa has corroborated these findings and found that Grade 1 scores were in fact more predictive of subsequent progress than were cognitive test scores (Liddell & Rae, 2001). In a recent systemic evaluation of Grade 3 learners performed by the Western Cape Education Department (2002) it was found that 63.6% of these learners performed below grade level. It could be inferred that these learners entered the school system with substantial deficits which contributed to these poor academic results. However, it could also be argued that any deficits were compounded by the difficulties associated with the implementation of the new C2005. (See Chapter One, p.6-8.)

1.3.2.3 Lack of support for Inclusive Education

White Paper 6 on Inclusive Education strongly echoes the core values contained in the Constitution of the Republic- to build a humane and caring society, not just for a few, but for all South Africans whether they have disabilities or not. The South African definition of Inclusive Education is broad and includes remnants of the 'old' dual system of education (special and ordinary). For example, the new policy does not suggest that special schools be discontinued, but rather suggests that these be 'strengthened' and that their functions be extended and that they be transformed into resource

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[5] Grade R or the Reception Year is the year before Grade 1. Grade R is officially recognized as the first year of the Foundation Phase (Grade R to Grade 3).

[6] Learners may no longer be kept back more than once in a learning phase. This may allow learners more time to attain learning outcomes in a higher grade, but within the same learning phase. The construct 'retention rate' is therefore no longer meaningful since the inception of C2005 in the Foundation Phase in1999.

centres. The definition of inclusion, however, also focuses on changing attitudes, behaviours, teaching methods, curricula and environment in order to meet the needs of all learners. What distinguishes an inclusion model of education from mainstreaming or integration is the ability of the education system to respond to the needs of all learners. Teachers have therefore been identified *'as our primary resource for achieving our goal of an inclusive education and training system'* (Department of Education, 2001:18). The policy explains that *'in mainstream education, priorities will include multi-level classroom instruction so that educators can prepare main lessons with variations that are responsive to individual learner needs; co-operative learning; curriculum enrichment; and dealing with learners with behaviour problems'* (Department of Education, 2001:18). Such a policy requires that further attention is given to developing a learner-centered approach to teaching and learning. Learners' strengths are recognized as they are enabled to participate actively and critically in the learning process. This is consistent with a developmental approach to understanding problems and planning action.

The education of learners with and without disabilities depends on the commitment and effective support of teachers. Engelbrecht, Forlin, Eloff & Swart (2000a:1), however, contend that increasing demands to educate learners with barriers to learning has received little consideration: *'The lack of teachers prepared to provide quality inclusive teaching to these learners and the limitations of existing support structures both impact on inclusion'*. Teachers regard inclusive education as being foisted upon them and are concerned about the implementation of inclusive education (Buell, Hallam & Gamel-McCormick, 1999; Forlin, Douglas & Hattie, 1996; Hall & Engelbrecht, 1999; Swart, Engelbrecht, Eloff, & Pettipher, 2000). Teacher support is thus regarded as critical in assisting teachers to cope with those conditions which are likely to cause the most stress (Engelbrecht, Forlin, Eloff & Swart, 2000a). Areas which have been found to create most stress include administrative issues, behaviour of learners, the teacher's perceived lack of self competence and dealing with the parent of a learner with a disability (Engelbrecht, Forlin, Eloff & Swart, 2000b). These findings emphasize the need for effective teacher-training and the importance of the provision of support services to teachers in the South African context.

1.4 STUDY CONTEXT

1.4.1 Location of the study

The study was conducted mainly on the 'Cape Flats', an historically disadvantaged area on the outskirts of Cape Town, South Africa. It is a flat, sandy, windswept plain on the eastern side of Cape Town. Townships in this area were established during the most repressive period of the apartheid era (1980's) in order to enforce the policies of racial, economic and geographic segregation. Large numbers of the 'Cape Flats' residents were relocated to these areas from their original homes in the city and sea front suburbs of Cape Town.

The standard of living in the 'Cape Flats' varies according to the area. However, it is generally considered to be 'unacceptably impoverished' (Standing, 2003). Surveys in the area have revealed the unemployment rate to be approximately 46% (SALDRU, 2000). The 'Cape Flats' is therefore home to a large number of people who live outside the formal economy. In this context one finds depressing social features shared by numerous other urban ghettos, most notably ill health, stress, the adverse effects of drug dependency, family fragmentation, school truancy and exceptionally high levels of inter-personal conflict, especially domestic violence and assaults involving knives and guns (Standing, 2003).

The residents of the 'Cape Flats' are mainly '[7]coloured' in origin, however, there are also many black communities. The 'coloured' residents are people of mixed ancestry, indigenous to Cape Town. Their white ancestry can be

[7] The term coloured was introduced by the apartheid regime, in order to describe people with a lighter colouring of skin, i.e. those who were not black or from any other identifiable ethnic grouping (e.g. Indian, Chinese, Malay). Notwithstanding, the term coloured as a generic racial grouping has been retained even after the abolishment of apartheid in 1994.

traced to the first Dutch settlers who arrived in South Africa in the early Seventeenth Century. The Afrikaans language developed from high Dutch, which was spoken by the settlers who were residing in the Cape Colony. Afrikaans was therefore the language spoken by the majority of the residents of the 'Cape Flats'. However, in recent years (post-1994) there has been a major shift in language patterns from Afrikaans to English (Taylor & Vinjevold, 1999). Taylor & Vinjevold (1999) argue that the reasons for these shifts are chiefly that English is regarded as a means to gaining access to mainstream national and global society. This trend is especially prevalent in schools, where learners are increasingly being encouraged to attend English medium schools (even though their parents might still speak Afrikaans at home). Children are therefore growing up in an increasingly bilingual language environment.

1.4.2 Local education authorities

The study was conducted in two local education authorities or Education Management and Development Centres (EMDCs) in the [8]South and Central Metropoles. Seven EMDCs were established by the Western Cape Education Department in 2001 with the aim of bringing management and developmental support closer to public schools. A large number of the schools in both South and Central were located on the 'Cape Flats'. (See Chapter One, p.9-11). In addition, the South has been identified as a nodal zone, which indicates that this is a priority area (along with 21 other nodal zones in SA) targeted for intervention, as a result of the severely disadvantaged status of these areas. The study was strongly supported and assisted by the management and staff in the Specialized Learner and Educator Support (SLES) component of the above-mentioned EMDCs. The role of the Learning Support Facilitators from SLES is to provide support and assistance to teachers at their schools. Learning Support Facilitators from South and Central were directly involved as field workers in the current study.

[8] To be referred to as South and Central throughout the text.

1.4.3 History of the development of the study

The study originated as a result of the work of the researcher at the Athlone and Newlands Education Support Centres (1999 & 2000). Foundation Phase learners who were assessed at these clinics and who were residents of the 'Cape Flats', presented with deficits in their knowledge of basic conceptual systems. The researcher became aware that many primary school learners experienced difficulties with understanding concepts that were assumed to have been internalized during the pre-school years (e.g. the names of colours). This prompted the researcher to facilitate a workshop with teachers at the Athlone Education Support Centre. These teachers volunteered to participate in four workshop sessions which aimed to explore and to develop their thinking around their teaching practice, with a focus on the teaching of basic conceptual systems. This was the stimulus for the development of the Basic Concepts Mediated Learning Programme (and thus the study) a year later (2001).

1.5 THEORETICAL BASE OF THE STUDY

Cognitive educational theory forms the cornerstone of the theoretical base for this study, appropriate for the cognitively orientated nature of the programme. The study draws on both individual constructivist (Piagetian) and socio-cultural (Vygotskian and Feuersteinian) perspectives of cognitive education. It is contended that knowledge about both mental structures and how to facilitate change in these structures is essential in order to promote cognitive development. The theoretical base posits that knowledge of the expected mental actions that arise during the normal course of development (as suggested by Piaget) is important, and especially for those working with children. However, without an emphasis on creating the conditions for emergence of these actions (as suggested by Vygotsky & Feuerstein), potential for development will remain unrealized. All three theorists believed that both environmental and maturational factors influenced development. However, the contention (of Vygotsky and Feuerstein) that learners can advance beyond what they already know (given the right conditions) has far reaching implications for teaching and learning processes.

1.6 BRIEF OVERVIEW OF THE STUDY

The study was conducted using a quantitative, quasi-experimental, pre-test and post-test design. Representative samples of male and female learners who experienced barriers to learning were purposively assigned to an Experimental and Comparison group. These learners were drawn from schools in two local education authorities (South and Central). The learners in the Experimental group were exposed to the BCMLP (the programme designed for the purpose of the study), whereas the learners in the Comparison group received an alternative learning support (remedial-based) programme. The programmes for the learners in both research groupings were administered by Learning Support Teachers (remedial teachers) posted at these schools.

The Main Study was preceded by a developmental phase (2001 & 2002) and was implemented at the start of 2003. The Main Study is described in four stages: - i) in-service training of Learning Support Teachers, ii) pre-intervention testing, iii) implementation of the intervention programme (with teacher support) and iv) post-intervention testing. The data derived from this quasi-experimental study were analysed using various parametric and non-parametric methods of analysis deemed appropriate for such a study. Care was taken to identify the possible effects of variables such as gender, location and teacher that were beyond the control of the researcher. Such a study also required an understanding of the complex issues involved in the measurement and evaluation of cognitive change which are further expanded in Chapters Five and Seven.

1.7 OUTLINE OF THE STUDY CHAPTERS

Chapter One: *Introduction*

A broad overview of the study is provided. The chapter describes the aims, rationale and theoretical base of the study as well as the research procedures to be expanded on in the forthcoming chapters. Furthermore, it provides an important overview of the general and specific context in which this study was located.

Chapter Two: *Theoretical Base-A Troika of Theorists*

A detailed exposition of the theoretical framework for this study is provided. The theoretical base is underpinned by the work of three prodigious theorists (Piaget, Vygotsky and Feuerstein). The contribution of each theorist is extensively discussed and critically evaluated. A synthesis of these perspectives is presented providing a coherent, interconnected theoretical base.

Chapter Three: *From Theory To Practice- A Review Of Three Metacognitive Programmes*

Three carefully selected programmatic applications, direct 'descendants' of the above-mentioned theoretical contributions are presented. These metacognitive programmes (Bright Start, Cognitive Acceleration Through Science Project, Concept Teaching) are critically reviewed and thereafter compared and considered especially within the South African context. The chapter concludes with a motivation for a metacognitive intervention programme appropriate for the South African context.

Chapter Four: *The Basic Concepts Mediated Learning Programme (BCMLP)*

The BCMLP, the metacognitive intervention programme designed for the purpose of the study, is introduced. The background and evolution of this metacognitive programme is outlined. An extensive overview of the programme goals, purposes, procedures and processes is also presented.

Chapter Five: *Research Methodology*

The methodology used during the study is detailed in this chapter. The chapter presents the study's hypotheses and describes the research design used. The processes that contributed to the Pilot Study (part 1&2) which preceded the main study are also presented. The main procedures used for gathering and analysing data are explained together with validation strategies and steps taken to ensure ethical conduct of the research.

Chapter Six: *Results*

The results of this quantitative, quasi-experimental study are presented in this chapter. The effects of certain intervening variables on the study findings are also presented. Thereafter, the results are explored in relation to the global hypothesis and sub-hypotheses of the study. More detailed analyses of certain data sets are also presented.

Chapter Seven: *Discussion Of Study Results- The BCMLP A Metacognitive Programme Developed For The South African Educational Context*

The study results are discussed and interpreted in this chapter. The discussion of the results reflects the close inter-relationship of the study aims and hypotheses, assessment measures and theoretical base of the study. The appropriateness and relevance of the intervention programme (BCMLP) in the South African context is also evaluated. The chapter concludes with an overview of the study's limitations and presents recommendations for enhancing the efficacy of the BCMLP, improving the validity of the programme, and introducing the BCMLP in the South African context.

1.8 SUMMARY

The study was performed in order to determine the effects of a metacognitive programme (BCMLP) on the cognitive and scholastic functioning of young learners who experience barriers to learning in the Foundation Phase. This theoretically derived metacognitive programme was designed to address the unique needs of teaching-learning in the South African context. The programme's content and design, although similar to other well-established metacognitive programmes for younger children, also differed from these programmes. The chapters which follow attempt to elucidate the theoretical base, processes and outcomes of this research study in order to provide a critical and thorough evaluation of the effectiveness of this metacognitive programme.

CHAPTER TWO

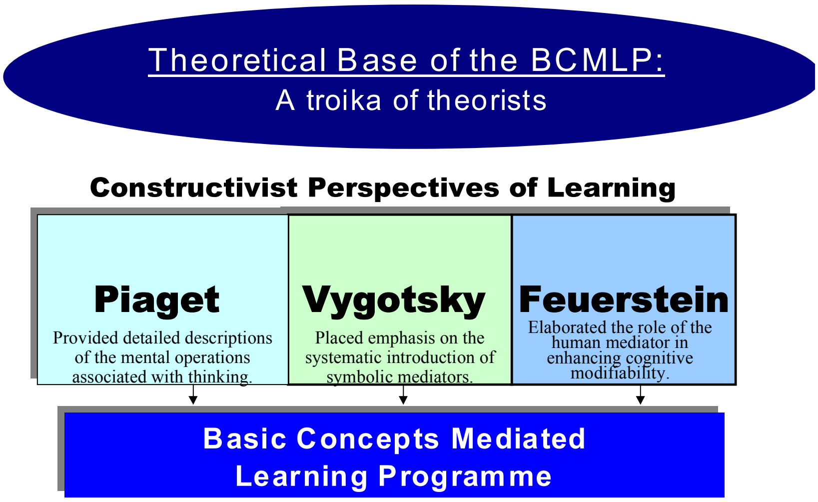
THEORETICAL BASE-
A TROIKA OF THEORISTS

2.1 INTRODUCTION

The Basic Concepts Mediated Learning Programme (BCMLP) is grounded in the interrelated conceptualisations of three prodigious psychological theorists: Jean Piaget, Lev Vygotsky and Reuven Feuerstein. This chapter will provide a detailed exposition of the core theoretical constructs of the identified theorists, highlighting vast tracts of convergence while extracting and interpreting nuances of divergence. A visual image of the 'theoretical troika' is offered; most often standing alongside each other, at times standing on each other's shoulders, but seldom standing in complete opposition to each other. (See Figure 2.1.) The fierce confrontations that are sometimes waged between proponents of different theoretical frameworks can diminish the foundational value of these perspectives when unidimensional interpretations of these theories are put forward to accommodate narrow and self-serving agendas. The theoretical stance adopted will argue for a closer, interconnected discourse, drawing on distinctions to elucidate advances in the epistemology of human cognition.

The chapter will first provide an outline of each theorist and thereafter offer a synthesis in order to provide a coherent interconnected theoretical base. Chapter Three will then provide selected examples of varied applications derived from these theoretical perspectives.

FIGURE 2.1



2.2 THREE THEORECTICAL PERSPECTIVES: PIAGET, VYGOTSKY, AND FEUERSTEIN

2.2.1 Jean Piaget

2.2.1.1 Background and overview

Jean Piaget (1896-1980) was born in Switzerland and is considered one of the fathers of the cognitive revolution (Kozulin, 1998). His seminal ideas contributed to the decline of behaviourism. It could be argued that Piaget was the most influential researcher to study knowledge development in humans (Campbell, 2002; Crain, 2000; Vergnaud, 1996). As Mayer (1983:260) points out that *'…he and his associates in Geneva have published the world's largest existing source of information and theories on cognitive development'.* Piagetian psychology still remains under construction two decades after his death, mainly by neo-Piagetians and ardent followers of his theoretical tenets (e.g. Boden, 1990; Cardellini & Pascual-Leone, 2004). Those most critical of Piaget acknowledge that even the mistakes he made were smart ones, which are still being investigated by researchers (Campbell, 2002).

Piaget considered himself a biologist and philosopher first, and a developmental psychologist, second. He initially studied biology and later completed a doctorate on molluscs. Interestingly, Piaget's first book was not a study in psychology, but a philosophical prose poem. Piaget did not usually call himself a psychologist, but a genetic epistemologist. He was primarily interested in knowledge and how it was acquired. *Biology*, *epistemology* and *psychology* have different approaches to knowledge: -

- *The biologists asks:* How does knowledge contribute to the adaptation of the organism to its environment and how has it evolved?
- *The epistemologist asks:* How is knowledge possible, and what types of knowledge are basic to, or essential for our view of reality?
- *The psychologist asks:* How is it possible for the human organism to acquire knowledge?

(Boden, 1979:15)

The crucial point is that Piaget did not take up psychology for its own sake, but as a means to an end, that is to develop a biologically-orientated theory of the nature and origins of knowledge (Boden, 1979). *'Between biology and the analysis of knowledge I needed something other than philosophy… a need that could be satisfied only by psychology' (Piaget, 1952a:243).*

Piaget approached his investigations using a method of argument that made use of logical disputation. This approach was consistent with Piaget's rejection of logical positivism (Smith, 1993). Piaget's approach was not linear but a spiralling creative process (Boden, 1979). He viewed psychological development as an 'epigenetic' spiral, not a predetermined unfolding of innate properties, influenced not by only psychological maturation or environmental triggering, but also by the person's actions in the world (Boden). It could be posited that it was Piaget's dialectical approach to the reconstruction of his theories that contributed to their intellectual vitality and developmental potential.

2.2.1.2 Main theoretical tenets

Theory of learning

Psychologists have given much attention to Piaget's theory of intelligence as interiorized action and his vision of the mind as a continuously developing system of self-regulating structures that actively mediate and are transformed by the subject's interaction with the environment. Piaget discovered that the errors made by children are not insignificant mistakes due to childish ignorance, but rather that the schemata (cognitive structures) of the child's mind are importantly different from an adult's mind. A continual equilibration is said to be central to developmental processes of all kinds. The [1]dialectical processes of equilibration are comprised of the active building of structures. It is for this reason that Piaget called his theory dialectical constructivism. (Boden, 1979). Development from a Piagetian perspective was attributed to what cognitive structures do, that is, the active interaction of cognitive structures with the environment. The subject's activity is seen as the main agent of psychological adaptation, playing a central part in learning and development (Vergnaud, 1996). Piaget therefore believed that knowledge was primarily operative involved in processes of change and transformation. The French consequently refer to Piaget's theory as *'la théorie opératoire'* (Campbell, 2002).

Cognitive structures are patterns of physical or mental actions that underlie specific acts of intelligence and correspond to stages of child development. Piaget argued that we are not [2]born with a fixed set of cognitive structures and nor are they passively absorbed. In Piagetian terms applying an existing schema for a new situation is called *assimilation*. Changing the schema so that it works better is called *accommodation*. The developmental ideal is the attainment of *equilibrium*, that is, balance between assimilation and

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[1] Piaget's definition of dialectical was not the same as Hegel's (or Vygotsky's). Piaget was opposed to paradoxical conclusions and instead proposed a process of natural logical disputations, e.g. starting at **x** the learner finds that **y** is a necessary condition as it is an intrinsic variation within the total system (Piaget, 1977, cited in Vuyk, 1981).

[2] Piaget has been proved wrong in this respect: some aspects of human cognition are innately specified (Anderson, 1992; Boden, 1988 Haith & Campos, 1983; Karmiloff-Smith, 1994; Young, 1978, 1987).

accommodation. Piaget called the bundle of processes and constraints that tend towards equilibrium, '*equilibration'*. Later in his life, Piaget introduced an additional construct, *reflective abstraction,* another process critical for cognitive transitions from one developmental stage to another. It is through the process of reflective abstraction that assumptions are made explicit and thereafter available for examination.

Not only cognitive structures, but also cognitive change

While cognitive structures were important to Piaget, the way in which structures changed was equally important to him. In Piaget's approach to the study of cognition the developmental stages were a tool for taxonomizing thought and for tracking children's progress (Campbell, 2002). Piaget's psychological stages were the more general aspects of his epistemology and his epigenetic view of biology. His constructivist view of knowledge acquisition, vision of the cognizer as a very active participant in his own cognitive development, and focus on emergent forms, were the more specific aspects of his study into the development of knowledge (Karmiloff-Smith, 1994). Thus while the core of Piaget's theory was his commitment to the idea of structure, the idea of change is also an important component (Kalish & Viola, 2002). Piaget rejected theories which did not address both these aspects of mental life (Campbell, 2002).

The interpretation of Piaget's theory, however, has often been limited to an account of his developmental stages. This was the mistaken understanding of many psychologists, especially in the United States (Campbell, 2002). The erroneous conclusion that one had to *'wait until the child was ready'* before teaching new material led to a view of cognitive development that was closely related to the maturation of the central nervous system. However, for Piaget the process of maturation interacted with, and was subservient to, the process of equilibration. The process of equilibration was responsible for the establishment of new developmental states as a result of interaction with the environment. Accepting that the environment plays a role in the processes of cognitive development opens the way for the environment to be manipulated by a teacher, parent or peer (Shayer & Adey, 1994). *'If this counts as teaching*

…then the effect on the child must count as learning' (Shayer & Adey, 1994:4).

Cognitive structures

Piaget identified four primary cognitive structures and associated these with corresponding stages of development: -

i) *Sensory-motor (0-2yrs)* where intelligence takes the form of motor actions;

ii) *Pre-operational (3-7yrs)* where intelligence is intuitive in nature;

iii) *Concrete operations (8-11yrs)* where intelligence is logical, but still depends on concrete referents; and

iv) *Formal operational (12-15yrs)* where thinking involves abstractions.

(Sutherland, 1992:8-24)

The cognitive transitions that are required from pre-operational to concrete operations are pertinent to the current study and will therefore be outlined. There are a number of limitations of thinking associated with the pre-operational child. These limitations suggest the kind of operations that can be expected to develop in the stage of concrete operations.

Prinsloo, Vorster & Sibaya (1996:87) have described five limitations of thinking which are associated with the pre-operational stage: -

- **Egocentric thinking:** the child's reasoning is based on his/her own point of view. The child is the dominant figure.
- **Centered thinking:** the child's world revolves around a central aspect, leaving out other aspects. He/she is not able to consider more than one source of information at a time.
- **Irreversible thinking:** the child views situations in isolation. The child cannot reason in logical steps or work backward to the starting point.
- **Transductive thinking:** rather than thinking inductively or deductively, the child draws transductive conclusions. The child reasons from one particular case to another particular case. For example, if a child does not have breakfast one morning, he/she will transduce that it is not morning.

- **Conservational thinking** (tasks that require conservation)**:** the child finds it difficult to understand that an object that has undergone a certain type of change remains the same object.

The schemata which Piaget and Inhelder (1966) proposed as typical of concrete operations include: - conservation, seriation, elementary classification and concrete modelling. These concrete operational schemata provide a clear set of types of thinking which can readily be operationalized in teaching and assessment activities. However, the concrete operational schemata can not be established until the pre-operational schemata are in place (Adey, 1997). One should be cautious not to interpret this 'stage information' in a rigid, all-or-nothing manner. The developmental process described by Piaget has an invariant functional form with variable structural manifestations (Smith, 1986, 1987a). Piaget's concept of d*é*calage explains differences between children at a particular 'stage of development'. The concept of [3]d*é*calage elucidates how a child at a certain stage of development may move directly to the next stage in a particular area of conceptual development. The development of a schema might therefore manifest earlier or later depending on the child and his/her prior cognitive operational status. Notwithstanding, many researchers (e.g. Brainerd, 1978a, 1978b; Feldman, 1980; Fischer, 1980; Flavell, 1982; Siegler, 1981) have diverged from Piaget's ideas regarding developmental stages focussing rather on his detailed description of the specifics of the products of mental development (Shayer, 2003).

Social aspect of learning

Piaget noted that development was firmly rooted in social relationships and schemes of action (both physical and social) (Piaget, 1969). He did not discount the co-equal role of the social world in the construction of knowledge.

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[3] The construct d*é*calage was not fully elaborated by Piaget (Meadows, 1993:208).

'There is no longer any need to choose between the primacy of the social or that of the intellect: collective intellect is the social equilibrium resulting from the interplay of the operations that all enter into in co-operation' (Piaget, 1970:114). Therefore the arguments that the ideas of Piaget conflicted with certain theorists (e.g. Vygotsky and Feuerstein) around the primacy of the individual over the social are not an accurate representation of the actual differences that do exist between these theorists (Dahl, 2005). It has, in fact been shown on a theoretical level that Piaget and Vygotsky occupied very similar territory with respect to their theories of the social origins of thinking (Smith, 1996).

Role of language

Piaget extensively studied the role of language in the development process, however, did not place emphasis on language as an important component in the development of cognitive structures (e.g. Piaget, 1952b). Piaget believed that language was not able to convey what was not already established in thought. *'Language is necessary but not sufficient'* for normal human development to occur (Campbell, 2002). The implication was that language is slightly delayed compared with thinking and therefore to use language to diagnose thought would in these cases give rise to a false diagnosis of immature thinking (Meadows, 1993). Paradoxically, it was Piaget's inappropriate use of language that was regarded as the reason for the failure of young children on certain conservation tasks (e.g. Donaldson, 1983).

2.2.1.3 Limitations of this theoretical perspective

Writing and terminology

Piaget's writing style has been criticized as difficult to understand (Boden, 1979; Campbell, 2002; Vuyk, 1981) and by others as graceless. When his thinking became increasingly complex, his writing became more convoluted. It is also thought that there was a lack of editing of his work. His writing style was also criticised for being so vague as to be irrefutable. Vuyk argues that any criticism of Piaget's writing style does not invalidate his theory. Piaget's tendency is to use the same theoretical terminology to characterize apparently distinct domains, for example his use of terms such as equilibrium, assimilation and accommodation has been criticized. These terms have clear meanings in biology from where they are drawn, however, confusion arises when they are transplanted into psychology (Boden).

Research methodology

Piaget's methodology has been criticised for its lack of controlled experimental designs and statistics (Boden, 1979). He preferred a quasi-clinical method. This criticism was particularly evident in the United States (US) in the 1970's when American psychology was in ascendancy. A historical review reveals that US psychology initially rejected Piaget, as a result of the dominance of behaviourism in the US at that time. Those who did not reject Piaget, called themselves neo-Piagetians and maintained that their interpretations of Piaget had extracted all the value found in his theory, and then proceeded to improve it. Campbell (2002) argues that much of the criticism levelled against Piaget was misguided and the result of misinterpretations of his theory. It could also be argued that the complexity of Piaget's work and his prolific, voluminous contribution over 60 years, were bound to produce inconsistencies and errors. There are many examples where Piaget in fact reversed positions formulated earlier in his life, with ideas formulated later in his life (e.g. the construct *'structures-d'ensemble'*) (See Chapter Two, p.27, for further discussion of this construct.)

Neglect of affective, social and motivational factors

Piaget has been harshly critiqued for his singular focus on intellectual and cognitive development of the child. *'Perhaps the clearest concept of the intellectual development divorced from the development of the need-affective sphere is that contained in the theories of J. Piaget'* (El'konin, 1971:233). The intellect as an adaptive mechanism is considered to be responsible for the child's adaptation to the world of things. Thus the prime motivation for intellectual development would come from operative structures (Furth, 1970). Notwithstanding, Piaget did not negate the influence of the social/environment on the child's development, however, he contended that intellectual development proceeds by way of formal abstraction.

Stage model

The notion of there being broad stages of development, each characterized by distinct structures has been questioned (Gelman & Baillargeon, 1983). Experimental evidence no longer supports the hypothesis of a major qualitative shift from pre-operational to concrete operational thought (Donaldson, 1983; Gelman & Baillargeon, 1983). No one would argue that most children who are less than six years old fail standard Piagetian tasks, however how should one interpret these failures. Do they indicate differences in cognitive capacity? Piaget would explain that the child's operations are organised into well-integrated mental sets, or structured wholes, and that they develop [4]logico-mathematical models to characterise these wholes. Smith (1985a) contends that the process of knowledge development moves from indifferentiation to differentiation, a position supported by Piaget. (Smith, 1985a, cited in Adey, 2002). Piaget made use of an explanatory model of modal development. He argued that modal concepts of possibility and necessity are central to human understanding and that modal errors in these areas lead to developmental differences in understanding. These errors are classified either as false positive modal errors (something that was judged possible that was not) or as false negative modal errors (something that was not possible/necessary). Piaget's logical model was regarded as compatible with his modal mode (Smith, 1985b). Thus, it was not critical whether the child was able to solve a problem or not, but whether the child was able to distinguish between the empirical aspects of the concepts (possibilities) and the logical modes of thinking required (necessities) to solve the problem.

In addition, most studies which have compared children's abilities at the concrete operational phase have failed to show high intercorrelations between several of the abilities tested (e.g. Berzonsky, 1971; Dimitrovsky & Almy, 1975; Jamison, 1977). Such findings would not be inconsistent with Piagetian theory. He did not claim that all concrete operational abilities are based on a

[4] Piagetian theory fails to provide an adequate formal description of the logico-mathematical structures underlying concrete operations. However, Gelman & Baillargeon (1983) argue that one should not conclude that no structures exist, as perhaps one has not yet succeeded in finding their proper characterisation.

single underlying structure or that all these abilities emerge in a parallel fashion (Gelman & Baillargeon, 1988). If individual development proceeded from incomplete displays of concrete operations, culminating in concrete competence, then one would expect that i) no child would display all concrete operations at the same time, ii) low inter-task correlations would therefore be expected, iii) heterogeneity in the demands of concrete operational tasks would be found, and iv) the pre-cursors of concrete reasoning would be present during early childhood (Smith, 1987b). Piaget (Piaget & Garcia, 1987) eventually accepted this position (i.e. point number: iv).

Later in his career, however, Piaget made changes to the dramatic demarcation between stages. He then regarded the moves from stage to stage as the disequilibrated periods for brief periods in time. He later proposed that a considerably less step-like development process occurred, where there were smoother transitions over years and where stages flowed into each other. This also marked Piaget's move away from his structures d'ensemble (Meadows, 1993). Thus, one might concur with Gelman & Baillargeon (1983:169): *'Piaget (was) correct about the general issue, but not about the specifics.'*

Mechanisms of change

Klahr (1976) is dismissive of Piaget's principles of assimilation and accommodation as mechanisms to explain change, however neither is he convinced that sociogenetic or microgentic studies are accurate or descriptive enough. A pervasive criticism of Piaget has been his lack of specification of the procedural mechanisms which generate the phenomena he describes (Boden, 1979; Meadows, 1993). Piaget has thus been accused of reverse psychologism, that is, the assumptions that are made about accomplishments of which we are capable become descriptions of the processes by which we produce those accomplishments. We cannot however conclude that the forms of logic described by Piaget (e.g. mathematical structures) are necessarily responsible for all acts/operations performed (Campbell, 2002). For this reason, critics of Piaget suggest that his model is actually just maturation and environmental triggering of innate mechanisms (e.g. Foder, 1980).

Role of the teacher

Many developmental psychologists have criticised a view of the child as an active, but lone scientist, which underlies the orthodox Piagetian model. The Genevan methodology deliberately avoided mediation and in fact would offer counter suggestions in order to gauge the stability of the child's concepts (Shayer, 2003). This approach was consistent with Piaget's approach as a genetic-epistemologist and his focus on how children in a population responded (unaided) to a stimulus. Piaget, in fact never claimed that he was interested in the individual child (Shayer, 2003). Piaget's work as a researcher did not intend to provide pedagogical applications. Neo-Piagetian interpretations of the teacher's role have placed emphasis on 'how-to' questions. These questions are answered more directly by a kind of 'discovery method' and by placing opportunities in the path of learners. The questioning is sometimes done in a challenging way in order to create cognitive conflict or to stimulate justification at a conceptual level. Other 'mediational mechanisms' used by the neo-Piagetians might include: - explication, teaching for transfer, self-mediation, and creating a need to know (Haywood, 2003). Thus from a neo-Piagetian perspective, when the learner on his/her own deduces a rule or a concept for themselves, that discovery represents a different level of learning to understanding what a mediator has said (Haywood).

2.2.1.4 Conclusions

The perception that Piaget was only concerned with the structural aspects of thought is in direct conflict with the entire Piagetian enterprise since the early 1920's, which was committed to finding the mechanisms and processes responsible for the development of knowledge. Shayer (2003:478) provides a useful analogy to explain Piaget's focus on both structural and process aspects of knowledge: *'…it is necessary to imagine the state of our knowledge without Piaget's life-work. It is like medicine before anatomical knowledge was available: before you can intervene to remedy a dynamic function you first must know what it is that is in motion and interaction …Piaget had to first describe …all the steps of knowledge development all over the psychological spectrum'.* Those who have been critical of the structural aspects of Piaget's work have tended to reduce the complexity and the value of his seminal ideas to reductionist, either-or statements. Other criticisms of Piagetian theory have also presented similar conclusions, for example: biological determinism; a rigid (all-or-nothing) stage model; discovery learning; the individual without consideration of the social context in learning. Piaget, as a researcher, paradoxically contributed more to the understanding of development through his detailed, painstaking descriptions (based on his own case studies) than various theorists (Shayer, 2003). Piaget's complex body of work, which is often not internally consistent, may be the greatest source of on-going tension regarding the interpretation of his work. This does not reduce the importance of his foundational 'schema' for those committed to uncovering the dynamics and tensions involved in the process of development and learning.

2.2.1.5 Key contributions from the Piagetian perspective

- Piaget introduced constructivism to the world and therefore successfully bridged the dichotomy between nature and nurture.
- A central tenet of Piagetian theory suggests that knowledge arises from action and fulfils a biological function. This debunked the enduring myth that knowledge was created out of atoms/primitive concepts/mental entities, that is, the notion that knowledge could be reshuffled but not added to.
- Piaget's operational view of knowledge, (i.e. knowledge of what could happen and sometimes knowledge of what must happen as well as the reverse) is therefore often considered his most important contribution. This construct has important implications for education.
- Piaget thus contends that infants and children do not always think the way adults do. He reasoned that if there was a qualitative difference in knowledge between child and adults, then thinking at earlier developmental stages was different in kind from thinking at later stages.
- The heart of cognitive development is conceptualisation: this is something that Piaget saw sooner than most other psychologists (Vergnaud, 1996). Piaget tried to analyse conceptualisations by observing and 'provoking' the

child's activity. Piaget was therefore concerned with the difference between success and understanding, that is, the difference between being able to do something and being reflectively conscious of how one does it. This contradicted the common sense notion that knowledge about a concept (e.g. for example, quantum physics) also implied an automatic and deep understanding of the concept.

2.2.2 Lev Vygotsky

2.2.2.1 Background and overview

Lev Vygotsky (1896-1934) was born in the Soviet Union. He died at the young age of 37 of tuberculosis, but worked at a highly productive rate during his short, but illustrious, professional career. He had produced **180 -*270 pieces of scientific research at the time of his death (*Schutz, 2002 & **Werstch, 1985). However, as a result of his premature death, many of his ideas were developed by his successors. These have not been without disagreements (Kozulin, 1986, 1990a; Zinchenko, 1985). Vygotsky's work focussed on creating change. His psychology was social, cultural, political and historical in orientation (Sutton, 2002). Thus, in order to develop an adequate understanding of Vygotskian theory, it is also necessary to have a sense of the many tumultuous political upheavals and issues of the time.

Graduates of philosophy in pre-revolutionary Russia mostly became teachers in public schools, a position that was not allowed for Jews. Vygotsky, who came from a Jewish family, thus initially enrolled at the University of Moscow to study medicine. However shortly after the start of his studies, he changed courses to study law. Both of these professions would have allowed him to live outside the boundaries of the Jewish [5]Pale of settlement. He was also not content with his decision to study law and therefore concurrently enrolled in the historical-philosophical division of the Shanavsky University in Moscow. This institution was not officially recognized in the Soviet Union. Like Piaget,

[5] The Pale was a settlement where Jews were allowed to live and open businesses without restriction. Gomel, the town where Vygotsky lived was predominantly Jewish (Kozulin, 1990b).

Vygotsky's first research paper was not a study in psychology. [6]It was a paper on the Shakespearean tragedy, Hamlet. It was at this time, as a young student in Moscow, that Vygotsky developed an interest in psychology (Vygodskaya, 1995).

Vygotsky was a Marxist and was committed to the dialectical-materialistic understanding of development, where history is a conflict between opposing societal forces (Sutton, 2001). What Vygotsky sought and found in Marx was a social theory of human activity set in opposition to naturalism and the passive receptivity of the empiricist tradition. Marx therefore attracted Vygotsky with his concept of human praxis: the concrete historical activity that serves as a generator of different forms of human consciousness (Kozulin, 1998). Notwithstanding, Russian psychology both before and after the revolution was also deeply dependent on European Psychology (e.g. Wundt, Janet). Even at the peak of the influence of the reflexological approach in Russian psychology it was committed to a deeper understanding of the mind, in contrast to the narrow focus on behaviourism that was the trend in the US. Vygotsky (1962:9) in fact wrote with much admiration about Piaget: *'Psychology owes a great deal to Jean Piaget'.* Vygotsky acknowledged Piaget's revolutionary impact on child psychology (Kozulin, 1998) and accordingly introduced Piaget's first two books published in the Soviet Union (in 1932).

The concept of activity, a core construct in Vygotskian psychology, was reflected in his earliest writings (1925) as a way to restore the legitimacy of the concept of consciousness and challenge the dominance of behaviourism. The concept of activity suggested that socially meaningful actions served as an explanatory principle with regards to the development of human consciousness. The concept of activity was incorporated into his cultural-historical theory of higher mental functions and used in conjunction with his

[6] The importance and influence of literature in Russian society can not be underestimated, as encapsulated in the following quotation: *'The text …is the primary given of all…disciplines and of all thought on the human sciences and philosophy in general …'* (Bakhtin, 1986:103)

studies of language and development of concept formation. A dramatic event in the history of this construct occurred during the 1930's which altered the course of Vygotskian psychology for the next 40-60 years. This transpired when a group of Vygotsky's disciples split from their teacher and came up with a revisionist version of the concept. This version put practical activity at the forefront while simultaneously playing down the role of symbolic tools as mediators of human activities (e.g. Leontiev & Luria, 1968; Zinchenko, 1984). These influential neo-Vygotskians placed activity in the broader social context and therefore distanced themselves from Vygotsky's emphasis on the individual-cultural aspects of activity (Kozulin, 1998). The former located concrete activity closer to the ideal of the socialist political programme of the day that aimed to transform the condition of humankind. It was this version of activity theory that received official status in the Soviet Union and would remain the dominant view until the late 1970's. Ironically, the neo-Vygotskians' version of activity theory was closer to the Piagetian programme of exploring the internalization of sensory-motor actions, whereas Vygotsky was also concerned with the context (viz. symbolic tools) which gave rise to this activity (Kozulin).

Vygotsky's work was banned from the 1930-1950's which consequently also prevented the international community from gaining access to his work. Vygotsky was an independent thinker who expressed many original ideas. He was consequently denounced as 'anti-Marxist', 'eclectic' and 'erroneous' (Kozulin, 1998). He was also attacked for his alleged bias against ethnic minorities. Vygotsky's work was 'rehabilitated' in the 1950's during the post-Stalinist period. However, it was not until the 1990's that many of the 'myths' regarding his work, initially introduced during the Stalinist era, were debunked in Russian society (Kozulin). The process of reconstruction (Perestroika) initiated serious changes in the education system which were marked by the introduction of the social-pedagogic movement (in 1991). Vygotsky's ideas found fertile ground in this movement and played an important role in the renewal of the Russian school system. This approach recognized the power of pedagogy to create new mental potential, and the importance of the wider social and cultural context of children's lives in securing the maximum individual development (Sutton, 2002).

2.2.2.2 *Main theoretical tenets*

Socio-cultural theory

Vygotskian theory (Vygotsky, 1930/1981; 1978; Vygotsky & Luria, 1930/1994) of child development appears as a process of integration of maturational and experiential factors into the leading formative process that has a socio-cultural nature. At each stage of the child's development there is an interaction of natural factors, determined by genetic and maturational mechanisms with socio-cultural factors. Pure or natural child development is impossible, as from the very beginning the interaction of the child with the environment is mediated by the socio-cultural world of humanity (Kozulin, 2002).

The closest approximation of natural development is called primitivity where a child's development is guided almost exclusively by maturational processes and unsystematic everyday experiences. Such a child's experiences remain unmediated by either the socio-cultural symbolic systems (speaking, reading, writing, mathematics) or by the systematic experience of adults. The normal developmental pattern includes the interaction of maturational and spontaneous experiential factors of the child with the systematic formative influence of the family, community and the given culture. The latter influence is conveyed predominately through the symbolic mediators and the educational systems built around them (Kozulin, 2002).

Socio-cultural theory (Vygotsky, 1978; Vygotsky & Luria, 1930/1993) makes an important distinction between experiences produced by the immediate contact of the individual with environmental stimuli and experiences shaped by interactions mediated by symbolic tools. The most ancient of these symbolic mediators included casting lots, tying knots and counting fingers (Vygotsky, 1978). However, beyond these primitive tools lie vast areas of higher order symbolic mediators including different signs, symbols, writing, formulae, graphic organizers, etc. Psychological tools are thus used to transform natural responses into higher mediated processes. Psychological tools aim to master the natural behavioural and cognitive processes of the individual (Kozulin, 1990). In their interaction with the socio-cultural mechanisms, the natural developmental processes do not disappear, but become integrated into a new system as its subordinate elements. They reveal themselves under special experimental conditions and also when higher functions are disturbed or deficient (Kozulin, 2002).

Periodization of human development: A stage model

Towards the end of his life, Vygotsky was interested in the [7]periodization of human mental development, that is the way children pass through distinctly different ways of thinking and learning (El'konin, 1971). In this way Vygotsky was not different from many Continental educators and psychologists (e.g. Piaget), with their diverse views of what constitutes significant stages in children's mental development (Sutton, 2001). Vygotsky referred to sensitive periods of development, but does not regard them as spontaneous manifestations of previously latent functions, but as a reflection of interaction between the inner development of cognitive functions and external socio-cultural factors. These are periods of dramatic change ('age of crisis') that lead to the emergence of the new quasi-stable structures (Vygotsky, no date found, cited in El'konin, 1971). For example, Vygotsky argued that a child at the age five to seven would be ready to learn to read because more general cognitive functions essential for reading are usually in a state of formation during this age period. In fact the mastery of reading and other systematically learned activities is inseparable from the development of cognitive functions integrated into these activities. Vygotsky was unequivocal in his conviction that cognitive functioning based on higher order symbolic tools associated with literacy and numeracy is superior to that based on everyday experience and the oral transmission of culture (Vygotsky & Luria, 1930/1993; Luria, 1976). This conviction is based on the value attached by Vygotsky to the development of metacognitive functions and critical reasoning which are

[7] The Russian term may literally be translated as 'periodization'. Whereas, the term 'stage' is used in America and Western Europe (El'konin, 1971).

related to the mastery of one's own psychological functions achieved with the help of higher order symbolic mediators. Cognitive development and learning according to Vygotsky therefore depends not only on the child's biological readiness to learn during 'sensitive periods', but on the mastery of symbolic mediators, their appropriation and internalization in the form of inner psychological tools (Kozulin, 2002).

Symbolic representation and mediation

It cannot be taken for granted that children will automatically detect a symbolic relationship, no matter how obvious it appears to adults. However, learning materials developed for children often make the assumption that they have already mastered the symbolic relationships between object symbols and concepts. [8]Symbols remain inert unless their meanings as cognitive tools are properly mediated. The concept of mediation is therefore central to Vygotsky's (1978, 1934/1986, 1983/1997, 1984/1998) theory of child development (Karpov, 2003 ; Meadows, 1993). *'Mediation, or the use of communicable systems for representing reality as well as acting on it, is at the foundation of cognitive processes, which cannot therefore be reduced to automatic links between stimulus and response' (*Meadows, 1993:243). [9]This also points to an important issue, that is, the relationship between symbolic and human aspects of mediation. The mere availability of signs and texts does not mean that they will be used by learners as psychological tools. The appropriation of symbolic mediators is dependent on the goal the teacher/parent sets for the tool-mediator offered to the child. Thus not every type of literacy leads to the cognitive changes suggested by Vygotsky and Luria (Luria, 1976), unless literacy is mediated to the student as a cognitive tool.

[8] Vygotsky did not fully develop his ideas of semiotic mediation, however, mainly emphasised the role of language as a psychological tool.

[9]Kozulin contends that Vygotsky focussed on the role of symbolic mediators, whereas it was Feuerstein who fully articulated the role of the human mediator. This distinction will be explored in the next section of the chapter.

Spontaneous concepts and scientific concepts

Vygotsky's conception of the relationship between instruction and development is reflected in its most concrete and developed form in his analysis of scientific concepts in formal instruction (1934/1986:128). Vygotsky was concerned with whether the social and natural science concepts learned in school (*e.g. 'amphibian', 'force', 'capitalism'*) develop in the same way and have the same psychological characteristics as the concepts that the child acquires in a more spontaneous manner in the pre-school period (e*.g. 'brother', 'puppy', 'bike'*). Vygotsky rejected two positions on this issue: i) that scientific concepts are merely transferred from adult to the child in instruction, that is, they do not develop and ii) that scientific concepts follow the same developmental course as spontaneous concepts (Minick, 1987). Piaget also made distinctions between knowledge schemas and schemas for dealing with new information, however, did not provide the detail with respect to the didactics.

Spontaneous (everyday) concepts originate from the child's everyday activity, while scientific concepts emerge from systematic school-based learning. The former are described as rich but unsystematic and highly contextual, whereas the latter originate in structured specialized activities in the classroom and are characterized by systematic and logical organization. The neo-Vygotskians contend that to understand an object theoretically one has to construct its ideal form and to be able to experiment with it (Kozulin, 1998a). *A* theoretical concept is generative in the sense that it should be possible to generate from it a number of empirical outcomes. It is universal, that is all empirical data are explainable through it and it should not require prior knowledge of all those phenomena it is expected to explain. A focus on theoretical concepts (through a [10]theoretical learning approach) will help learners to construct a deep understanding of the object and thus liberates them from domination of surface facts. On the other hand, spontaneous concepts are acquired through the identification of similar features in a group of concrete objects which are

[10]It interesting to note that theoretical learning cannot be achieved in a *'pure form'* without domain specific learning (Lompscher, 1997, cited in Kozulin, 2002).

then given a verbal label. This requires a simple abstraction that does not demand any higher-level thinking, which is needed for 'theoretical thinking' (Kozulin).

Vygotsky also claimed that the development of scientific concepts advanced the development of spontaneous concepts *(1934/1986:147).* Vygotsky was not saying that teachers should remain ignorant of the learners' level of mental development and in fact argued that direct teaching of concepts is impossible and fruitless. *'… a teacher who tries this usually accomplishes nothing, but empty verbalizations… parrot repetitions of words by the child… simulating knowledge of the corresponding concepts but actually covering up a vacuum'* (*1934/1986:*150). He was suggesting that teachers should not avoid introducing new concepts to learners, but should begin the process of their appropriation. Deliberate introduction of new concepts does not precede spontaneous development, but charts a new path for its development. Therefore, if one accepts that a dual and reciprocal relationship exists between conceptual learning and cognitive development within school subjects, then the development of the latter should make higher levels of learning possible. In addition, as children are challenged by new school learning demands they will be stimulated to re-process the learning in their own spontaneous manner, creating another stimulus for cognitive development.

The Zone of Proximal Development

The Zone of Proximal Development (ZPD), a core Vygotskian theoretical construct, is directly related to the above assertions. Even though the ZPD was central to Vygotskian theory it was only formulated later in his writings (Wells, 1998). Sutton (2001) contends that Vygotsky's zone of [11]next development is more than an abstract formulation. Vygotsky (1978:86) defined the ZPD as the: -

[11] Next or nearest development is regarded a more literal translation of the Russian term 'blizhaishei', as opposed to the word proximal.

'…distance between the actual developmental level as determined by independent problem-solving and the level of potential development as determined through problem-solving under adult guidance or in collaboration with more capable peers'.

The ZPD represents a challenging alternative truth, that childrens' essence is created out of active collaboration with active adults and more experienced peers, in the transmission of culture from one generation to the next (Sutton, 2001). The learners' potential is not fulfilled or achieved in their education, but is actively created out of the pedagogic process. The ZPD shows not only the today of development, but also the tomorrow of development. The latter indicates what children can learn in collaboration with others who are more experienced. The zone of next development provides insight into the process of forming new mental structures by teaching and provides a unifying theoretical construct that links culture, history, pedagogy, mental development and neuro-psychology (Sutton). New psychological formations that emerge in the ZPD are not simply brought from the outside and added to an existing repertoire of functions. Scientific concepts and the forms of thinking associated with them are not simply planted in a child's mind from the outside, but they would also not develop without the reorganization of the child's psychological activity that occurs in social interaction (Minick, 1987). It could therefore be argued that the ZPD, with its emphasis on the collaborative process as a catalyst for change (aimed at improving the human condition) operationalizes Vygotskian theory.

Internalisation of learning

The concept of internalisation (equilibration being the parallel concept in the Piagetian framework) also plays a central role in Vygotsky's theory of learning and development. In fact it might be said to be the end for which interaction in the ZPD was conceived (Wells, 1998). *'All higher mental functions are internalized social relationships'* (Vygotsky, 1981:164). Vygotsky (1978:57) formulated a general genetic law of cultural development to expound this concept: -

' …every function in the child's cultural development appeared twice: first on the social level, and later on the individual level, first between people (interpsychologically), and then inside the child (intrapsychologically)'.

For example, Vygotsky traced the differentiation of the child's initial 'social speech' into speech for others and 'egocentric' speech for self which, in turn, becomes converted into the intrapsychological activity of 'inner speech' (Wells, 1998). Vygotsky saw thinking as the product of internalization. The child appropriates this function through practical activity (social interaction) and creates new mental tools. The central process involved in internalisation is the gradual emergence of control over external processes, including control over external signs and systems of communication (Meadows, 1993).

Language and action

Vygotsky rejected the notion that speech and action evolved independently of each other or even in parallel (Shayer, 2003). Vygotsky instead argued for the unity of the evolution of speech and action. Even though action is initially dominant in children, they more easily make meaning with words than adults do because children are not yet over determined by the societal norms, rules and uses of language. Children are therefore closer to the essential characteristic of language as an activity which they use as a tool for meaning making through language play (Newman & Holzman, 1993). To separate speech and action or to place more emphasis on either would create a dualism, conflicting with the dialectical perspective that was adopted by Vygotsky. Shayer (2003) argued that Piaget and Vygotsky had reached an almost identical position on the question of the development of language and action by 1933.

Language and thought

The ongoing debate of whether language precedes thought or the converse is an argument with dualistic assumptions (Newman & Holzman, 1993). For Vygotsky, thinking and speech were not separate developmental process that arbitrarily came together. According to Vygotsky early childhood speech was not an individual egocentric act (as suggested by Piaget), but the reverse: it was both social and communicative in origin and intent. Egocentric speech thus had a very specific function. Vygotsky (1962:16) contended that speech *'…besides being a means of expression and release of tension …(it) soon becomes an instrument of thought in the proper sense- in seeking and planning the solution of a problem'*. Vygotsky saw the activities of speech, word meanings, signs, and language as psychological tools created by our species that make human development and learning possible (Newman & Holzman). Speech thus forms what Vygotsky referred to as higher mental processes. Language does not simply reflect or represent concepts already formed on a non-verbal level. Rather, it structures and directs the processes of thinking and concept formation themselves.

2.2.2.3 Limitations of this theoretical perspective

Terminology and writing

A major criticism of Vygotsky, which could also be considered his greatest virtue, was the fact that he updated his thinking every time he gave a paper, instead of trying to make himself consistent with what he had already said. Vygotsky thus made things particularly difficult for the reader to gauge what the issues were he was trying to address (Shayer, 2003). Minick (1987) in defence of Vygotsky explained that his theory was constantly evolving which resulted in his written oeuvre not being internally consistent. An additional problem for scholars of Vygotsky has been the 'severe and pervasive' difficulties of the English translations of his work (Sutton, 1983). However, with the recent shifts towards globalisation, more first language Russian speakers have begun to translate Vygotsky into English (e.g. Kozulin 2002, Karpov, 2003).

Research methodology

A general critique of Vygotsky's work relates to the limited availability of quantitative information, which raised questions regarding biases in available studies (Grigorenko & Sternberg, 1998). This was because of the lack of hard data from carefully controlled studies. The data collected was based on descriptions of programmes in which little attention was given to the quantitative aspects of the work in general and to programme evaluation in particular (Grigorenko & Sternberg).

Neglect of affective, social and motivational factors

The primacy of cognition in Vygotskian literature and its consequent neglect of affective, social and motivational dimensions is regarded as a general weakness of this theory. Wells (1998), however, suggested that the reason for this imbalance should not be attributed directly to Vygotsky, but to the cognitive revolution of the 1960's and the central role of the metaphor of the mind as computer, played in cognitive science. Vygotsky (1987:282), in fact had a balanced conception of development, as was seen in Thinking and Speech: -*'thought has its origins in the motivation sphere of consciousness, a sphere that includes our inclinations and needs, our interests and impulses, and our affect and emotions. A true and complex understanding of another's thought becomes possible only when we discover its real, affective-volitional basis'*.

Zone of Proximal Development

Wells (1998) poses a number of challenging questions regarding Vygotsky's ZPD. For example: Did instruction need to be given in verbal face-to-face interactions? Should the account offered by Vygotsky of learning and teaching in the ZPD be taken as universal and normative or merely descriptive of the practices of a particular stratum of society in which he lived? Did the ZPD only apply to intellectual development? Was there any point in the child's development that the ZPD was a fixed and quantifiable attribute of that particular child? These questions will be addressed (in the order that they are presented above) in the section below.

- **Are changes in the ZPD mediated only by verbal face-to-face interactions?**

Learning and teaching in the ZPD is clearly dependent on social interaction which most typically involved, from a Vygotskian perspective, face-to-face interactions mediated by speech. The development of higher mental functions is achieved largely through the construction on the intramental plane of the discursive practices that are first encountered on the intermental plane of activity-related social interaction. However to focus only on face-to-face interaction mediated by speech is to seriously limit our understanding of the range of semiotic mediation. Vygotsky (1981:137) was clear that the means of semiotic mediation were not limited to speech, he included various systems for counting, mnemonic techniques, algebraic symbols, works of art, writing, schemes, diagrams, maps, and mechanical drawings, etc. Vygotsky's premature death did not allow him to elaborate on these ideas. Broadening the range of modes of semiotic mediation leads to the recognition that there are other sources from which learners can receive assistance in the ZPD (Wells, 1998).

- **Are applications derived from the ZPD universal?**

Vygotsky's assumption regarding the inevitable progression at the level of ontogenetic development has been questioned (Wells, 1998). It is proposed that the learner's interpersonal experiences might constrain or even distort his/her development (Engestrom, 1996). For example, where children are extremely deprived and abused this could result in long-term harmful consequences for themselves and society at large. Vygotsky (like Piaget) was challenged with respect to his 'stage model', according to which development unfolds in a predictable sequence of steps which have universal applications. However, Vygotsky's socio-culturally-orientated theory appears to have been less vulnerable to the harsh critique handed out to the Piagetians. The reason for this might be that Vygotsky did acknowledge the locally accomplished nature of development, but his theory clung to the idea of only vertical improvements (Engestrom, 1996).

- **Does the ZPD refer to changes only in the development of abstract thinking?**

A further criticism of Vygotsky was that his work placed emphasis on the mastery of abstract and decontextualized modes of thinking, concerned only with intellectual development. Cole (1985), however, argues that this would be at variance with Vygotsky's own requirement that assessment be related to the cultural activities in which the tested learner habitually engages. The implication is that ZPD assessment is more appropriately carried out in the context of particular students' engagement in an educational activity (Allal & Ducrey, 1996). The practices of reciprocal teaching (Palincsar & Brown, 1984) and curriculum-based approaches which include a formative and informal approach to assessment (e.g. Schneuwly & Bain, 1993), also fit this approach. Tharp and Gallimore (1988) refer to the latter assessment approach as instructional conversation. It is this approach that is considered the best application of assessment to guide instruction from a Vygotskian perspective.

- **Are the changes in the ZPD fixed and quantifiable?**

Shayer (2003) argued that the initial interpretation of the ZPD given by Vygotsky has been shown to be partially wrong. Shayer contends that Vygotsky's ZPD provided a limit of the developmental potential of a child. However, Minick (1987) argued that this interpretation (especially as applied to the assessment of learning) of Vygotsky's ZPD is incorrect. He argues that Vygotsky's ZPD was a framework for analysing the child's current state of development and for predicting the next level of development that the child might be expected to attain. Vygotsky was not concerned with the quantitative assessment of learning ability or intelligence, but with the qualitative assessment of psychological processes (Minick, 1987). Therefore instead of viewing development as progress towards some ideal, the ZPD provides a focus for the transformative nature of learning, with an emphasis on diversity rather than on improvement. Wells (1998), however, contended that this idea was only 'embryonic' in Vygotsky's work.

2.2.2.4 Conclusions

As Western societies enjoy more time and broader exposure to Vygotsky, there is also more opportunity for constructive and informed debate. Notwithstanding the many limitations of Vygotskian theory (compounded by his early demise), it remains difficult if not impossible to exclude him from any serious discussion about learning. Even though Vygotskian theory subscribes to a biological perspective of development, as does Piagetian theory, his work still appears to enjoy much attention. The reason for this could be Vygotsky's additional socio-cultural emphasis, that is, his equal insistence on the relevance of social, cultural, and historical milieu to the individual's cognitive development. This is a theory which could contribute to an incisive analysis of learning processes and therefore be of great importance to educators.

2.2.2.5 Key contributions from the Vygotskian perspective

- For Vygotsky, psychological activity has a socio-cultural characteristic from the start of development. Children from this theoretical perspective are thus not regarded as lone discoverers of logical rules, but individuals who master their own psychological processes through psychological tools offered in social interaction by a given culture (Kozulin, 1998a).
- Vygotsky proposed that learning and teaching in the ZPD provide both the assurance of a degree of cultural continuity and the opportunity for creative transformation and further development, that is, where resources of the past are deployed in the present to construct an envisaged future (Wells, 1998). Vygotsky placed emphasis on instruction and specified a certain kind of instruction in the ZPD: which leads development. This has many implications for the kinds of teaching-learning that take place.
- Vygotsky emphasised the role played by symbolic mediators in the development of human cognition. New symbol systems (e.g. literacy learning) that are not explicitly and systematically mediated as psychological tools remain inert empirical knowledge. Mediation is therefore central to the process of learning and development whereby natural responses are transformed into higher order processes.

- Vygotsky's most practical elaboration of the theoretical interrelationship between instruction and development was expressed in his understanding of conceptual development. Undeveloped scientific concepts are mediated through other concepts, that is, their development is inherently dependent on the development of spontaneous (everyday) concepts. However, it is the scientific concept which moves ahead into a zone where the corresponding potential has not yet matured. This highlights the decisive role of conceptual development in the mental development of the child (Minick, 1987).
- Language is pre-eminent amongst the complex 'signalling systems' which Vygotsky considered, and the relationship between language and thought was possibly his central interest (Kozulin, 1990b; Vygotsky, 1986).

2.2.3 Reuven Feuerstein

2.2.3.1 Background and overview

Reuven Feuerstein, was born in Botosani, Romania, 1921. Feuerstein was raised in a religious Jewish family environment and was taught by his father, it was here that he developed a love for books and learning. It was also in this context that his dream of a re-established Jewish homeland in Israel was born. This yearning to live in Israel, arose largely as a result of the pain and misery which typified the lives of European Jewry. Feuerstein's optimism about a better future would eventually influence his philosophy as well as his theoretical system (Burgess, 2000; Norguez, 2002).

At the age of 17, Feuerstein went to live in Bucharest and joined up with many others who had been denied access to advanced studies in philosophy or medicine. At this time, Feuerstein enrolled and began his studies at a teacher's seminary in Bucharest. Feuerstein was arrested for his involvement in Zionist activities and taken to a labour camp. He managed to escape from this camp and thereafter evaded arrest and eventually smuggled himself out of Bucharest on a boat and arrived in Palestine (Burgess, 2000; Norguez, 2002). While reflecting on these life threatening events, Feuerstein explained that it was the uncertainty or disequilibrium that led him to plan, to anticipate, and to *'create conditions of life which are adaptable in states of oppression' (Interviews with Feuerstein (1), 1994:5).*

In Israel, Feuerstein was confronted for the first time with children, survivors of the holocaust and was determined *'…not to lose one more child' (Interviews with Feuerstein (2), 1994:6).* It was this experience that propelled Feuerstein to embark on the development of an educational programme. The purpose of this programme would be to help these children to recognize that they came from a rich past with thoughtful traditions, and that they were a vital part of the dynamic present and future (Burgess, 2000). Feuerstein was enrolled at the first teachers' training college in Israel, but from the start rejected the dominant behaviourist model of the time: *'Already I was too sophisticated and had too many successful experiences as a mediator to accept such things. I knew humans were not simply registers of things and …certainly behaviourism did not provide long-term positive possibilities'* (Interview with Feuerstein (3), 1994:6). Instead he argued that humans were not static beings, but rather were dynamic in that they could reach towards unlimited positive or negative potentials.

Feuerstein became seriously ill with tuberculosis and was sent to Switzerland to receive treatment. Feuerstein had, however, not yet decided on the final path that he would follow: *'I was constantly moving between philosophy, psychology, and biblical sciences … It took me years to put shutters on my eyes, to focus on one thing'* (Interview with Feuerstein (4), 1994:6). He was initially interested in writing a dissertation on the prophet Amos, however, decided against this (Burgess, 2000). Feuerstein instead decided to study psychology. Feuerstein's journey was remarkably similar to that of Piaget and Vygotsky. All three theorists studied psychology, not as their first option, but as the most pragmatic way to address issues, mostly of a quasi-philosophical nature, that could reveal core universal principles and truths.

While in Switzerland Feuerstein attended lectures presented by Carl Jung. Jung assisted in shifting psychology from the focus on sexual drives to a higher plane in which humans were transformed through universal archetypes. Feuerstein then went to Geneva to study with Piaget because of his decision to pursue cognitive psychology. Piaget's interest in human development, and, as a corollary, individual potential for growth in adaptive capacities, intrigued Feuerstein (Burgess, 2000). He was especially influenced by Piaget's scientific approach and his mode of questioning, which provided a protocol for systematic inquiry. He was also influenced by Piaget's approach to research, which included a collaborative inquiry. However, Feuerstein differed with Piaget in a number of ways, most pointedly expressed in their divergent views of development. Piaget proposed that development followed a prescribed set of stages, whereas Feuerstein contended that the order and timing of cognitive development is not set by maturation, but mediated by social experiences (Burgess).

Feuerstein studied and later collaborated with Rey from Geneva. Feuerstein and Rey discovered that many Moroccan children living in France who would have been classified as mentally retarded by conventional psychometric measures, were suffering from 'cultural deprivation'. These children had virtually no access to the types of thinking necessary for them to respond even to the simplest tasks. They had no logical systematic way of understanding the world around them. Feuerstein discovered that mediated intervention showed positive results with these children (Burgess, 2000).

The idea of human perfectibility was proposed by Rousseau (1762/1991) to designate what he felt to be the distinctive feature of the human species: - the faculty to perfect oneself aided by circumstances. Feuerstein's work also aimed to show that perfectibility is the very essence of the human being *'…if Man is perfectible then perfectibility should be considered a central goal in all action concerning Man'* (Hadji, 2000:31). Feuerstein has been guided by the 'principle of the possible' during his own life and has extended this notion to the lives of others. He was deeply aware of endo-exogenous conditions such as differences in maturation levels, emotional balance of the child or parents, and varying types and degrees of environmental stimuli or conditions. Feuerstein, contended that the human organism has the unique capacity to become modified in a variety of cognitive and motivational functions and to adapt to changing demands in life situations (Feuerstein & Feuerstein, 1991). Thus, his theory of Structural Cognitive Modifiability is about hope, dignity and positive potentials beyond current realities. In contradistinction, the doctrine of positivism advocates that a society can be analysed in purely objective mechanistic terms and provides few positive alternatives for those who are displaced, disabled, or disenfranchised by society (Burgess, 2000), thus enhancing the probability that those *'deprived of their heritage and cultural mediation would be placed in segregated and less cognitively challenging settings'* (Interviews with Feuerstein (5), 1994:14-15).

2.2.3.2 Main theoretical tenets

Overview of the discourse

Feuerstein's work did not only focus on scientific research, where the truth can be established through the construction of an adequate theoretical model, but involved a number of other fields. Hadji (2000) identified three fields in Feuerstein's work: i) *science*: theory of the development and functioning of human cognition, ii) *pedagogy*: practical instruments to promote development and learning through improved cognitive functioning, and iii) *ethics*: where issues are raised with respect to the legitimacy and meaning of an educational action. However it is the latter, that is, Feuerstein's ethical stance, which unites all the dimensions of his work.

i) Feuerstein the theoretician:

Development and Learning

Feuerstein contributed to the on-going grand debate psychologists hold with respect to the importance of development and learning. Here Feuerstein is in agreement with Vygotsky's position that learning activates development. According to this theoretical analysis it is the ability of the human being to undergo constant modification which is expressed in the dual dimension of development and learning. It is from this dynamic perspective that Feuerstein analyses the mental act as organized around seven parameters which he termed the Cognitive Map (Appendix 1). From this perspective, intelligence is perceived as a propensity, thus challenging the naturalistic and substantialist behaviourist conceptions of intelligence. Feuerstein's work therefore grappled with many of the same problems debated by Vygotsky (Hadji, 2000).

According to Hadji (2000), all theories offer answers to two questions: *'How is reality structured?'* and *'How does it operate?'* Reality in this instance refers to the human being and how he/she develops and learns. Feuerstein proposed that human beings are modifiable and endowed with the propensity to learn. If development and learning are regarded as facts, then the scientific problem is to create a model of humans which will incorporate these facts. Two interrelated issues are thus raised: the relationship between heredity and the environment, and the question of intelligence. Feuerstein addressed both these issues directly through his theoretical position.

Theory of Structural Cognitive Modifiability

Feuerstein's theoretical framework describes the ability of a particular person to change the structures within which he/she functions and to be able to build up new abilities, especially cognitive ones. Feuerstein (1990) claimed that plasticity is the primary characteristic of achieving/underachieving individuals and thus suggested that cognitive modifiability is a unique *'characteristic of man'*. Cognitive modifiability is regarded as the root of both development and learning and it is this ability of the individual to change which enables different modalities of functioning. Feuerstein here goes a step further than Piaget, in speaking about structural modifiability, which is a fundamental process of change that has a self-perpetuating nature. The change that humans are capable of does not consist simply of the content that they attribute to thought, but also of the instruments which act upon this content, that is, the cognitive structures. Piaget spoke of a constant and perpetual readjustment and balancing which engender mental structures (Hadji, 2000). Feuerstein et al. (1980: xviii) in contrast believed that *'…(the aim was) to achieve a permanent, enduring, and stable state of modifiability'*, that is, an emphasis on the unpredictable nature of cognitive change. In his rejection of the normative developmental model, Feuerstein offers the possibility of radical modifiability of psychological functions at practically any age and condition (Kozulin, 2002).

Cognitive and affective factors in human development

The fact that fundamental *'automodifiability of man'* (Feuerstein, 1990) is translated into changes which occur in cognitive structures does not imply that 'man' is reduced to a cognitive dimension. Feuerstein (1996) has suggested that cognitive factors cannot be separated from emotional factors. In fact he saw cognitive factors as 'auxiliaries' of affective factors in that they play a role in the genesis of affective elements (Feuerstein, 1990). The affective factors within this theoretical framework are accessed through the cognitive. However, it is the affective factors which are regarded by Feuerstein as the driving force of change (Hadji, 1994). For example, Feuerstein's applied education programme, Instrumental Enrichment aims at reaching the cognitive factors in order to create *'the vigorous affective modalities which direct, orient, and guide the behaviour of individuals'* (Feuerstein, 1990:95).

Theory of mediation: Mediated Learning Experience

Mediated Learning Experience (MLE) is an interactional process during which the human organism is subject to interventions of a mediator. The mediator is not necessarily an adult, but a more experienced person or even a peer. The latter will interpose him/herself between the learner and learning material, making learning intentional, helping the learner to extract the principles embedded in the material, and helping the learner to transfer these principles to other content areas (Kozulin, 1995). The mediator thus arouses the child's vigilance, curiosity and sensitivity to the mediated stimulus, and creates for, and with the child, temporal, spatial, and causal relationships between stimuli (Feuerstein, Klein & Tannenbaum, 1991). The goal of mediation is to arouse the potential of the learner to become a self-evolving actor. This is also the reason that it is possible to imagine mediation without an external mediator (implicit mediation) (Hadji).

Feuerstein and Feuerstein (1991:5) explained that the lack of Mediated Learning Experience (MLE) is responsible for an individual being *'devoid of all learning tools, habits, dispositions, and propensities to learn'* so that an individual's modifiability is more or less restricted. The theory holds that internalized cognitive dispositions and motivational propensities for which the learner may previously have had no perceptual basis or need can be developed through the provision of MLE. The provision of MLE thus fosters the development of the mental tools that are used to construct and act upon experience (Feuerstein, 1970,1979; Feuerstein & Jensen, 1980; Feuerstein, Jensen, Hoffman & Rand, 1985; Jensen & Feuerstein, 1987; Jensen, 1992; Tzuriel, 2001). This is why the notion of mediation becomes pivotal in the analysis of educational experiences.

It is the quality and quantity of the mediated experience that Feuerstein perceives as an explanatory factor of individual differences. MLE describes a set of qualities in human relationships (Jensen, Feuerstein, Rand, Kaniel & Tzuriel, 1988). As qualitative characteristics of interactions between human beings MLE can be observed and applied across cultures, settings, content areas, languages, ages and levels of functioning. In MLE an intentioned, affectionate and initiated person filters the learner's experience both from the standpoint of the information that is received and from the standpoint of the responses that are generated.

Feuerstein (1989:80) has developed an 'open-ended' list of 12 MLE Characteristics (Appendix 2), three of which (viz. transcendence, meaning and intentionality-reciprocity) he regards as: *'universally pervasive and omnipresent qualities in all human mediated interactions'*. However, research to be discussed (Chapter Two, p.56) questions Feuerstein's universalistic position regarding the importance of these three MLE Characteristics (Kozulin, 2002). Klein (2003) has attempted to clarify Feuerstein's MLE Characteristics. She contends that the basic elements which constitute a mediated interaction between a caregiver and a child include: focussing (mediation of intentionality and reciprocity), affecting (mediation of meaning), expanding (mediation of transcendence) and rewarding (mediation of feeling of competence). These factors of quality mediation have been found to predict cognitive outcome measures up to four years of age better than the children's own cognitive test scores in infancy or other presage variables related to pregnancy and birth histories and to mother's educational level (Klein, Wieder & Greenspan, 1987). Socio-economic, familial and cultural variables have been reported to impact on the amount and quality of parental mediated interactions (Feuerstein, 1989; Haywood, 1993).

Human Vs symbolic mediator

While Vygotsky proposed psychological tools as the mediating link between external and internal planes, Feuerstein et al. (1980) ascribed to the human mediator the critical linking of the two planes. These two views of mediation, however, are not incompatible as both theorists gave emphasis to social interaction, on the intermental plane, as the fundamental influence on the cognitive (psychological or mental) operations, bringing change on the intramental plane. MLE theory is thus similar to Vygotsky's socio-cultural theory, in its contention that students learn to construct knowledge and gain competence using systems of symbols that are rendered meaningful by context and, more generally, by culture (Geertz, 1973; Hong, Morris, Chiu & Benet-Martinez, 2000; Jensen, 1992; Karpov & Haywood, 1998; Robinson-Zanartu & Aganza, 2000; Shade, 1989; van Geert, 1993, 1998; Wertsch & Tulviste, 1992).

[12]Another similarity between these theorists is found in the use of the term *tools* (Vygotsky) and *instruments* (Feuerstein) in referring to the mechanism used to bring about change in psychological or mental operations (Pou, Tan & Seng, 2003). This again touches upon the relationship between human and symbolic aspects of mediation (Kozulin, 1998). Kozulin (2002) has proposed a synthesis between the kinds of learning required for acquiring psychological tools (Vygotsky) and the MLE Characteristics (Feuerstein) that are needed to create the cognitive prerequisites to initiate learning. Many of these cognitive prerequisites are closely related to the use of symbolic tools. For example, the

[12] Feuerstein, however, placed emphasis on the generalized nature (instrumental) of thinking processes, rather than on the specifics or content of what was being taught.

teaching of psychological tools must have the character of deliberate action. If there is no intentionality on the part of the teacher-mediator, psychological tools will not be appropriated by the students, or will be perceived as another content item, rather than as a tool (Kozulin, 2002).

ii) Feuerstein The Pedagogue:

Instrumental Enrichment: A means to an end?

Instrumental Enrichment (IE) is the pedagogical application of Feuerstein's theory of mediation. Feuerstein (1990:136) does not consider there to be a need for any compulsory materials: *'…one can live without IE, in fact one can live well without it'*. IE cannot be a desert island isolated from other continents of meaning: knowledge or cultural elements. [13]The mediator must bridge the material to the world of knowledge. But to return to the above contention: Why is there then a need for IE? A programme is needed to organize the environment. IE would otherwise (if it were a set of prescriptive exercises) be seen as a weakness in Feuerstein's model of educational action. Any programme could never be anything but a tool in the effort to organize the environment and lend it a mediating value. It is the effort to organize the environment that is essential. The exploration of possible tools can never end and it is in reference to this that the work of Feuerstein should be considered not just within the context of the battery of IE tools in its set form (Hadji, 2000). Thus for Feuerstein the instrument becomes a tool for cognitive change, whereas for Vygotsky a tool is the instrument required for the cognitive act (Pou, 2003).

IE aims at enhancing thought activity and the formation of cognitive skills through an appropriate system of exercises which are systematic, abstract and correspond to generalized mental tools. It is therefore the systematicity and the orientation towards the essential and generalizable which

[13] This could imply that Feuerstein's theory has *elements* of a stage theory because of the emphasis of the transitions from declarative to procedural knowledge. Unlike unidirectional stage theories, the theory of mediated constructivism ascribes significance to both the forward transitions through the stages (for efficiency) and to the reverse transitions (for modifiability). (Jensen, 2003)

characterizes the material which Feuerstein placed at the disposal of mediators. Feuerstein's contribution has therefore shifted the focus from the instrument as an 'accountable object' in the process of human learning to an object which offers opportunities to learn and understand (Hadji, 2000). Feuerstein, thus, only differs from Vygotsky in emphasis. However, whereas Feuerstein placed more emphasis on articulating and imbuing the role of the human mediator in the mediational process (*learner---**mediator**---instrument*), Vygotsky placed greater emphasis on the symbolic tools required for the cognitive act (*learner--- mediator--- **tool***).

3. Feuerstein as ethicist:

Feuerstein's humanist perspective is evident throughout his work. Feuerstein chose the agency of action (human action) as a fundamental component in human development and was not concerned with merely manipulating components of the stimulus-organism-response complex. An ethical stance operates from a set of principles that guide action absolutely. According to such a view, worth emerges in existence, but goes beyond existence. *'Man is worthy because he has the potential to go beyond all existential form. He is only worthy because he is where ethical demands can be understood to develop and to surpass themselves'* (Hadji, 2000:32). Feuerstein thus rejected the rigid boundaries imposed by structuralist ideas of human development that often tended to place emphasis on genetic and growth processes (e.g. Gesell, 1946) and neglected learning (mediational) processes. Furthermore, it was the result of these influences in developmental psychology and especially the way that they found their expression in the 'testing movement' that were of most concern to Feuerstein. For example, two young children on the basis of a test result were told *'you are ready to start school, but you are not ready (mature enough) to start'*. These test results do not reveal what these children need to be taught and thereby what they need to learn in order to succeed. These approaches were in conflict not only with Feuerstein's belief in human modifiability, but his belief in human worth. Feuerstein's approach was an appropriate antidote to behaviourism and even certain schools of developmental psychology.

2.2.3.3 Limitations of this theoretical perspective

Terminology and writing

Feuerstein has been critiqued for his convoluted style of writing and particularly for his unique transposition of biological terminology into this theoretical framework. In this regard Feuerstein experienced similar difficulties to Piaget and Vygotsky. Feuerstein's theory has evolved over the years. In fact Feuerstein and his colleagues consider his theory of Structural Cognitive Modifiability still to be in development. Feuerstein and Rand insist that *'it is neither rarefied nor set in stone'* (cited in Presseisen & Kozulin, 1994). Like Piaget and Vygotsky, Feuerstein is both praised and criticised for this developmental position.

Research methodology

Feuerstein's theory has been criticised for its lack of attention to the quantitative aspects of their investigation. Feuerstein's work still requires much in terms of providing convincing empirical validation (Grigorenko & Sternberg, 1998). Feuerstein's IE, however, has been extensively evaluated: Some studies have been critical (Blagg, 1991), others inconclusive (Haywood, Tzuriel, Vaught, 1992), and yet others have results which support the validity of the programme (Kozulin, 2000). However, the empirical difficulties of evaluating the work of Feuerstein make it impossible to present strictly experimental data about such a programme. Hadji (2000:30) emphasises that this should not lead us to refuse to assess the programme, however, that our *'area of observation and tools (need to) become significantly expanded from measuring the effects of the programme to exploring the process of application'.*

Neglect of affective, social and motivational factors

Like Piaget and Vygotsky, Feuerstein was criticised for his focus on the cognitive dimensions in his theoretical framework. However, with his strong emphasis on the human-as-mediator in his pedagogical applications, Feuerstein has been able to refute much of this criticism. Feuerstein's 'omission' of the affective-motivational dimensions within his theoretical framework has been resolved by many of his colleagues, who have elaborated on these aspects (while maintaining the theoretical integrity of his work) (e.g. Rand, 1991; Tzuriel, 1991).

Scientific dimensions of the theoretical framework

Grigorenko & Sternberg (1998) state that Feuerstein's work, in its attempt to provide an operational universal theory and methodology, has overlooked the finer details and the precision required for making certain inferential statements in interpreting data. A number of psychologists (Frisby & Braden,1992; Lidz, 1987; Rand, 1991; Sternberg,1984) have expressed concerns regarding the vagueness of the theoretical terminology used by Feuerstein. On closer examination of Feuerstein's work it appears that semantic fields of different concepts overlap, lack exactness and suggest undemonstrated causal links. For example, it has been argued by Feuerstein et al. (1979) that the proximal cause of individual difference is a lifetime of exposure to MLE or conversely to a lack of exposure to MLE. The support for this claim is inferred from studies which showed improvement in cognitive performance after a Mediated Learning Experience intervention. However, Grigorenko & Sternberg (1998) argue that an individual response to treatment does not necessarily imply such causality. Another example is Feuerstein's concept of transcendence, which Grigorenko & Sternberg (1998:88) contend *'renders operationalization difficult and validation of these concepts even more difficult'.* It is not clear how the transcendent nature of the intervention (a MLE Characteristic) translates into valid cognitive performance outcomes that are related to school and or other activities. Feuerstein's Cognitive Map (Appendix 1) has also been critiqued for being vague and ill-defined, nevertheless it has been found to be a helpful model to analyse a task at a much deeper level than that proposed by behaviourism (Burden, 2000).

Mechanisms of change

Can Feuerstein's theory of Structural Cognitive Modifiability accurately specify the conditions that will assist to promote change? Clearly it is not possible to determine scientifically what makes up the quality of mediation: the answer to such a question would merely state that the quality of interaction is primarily determined by the presence of mediation. However, research is being done into the linkages between MLE and motivation, self-concept, attributions, and other similar areas (Burden, 2000).

A generally agreed on means of classifying mediational interactions is missing. However, this could remedied through establishing distinctions between types of mediation and techniques of mediation. One may also question the ability of the MLE scales (e.g. Klein, 1998; Lidz, 1991) to capture the ‘same’ forms of mediation in different cultural groups. Though there is little doubt that certain forms of mediation are universal and can be found in any culture, the question remains as to what constitutes the universal core of mediation and which forms of mediation are culture-specific. It would also be important to find out whether the ‘same’ aspects of mediation have identical meaning and importance in different cultures and different social groups. The investigation of human mediation from a cross-cultural perspective has also yielded results that favour cultural specificity rather than universality (e.g. Tzuriel, 1997). Feuerstein regarded the first three characteristics of MLE as universal because they transcend not only culture but even the modality of the mediation. The Feuersteinians might however want to critically re-examine their postulate of the three universal characteristics of mediation (intentionality, transcendence and meaning) (Kozulin, 2002).

Instrumental Enrichment

Feuerstein’s IE programme has been criticized for its abstract nature and its inability to address classroom learning difficulties. Since IE is first of all a cognitive enhancement programme, its effectiveness was initially evaluated predominantly through cognitive measures. In this respect there is evidence of its effectiveness in enhancing the students’ problem-solving skills, especially as measured by non-verbal tests (Savell, Twohig & Rachford, 1986). However, with regard to the effect of ‘bridging’ to school subjects, the results are not always consistent or easy to interpret. A reason for this, proposed by Jensen (2003:110): *‘as a scissors have two blades the effective functioning requires both good cognitive skills and a knowledge base on which they can be applied’.*

Feuerstein’s emphatic position on the ‘content-free’ nature of IE can, however, also be viewed from a more nuanced perspective. Kozulin (2002) proposes that no programme can be absolutely free of content and the fact that IE is not linked directly to a specific content area does not make it contentless. The purpose of Feuerstein’s cognitive education programme was to develop learning prerequisites and as such it is not completely incompatible with Vygotsky’s attempt to integrate content and cognitive mechanisms in order to promote learning. Feuerstein would also agree that there is no such thing as pure thought applied at times to physical problems and at times to linguistic problems (Kozulin, 2002). However, the apparent contradiction between Feuerstein's stated focus on an entirely 'content-free’ approach and the inclusion of content in the form of school learning has not been resolved by Feuerstein.

2.2.3.4 Conclusions

Notwithstanding the difficulties that have been raised with respect to Feuerstein, he has developed a comprehensive theoretical system with numerous dynamic components (assessment, curricular applications, and interactive pedagogy), which is quite an extraordinary legacy (Burgess, 2000:18). This distinguishes Feuerstein from the ‘pure’ theory makers (such as Piaget and Vygotsky) discussed above. His theory and praxis have contributed directly towards the advancement of both knowledge and action. Feuerstein also, however, shares much in common with both Piaget and Vygotsky. (See Chapter Two, p.60.) However, it has been Feuerstein’s belief in positive change (human modifiability) that has contributed most to the development of this unique framework that integrates ethics with a knowledge of cognitive development.

2.2.3.5 Key contributions from the Feuersteinian perspective

- Feuerstein’s belief in human perfectibility places his system into an ethical realm. Feuerstein’s work is considered as a bridge that enables psychologists to break out of their traditional historically imposed constraints and to face up to the demands of their beliefs and values. School psychologists have tended to avoid adopting a values perspective in their work and have consequently struggled to accept that all human action must reflect human values because of their positivistic beliefs (Burden, 2000).

- Feuerstein provided a model of human-mediated action as the primary determinant of cognitive modifiability. The role of the teacher or parent in their child's development is thus emphasized and regarded as critical as they are responsible for finding ways to promote the modifiability of the learner. Feuerstein devised a set of instruments (Instrumental Enrichment), mechanisms (MLE Characteristics) and a conceptual framework (Cognitive Map) to guide this process.
- Feuerstein's notion of structural cognitive modifiability entailed a deeper and more fundamental analysis of cognitive structures than that proposed by either Piaget or Vygotsky. It explains the flexibility, plasticity and structural re-organizations that result after a mediated learning encounter. Academic psychologists have tended towards fragmentation in their research and theory-building efforts, focussing on sub-areas rather than developing broad-based pedagogical theories with well thought through practical implications for classroom teachers or parents. The work of Feuerstein on the other hand provides us with a rich source of inputs into the dynamic interactions between environment-teacher-task-learner factors and a theoretical structure which pulls them all together (Burden, 2000).
- [14]Postmodernism is concerned with addressing the fragmentation that permeates 20th century society. This in sharp contrast to modernism which is associated with materialism, positivism, quantification, utilitarianism, reductionism and structuralism. As seen in the previous point describing his work, Feuerstein could be associated with the postmodernist perspective. Other points supporting this are his strongly anti-positivist stance, most vehemently expressed in his rejection of IQ testing and his interpersonal qualitative approach to assessment (Dynamic Assessment).

[14] Davis (2000) contends that there are at least two versions of postmodernism. Deconstructive postmodernism seeks to undo all claims towards ultimate knowledge and truth. Whereas, reconstructive postmodernism recognizes multiple realities, multiple levels of reality, and the non-rational influence on reality, experience and action. In this text the term postmodernism refers to reconstructive postmodernism.

2.3 A SYNTHESIS OF THE THREE THEORETICAL PERSPECTIVES: PIAGET, VYGOTSKY AND FEUERSTEIN

TABLE 2.1

Piaget, Vygotsky and Feuerstein:

Key areas of convergence and divergence.

Key Areas	Piaget	Vygotsky	Feuerstein
1. Psychology was not the initial reason for their endeavour	√	√	√
2. Biological developmental perspective	√	√	√
3. Environmental-hereditary influences on cognitive development.	√	√	√
4. Theoretical perspective acknowledges influence of social-environmental factors on development	√	√	√
5. Emphasis on the development of abstract, logical & conceptual modes of functioning	√	√	√
6. Innate structures exist in the mind	X	X	X
7. Stage model of development	√	√	X
8. Emphasis on the role of the teacher as mediator in learning	X	√	√
9. Emphasis on the role of language in development	X	√	√
10. New concepts lead development	X	√	√
11. Emphasis on the role of the socio-cultural environment on development	X	√	√
12. Learning precedes development – agreement about modifiability & potential of learners to learn	X	√	√
13. Development precedes learning- new learning occurs in a gradual manner	√	X	X
14. Emphasis on the importance of symbols as mediators	X	√	X
15. The role of human as mediator is central	X	X	√
16. New learning can lead to permanent structural changes in cognitive functioning	X	X	√
17. Postmodernist perspective	X	X	√

Key: √ **= agree** or **X = disagree**

The ‘troika of theorists’ share a striking number of commonalties in their approach to understanding the formation of knowledge and cognitive development (Key Areas 1-6). The inter-linked perspective of these theorists, expressed in their evolutionary developmental view of the formation of mental structures, has its origin in the on-going interactions between maturational and environmental factors. The theorists became committed to psychology in their search to develop a comprehensive and explanatory theory of human development. All three theorists stressed the primacy of cognition in human development, however, they also acknowledged the role of the social aspects in development. It could be argued that Piaget’s influential, groundbreaking theory provided a platform for both Vygotsky and Feuerstein. Vygotsky and Feuerstein both acknowledge Piaget’s contribution. Furthermore, Piaget’s contribution may also be regarded as the structural blueprint for cognitive psychology, many aspects remaining unchanged since its initial formulation (e.g. the descriptions of the *mental operations* such as classification, conservation, and seriation). Vygotsky and Feuerstein thus converge and agree with Piaget’s contention that development advances, not as an innate mechanistic process, but in a coherently organized and systematic manner marked by qualitative changes in thinking, from intuitive and spontaneous ideas to logical and scientific reasoning.

Vygotsky and Feuerstein, however, also diverge from Piaget in a number of important respects (Key Areas 8-13). The most significant distinction is the role of environment (socio-cultural factors) in development and learning. Whereas Piaget theoretically acknowledged these factors, these theorists (Vygotsky and Feuerstein) incorporated the mediator as a central aspect of the learning process. Vygotsky and Feuerstein therefore disagree with Piaget regarding the gradual unfolding of new ideas and instead suggest that new ideas are actively introduced and systematically mediated. According to them development does not proceed as an ongoing process of adjustment and readjustment towards the attainment of equilibrium, but rather there is a radical juxtaposition of the known and unknown. Both Vygotsky and Feuerstein stressed the importance of language as a mediational tool. Language is thus used as the means to advance thinking and to lead learners to new relationships between objects and words. Integral to both these theorists is the optimistic view that learners (given appropriate mediation) can advance beyond what they already know. This view was different from Piaget's more traditional stance that the learner could only advance when his/her spontaneous ideas were developed enough to resist cognitive conflict.

Vygotsky and Feuerstein also differed in certain ways (Key Areas 14-17), though many of these differences are not incompatible. Vygotsky's notion of symbolic mediators was a central component of his socio-cultural theory. Symbolic systems (e.g. culture, language, writing and reading) explained transformations from natural (unmediated) processes into higher order (mediated) psychological tools. In contrast, Feuerstein emphasised the human (psychological) aspects of mediation which he saw as establishing intentional, caring and affectionate relationships needed to create the prerequisites for learning. It is therefore the researcher's contention that these perspectives are complementary: Without the human dimensions needed to focus the attention and interest of the learner, articulated by Feuerstein, and without the systematic approach to the mediation of content-specific-psychological-tools as described by Vygotsky no meaningful, higher order learning would be encouraged.

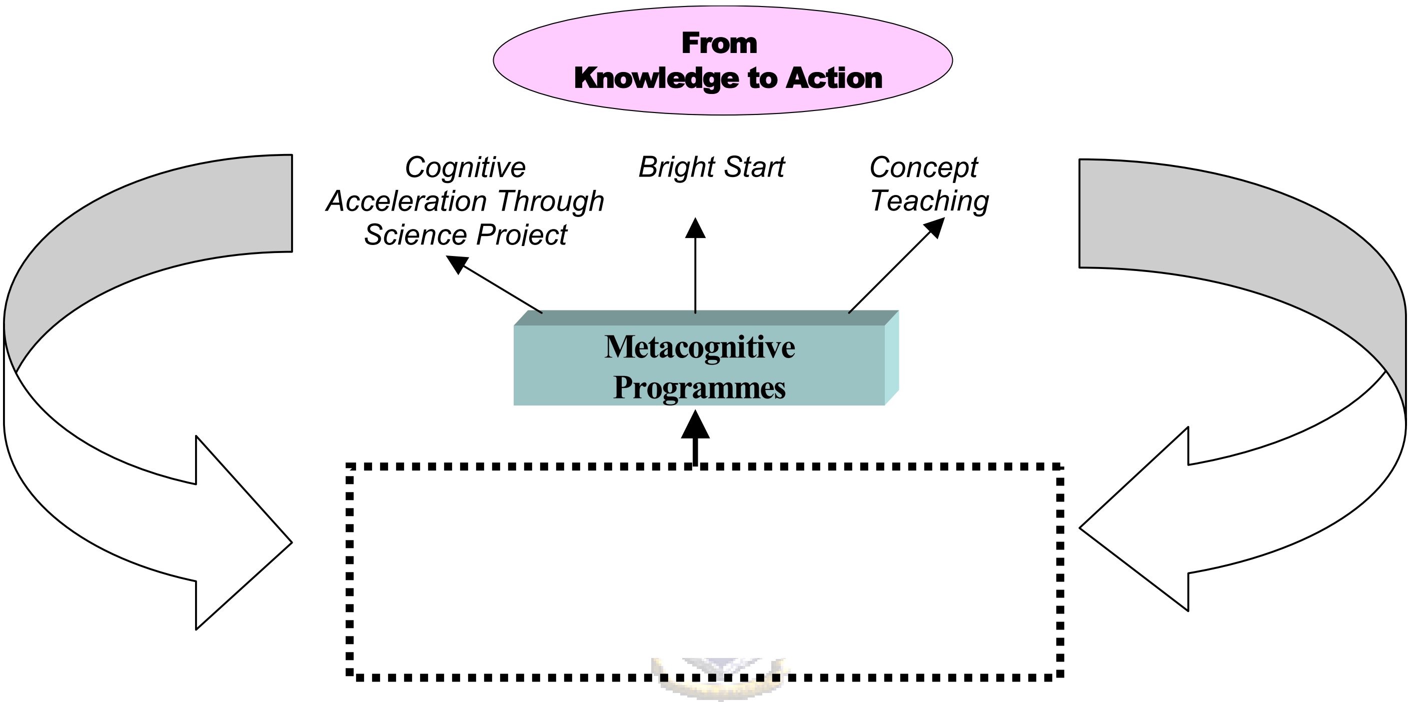
In contrast to Vygotsky and Piaget, Feuerstein rejected a stage model account of development (Key Area 7). Feuerstein (1980:xviii) contended that cognitive modifiability made possible changes that were '*durable, flexible and capable of effecting changes in the rest of system'*, in contrast to the predictable, orderly and limited changes expected from a stage model. Feuerstein's 'quantum-like' notion of change provides further optimism to the mediated learning encounter and thus adds a distinctly postmodernist quality to his applied theoretical framework.

Finally, it can said that Piaget, Vygotsky and Feuerstein are not only influential but essential contributors to the theory base proposed for this study. Were it not for Piaget then much of the substance and detailed account of the cognition operations would not exist. Were it not for Vygotsky then the systematic focus on symbolic mediators required for content learning would have been omitted. And were it not for Feuerstein then the essential human bonds and relationships required to acquire the cognitive operations/psychological tools would not be described. Furthermore, Feuerstein provides an ethical dimension, a belief in the possible- that irrespective of the age or the severity of the barrier to learning, meaningful human engagements will produce enduring cognitive structural modifiability.

CHAPTER 3

FROM THEORY TO PRACTICE - A REVIEW OF THREE METACOGNITIVE PROGRAMMES

FIGURE 3.1



3.1 INTRODUCTION

[1]It is noteworthy that even though Piaget and Vygotsky did not develop their own educational programmes, a considerable number of programmes have emanated from their theoretical perspectives. Feuerstein, in contrast was integrally involved in developing pedagogical applications. However, like the other theorists, he has also inspired numerous other educational programmes. Cognitive education *'began with the important notion that education should be about thinking, and that by improving abilities and habits of systematic, logical thinking we could improve the effectiveness and efficiency of learning of any specific content'* (Haywood, 2004:5). The potency of cognitive education theories thus lies in their orientation towards

[1]The pedagogical applications of the work of Piaget and Vygotsky were mainly developed by their followers, that is, by the neo-Piagetians and neo-Vygotskians.

educational praxis. This interactive, dialectical perspective of human development allows for their seamless transition from theory to practice.

The main distinction between applications of these theorists' (Piaget, Vygotsky & Feuerstein) work lies in their interpretations of the teacher's role and how teachers should mediate within the learning environment. The neo-Piagetians placed emphasis on the kind of questions that the teacher should ask to fulfil the main intention of guiding the learner in his/her learning. In contrast, the neo-Vygotskians and Feuersteinians emphasised the symbolic and human interactions (respectively) of the mediator, that is, that learning required the active interposition of an 'other' with a learner.

Haywood (1995) contended that although there were many cognitive educational programmes (almost 200), few of these programmes were metacognitive in orientation. He described metacognitive programmes as being *'…focused on elaboration of the microscopic cognitive processes by which one's intelligence is applied to the tasks of organizing the world of stimuli, learning, solving problems, and on making those processes intensely personal for each child.'* (Haywood, 1995:8*)* In metacognitive education programmes children are required to become reflexive and conscious of their thinking processes: '*the human system's capacity to re-represent recursively its internal representations allows us to become grammarians, poets, philosophers, and so on' (Karmiloff-Smith, 1991, cited in Adey & Shayer, 2002:68).* This is in contrast with programmes that are only cognitive, where someone has decided what thinking processes are important and then teaches these processes to children (Haywood, 1995). The core distinction which Haywood pointed to was whether the teacher regarded his/her role as simply transmitting a set of prescribed thinking strategies or as a transmitter of culturally constructed meanings. There was general theoretical agreement between the troika of theorists discussed in Chapter Two (Piaget, Vygotsky, and Feuerstein) that metacognition was important in advancing development. (See paragraph below.) In addition, the theorists agreed that cognitive development involved ongoing organization and reorganization of mental structures that were in constant interaction with the environment. The application of these theoretical perspectives by teachers would thus involve the manipulation of the environment (developing culturally constructed meanings) in the process of teaching, whether they approached their teaching from a facilitative (constructivist) or a collaborative (social constructivist) paradigm.

Both Piaget and Vygotsky made reference to the importance of metacognitive reflection in the child's thinking (Shayer & Adey, 2002). Metacognition involves very specific thinking processes by which we carry out the operations that cognitive functions require. In Piagetian terms, we move between *what we know* ('savoir') and *knowing how to do* ('savoir faire') in order to move to more specific mental operations (Haywood, 2004). Vygotsky spoke of de-automatizing (becoming conscious of) already automatized behaviours through symbolic mediators. However, it could be argued that Feuerstein and his colleagues were largely responsible for elaborating the role of adults as mediators of learning, that is, the main modality through which one gains access to the child's metacognitive functioning. Metacognitive education programmes specify both the *how* to teach as well as the *what* that is to be taught; that is, the content and method or process.

The predilection towards metacognition as a significant theoretical tenet of cognitive programmes is seen in a recent meta-analysis of 55 thinking skills programmes in the United Kingdom. This study concluded that:

'…there is powerful empirical evidence that thinking skills interventions can be very effective at all levels, but especially if they are directed at metacognition, self-regulation and what we have called 'value grounded thinking' (self-reflection and strategic thinking)'(Moseley, 2002).

This chapter will review only a few selected metacognitive programmes which share a number of common tenets. The purpose, therefore, is not to provide a review of the extensive and diverse spectrum of cognitive programmes (thinking skills frameworks), but to present an in-depth review of three similar theoretically derived frameworks. These programmes are *Bright Start*

(Haywood & Brooks, 1986), *Cognitive Acceleration Through Science* (Shayer & Adey, 1981) and *Concept Teaching* (Nyborg, 1971). These well-established programmes were carefully selected taking into consideration various commonalties with the current study. All these programmes were developed with the intention of addressing the causes of educational failure in society, and especially with respect to young children with/without learning difficulties from disadvantaged backgrounds. While each of these programmes has much to offer, it is contended that they would not necessarily be appropriate or efficacious for addressing the particular concerns of teaching-learning within the South African context. The main areas of commonality between the three metacognitive programmes (*Bright Start*, *Cognitive Acceleration Through Science and Concept Teaching*) to be reviewed are outlined below.

These programmes all focus on: -

- The **younger child** (ranging from pre-school to primary school age children) who may or may not experience barriers to learning and/or come from a background of social-cultural disadvantage/difference.
- The **social-cultural aspects of learning** which are strongly expressed through the role of the human mediator.
- The development of **higher order thinking** which is accepted as a goal of these programmes.
- The **durability and generalizablity** of the results of cognitive interventions over time, that is, there is an emphasis on both the durability of the results of the programme as well as the ability to transfer rules, principles and cognitive functions to a variety of different contexts.

These areas of focus of the programmes therefore also explain the exclusion of a number of other well-established metacognitive programmes which were designed for senior primary and adolescent learners: e.g. Cognitive Enrichment Acceleration (CEA) and Instrumental Enrichment (IE). It is interesting to note that there have in fact been very few successful thinking programmes implemented at school level, particularly for younger children (Venville, Adey, Larking & Robertson, 2003). The cognitive programmes to be discussed, even though derived from the same theoretical source (cognitive developmental theories), demonstrate a rich diversity in their application of the theory.

The chapter aims to provide a detailed and critical review of the three above-mentioned metacognitive programmes and will thereafter attempt to extract key aspects of each of these of these programmes for incorporation in a new metacognitive programme for the South African context. In Chapter Four, the reader will be introduced to the Basic Concepts Mediated Learning Programme (BCMLP), the intervention programme designed for the purposes of this study.

3.2 A CRITICAL REVIEW OF THREE METACOGNITIVE PROGRAMMES FOR YOUNG LEARNERS

3.2.1 Bright Start (BS)

Background, rationale and main purpose

BS was developed for pre-school children aged three to six years old, and can also be used with children up to eight or nine years of age with mild to moderate intellectual impairments. The programme was initially developed for normally developing children who were 'at risk' of school failure in the United States. These were often children from poor, culturally different, ethnic minority communities. BS has also been used successfully with children who have severe intellectual impairments, emotional disturbance, learning disabilities, autism, pervasive developmental disorders, neurological impairments, sensory impairments and cerebral palsy (Brooks & Haywood, 2003:101-102). A recent study has shown the programme to be effective in improving cognitive functioning and also sustaining improvements in cognitive functioning of children with Down's Syndrome (Molina & Vived, 2004).

The goal of this cognitive programme, consistent with that of other cognitive programmes, is to develop a set of logical modes in learners that will enable them to think systematically, logically and effectively. Apart from this more general goal, the authors of BS have outlined specific goals for their programme: i) the development and elaboration of learning skills and basic cognitive functions (required for concrete operational thought), ii) the identification and remediation of deficient cognitive functions, iii) the development of task-intrinsic motivation, iv) the development of representational thinking, v) the enhancement of learning effectiveness and readiness for school learning and vi) the prevention of inappropriate special education placement (Tzuriel, 1998).

Scope and structure

The programme was designed as a total immersion into an atmosphere that promotes cognitive development. BS has five components whose combination is essential for the effective implementation of the programme: - i) the theoretical base, ii) mediational teaching style, iii) the seven cognitive 'small group' units, iv) a cognitive-mediational behavioural management system and v) a programme of parent participation. The theoretical base of the study will be discussed in the section below. The mediational teaching style, based on the theories of Feuerstein and Vygotsky, is regarded by Brooks and Haywood (2003) as the most important and distinguishing characteristic of teachers' behaviour. The mediational teaching style is an approach which assists the teacher to: - i) facilitate the child's understanding of the generalised meaning of his/her experiences, ii) develop efficient strategies of gathering information and elaborating information, iii) enhance systematic thinking processes and iv) promote accurate communication strategies (Haywood, 1993). The seven cognitive instructional units, used with children in small groups, constitute the core of the programme. The small group units are: - Self-Regulation, Number Concepts, Comparison, Role Taking, Classification, Sequences-Patterns and Letter-Shape Concepts. Each unit is comprised of 15-30 lessons, so that by the end of the academic year children should have received close to 150 cognitive small group lessons (Tzuriel, 1998). Even though the lessons, which focus sharply on the metacognitive processes themselves, occupy only about

20 minutes in each school day, the cognitive functions that are the targets of these lessons are reinforced during all the other school activities through the day by the same teacher (Brooks & Haywood, 2003). This is also referred to as bridging, where the teacher and/or parent connects learning to daily life in ways that show how it can be applied in different situations. The cognitive-mediational behavioural management component of the programme refers to the application of the mediation principles to behaviour problems that arise either in teaching sessions or in social interactions within the kindergarten (Tzuriel, 2000). The parent programme is designed to correspond with the small group units and aims to reinforce/bridge learning at home through daily experiences.

Theory

BS is based on the theories of Piaget, Vygotsky, Feuerstein and Haywood. Philosophically it lies somewhere between a strict Piagetian constructivist position and the socio-cultural position of Vygotsky. It is one of the 'mediated learning' programmes that overlap with Feuerstein's theory of structural cognitive modifiability and mediated learning. Following Haywood's transactional perspective on the development of human ability, the programme placed strong emphasis on metacognition and on the interactive relationship between cognitive and motivational development (Brooks & Haywood, 2003:102). Haywood's contribution to the theory is referred to below.

Influence of Piaget: The children for whom BS was developed (children from three to six years old) are approaching the age when one expects the development of concrete operational thinking out of a preoperational status. This former stage is characterized by Piaget (Piaget & Inhelder, 1974, 1976) as a stage in which the operations of classification, class inclusion, understanding of relations, conservation and number concept are developed. Most of the programme's activities are designed with the aim of enhancing these operations (Tzuriel, 1999).

Influence of Vygotsky: In contrast to Piaget, Vygotsky (Campione, Brown & Ferrara, 1982; Vygotsky, 1929, 1962,1978) emphasised and described the role of the social environment in the development of children's cognitive processes. Children initially experience cognitive challenges in the presence of adults. The child's problem-solving is at first 'other-regulated' but becomes 'self-regulated' with appropriate guidance from adults. Vygotsky's concept of the Zone of Proximal Development (ZPD) (Chapter Two, p.37) is thus introduced. The ZPD refers to the ability of the child to benefit from interacting with an adult in the context of problem-solving. As such the ZPD is a social construct that describes a child's ability to benefit from such interactions and thus provides insight into his/her developing mental structures. Two Vygotskian concepts are thus highlighted in the context of this programme: - i) the necessity of having an appropriate social environment that includes instruction in problem-solving and ii) the quality of the interaction between the environment and the child (Brooks & Haywood, 2003:102).

Influence of Feuerstein: Feuerstein also placed emphasis on the quality of the social environment. Feuerstein's focus, however, was on enhancing parents' and teachers' effectiveness to reduce the discrepancy between children's typical performance and their potential performance. Feuerstein viewed the process of mediated learning as essential to the adequate cognitive development of children. As Brooks and Haywood (2003:105) pointed out, Feuerstein maintains that: *'It is an outgrowth of children's attachments to caregivers, and it capitalises on social bonds for motivation to engage problems'*. Feuerstein also stressed the role of basic cognitive functions in the process of learning academic and social material. When there are deficiencies in these functions there is inadequate learning. These basic cognitive functions are acquired through learning, both by children's direct exposure to environmental events and by a teaching process known as Mediated Learning Experience (Feuerstein & Rand, 1974). It is the mediational teaching style that is the single most important and distinguishing characteristic of the teacher's behaviour in a cognitive programme (Brooks & Haywood, 2003). *'In a cognitive classroom, the teacher serves as a catalyst,* *bringing about a cognitively important reaction between children's thought processes and events in their experience' (Brooks & Haywood, 2003:105).*

Influence of Haywood: Haywood has proposed a transactional perspective on human ability (Haywood, 1989, 1998, 2002; Haywood & Switzky, 1992; Haywood, Tzuriel & Vaught, 1992; Haywood & Wachs, 1981) that incorporates three essential elements in the development, elaboration and application of human ability. These elements are intelligence, cognitive processes and intrinsic motivation. An important part of this conception is the distinction between intelligence and cognitive process, including a difference in their origin, their relative modifiability, their nature and content, the methods by which individual differences can be assessed and differential contributions of parents and other adults to their development. Haywood (2003) argued that it makes sense to intervene in the development of abilities by concentrating on developing systematic cognitive processes, which is the focus of the BS programme. Haywood and Burke (1977) proposed a motivational theory of cognition which contends that task-intrinsic motivation provides the motive force to propel cognitive development and cognitive applications. Haywood (1992) thus suggested that task-intrinsic motivation and cognitive development had a mutually dependent relationship. A metacognitive emphasis is also incorporated as part of the transactional perspective on ability.

Research and evaluation

A recent meta-analysis of 10 BS studies, a majority of which did not involve the authors of the programme, found that the programme had met its stated goals or in other cases had indicated positive movements towards attaining these goals. (See above section.) However, Haywood (2003) acknowledged that some of these studies had not met all the requirements for experimental, quantitative research.

The following findings have been reported: -

- Positive effects on IQ (although this variable is not stressed);
- Indications that the programme helps to enhance children's development of task-intrinsic motivation;
- Indications that the programme assists in keeping children with disabilities in regular classes;
- Positive effects on cognitive functioning and development; and
- Generalized and durable effects on school achievement across a variety of academic subjects.

(Brooks & Haywood, 2003)

The above findings indicate that BS could be regarded as an especially appropriate programme for children who come from backgrounds of early educational disadvantage. The programme (as a majority of the above studies attest to) would assist these children to at least partially overcome the educational gaps which exist between them and children from more advantaged circumstances. However, core difficulties of the programme that have been raised in the literature might explain the reasons for its relatively low uptake into schools and the problems practitioners experience with implementing the programme in the field. In fairness, the difficulties to be raised are relevant to a host of similar metacognitive programmes. Some of the difficulties with this metacognitive programme are: -

- Terminology of the programme is not always clear and is complicated by complex language (e.g. the cognitive functions such as elaboration, using double alternation, selective attention, mental images, internal dialogue, noting spatial referents).
- Teachers are not supported within the classroom after training;
- The length of the programme (in the studies reviewed most had not implemented the programme fully).
- The programme, as presented in the teacher's manual, appears prescriptive and may therefore not always be consistent with the teacher's ideas/experience or with the cultural milieu of the learners.

- Certain of the core units of the programme might not be regarded as priorities in relation to the goals of an educational system.
- Certain of the core units may require some preliminary tasks in order to prepare children for the main activities.

BS is a theoretically grounded programme with a growing mass of associated research. The programme shows signs of promise in addressing the educational deficits in a heterogeneous, diverse population of learners from a range of countries. However, alongside these optimistic findings, BS also experiences some difficulties with respect to the implementation of the programme by teachers and the adaptation of the programme in different contexts. In addition, the 'content-free' nature of this programme has also required further efforts by teachers in order to make connections explicit between the programme and school learning.

3.2.2 Cognitive Acceleration Through Science (CASE)

Background, rationale and main purpose

The CASE project to be reviewed (CASE@KS1.H&F) arose out of the need to increase the life prospects of disadvantaged and culturally diverse children in [2]London by enhancing their cognitive development at the start of their school careers. The rationale for targeting the cognitive development of children at the start of their formal schooling (five to seven year olds) was in order to have long-term effects on their academic achievement, social variables and eventually on their employment prospects. This project was derived from the original project, known as CASE@KS3, which had reported effects on the cognitive development of [3]Years 7 and 8 in the United Kingdom (UK).

[2] The children came from schools in the London borough of Hammersmith and Fulham.
[3] The term 'Year' in the United Kingdom educational system corresponds with the South African term 'Grade'. A child in Grade 1 (SA) would be in Year 1 in the UK.

The initial project was designed to produce long-term gains in academic achievement by attempting to raise children's intellectual performance so that they would be more likely to succeed. CASE arose out of highly charged public debates around educational standards in the UK which have been growing since the end of the Second World War, but which took on an added urgency after the widespread liberalisation of education in the 1960's (Adey & Shayer, 1994). The dawning realisation of very large ranges in the abilities within the population peaked in the 1980's (Adey & Shayer). In response to these issues of educational standards and from a standpoint of academic and professional rigour, the authors of this programme proposed that: *'We will emphasize the psychological foundations of the innovation (CASE) and contend that no serious progress can be made in improving educational standards without a well-articulated theory which can be tested and described in enough detail to enable replication'* (Adey & Shayer, 1994:xi).

<u>*Scope and structure*</u>

It was proposed that intervention effects with much younger children could be achieved in a shorter time than the original project with adolescents which took approximately two years to complete. A one-year intervention programme (CASE@KS1.H&F) was consequently developed. A further variation from the original model (which was set specifically in a science context to be delivered by science teachers), was that for Year 1's the programme was to be more generic, guided by the schemata of concrete operations. Adey and Shayer (2002) argued that the reason for the focus on general mental abilities was that school subjects are not yet so differentiated in this age group. The programme is intended for a normal educational setting in ordinary schools with ordinary teachers and classes of at least 30 children (Adey, Robertson & Venville, 2002). The programme consists of 30 cognitive acceleration activities that are implemented in small groups within the class for 30-40 minutes per week. Each activity relates to one of the schemata of concrete operations described in detail by Piaget and Inhelder (1974,1976). The CASE activities are designed to familiarise pupils with the language and apparatus required for the activity (*concrete preparation*); provide 'events' which cause pupils to pause, wonder, and think again (*cognitive conflict*);

encourage pupils to reflect on their own thinking processes *(metacognition)*; enable learners to construct their thinking through interactions with their peers (*social construction*); and show how this thinking can be applied in many contexts (*bridging*). These features are referred to as the [4]Five Pillars of CASE. The intention of CASE is therefore to enhance the child's ability to process many aspects of reality simultaneously (a key to high performance in all spheres) and consequently to affect the learning ability of the child generally (Adey & Shayer, 2002).

Theory

The theoretical basis of CASE is referred to as Cognitive Acceleration (CA).

Some of the general theoretical assumptions of CA:

- It is valid to work on the basis of some general intellectual function in children which underlies any particular context (or subject);
- This general intellectual function develops with age; and
- The development of this general intellectual function is influenced both by the environment and by maturation.

(Shayer & Adey, 2002)

The authors of the CA approach argue and provide evidence that a general cognitive processing capacity underlies human abilities. However they do not exclude the existence of special abilities, for example, in language, logical-mathematics, spatial, musical and other spheres (e.g. Gardner, 1991, 1993) which might have some independence from one another. The second assumption that intellectual functioning develops with age is a common claim of cognitive psychology, established empirically by the work of various theorists (e.g. Piaget, 1930-1970; Vygotsky 1925-1934) and has more recently also received support from neurophysiological studies (e.g. Johnson, 1997, cited in Shayer & Adey, 2002). However, the last assumption of CA is possibly the most important: *'…if you do not accept the third of our*

[4]The authors also refer to Six Pillars of CASE. The additional Pillar is known as 'schema theory', which refers to the Piagetian schemata of formal or concrete operations, applicable to CASE@KS3 and CASE@KS1.H&F respectively.

hypotheses … then you condemn humankind to a deterministic world in which IQ is some sort of fixed function of an individual and the whole education enterprise is called into question' (Shayer & Adey, 2002:4).

In an attempt to design an environment of '*maximal stimulation'* for the intellect, derived from the above general principles, the authors primarily derived their efforts from two sources of developmental psychology: Piaget and Vygotsky. The theoretical influence of the work of Feuerstein was also acknowledged by the authors (e.g. Adey & Shayer, 1994; Venville, Adey, Larking & Robertson, 2003). From these theorists a series of working principles were developed, referred to as the Six Pillars of CA. (See Footnote 4.) The influence of each of these three theorists will now be explored.

Influence of Piaget: Piaget is the core theorist of the CA paradigm: *'The only description of development of intelligent behaviour we have which is sufficiently detailed to be related to school learning is that derived from Piaget'* (Adey & Shayer, 1994:13). CA (for younger children) was designed specifically to promote the type of higher level thinking associated with Piaget's concrete operational thinking: viz. seriation, classification, points of view, sequencing and causality (Piaget & Inhelder, 1974, 1976). The CA activities were designed to teach each of these operations. The cognitive schema of conservation (excluded from the programme content) was, however, used as a measure to evaluate the effects of the programme. Piaget is most strongly associated with the CASE Pillar referred to as 'schema theory', but is also associated with other CASE Pillars: concrete preparations, cognitive conflict and social construction (Adey & Shayer, 1994).

Influence of Vygotsky: The influence of Vygotsky with his emphasis on the social aspects of development has resulted in an unique integration of theoretical perspectives: *'Vygotsky would have needed Piaget's descriptions of development had he gone on in the work of improving schooling, and had Piaget wanted to convert his (correct) intuitions about the importance of collaborative learning among peers into school practice he would have needed to draw on the work of Vygotsky'* (Shayer, 2003:478). The authors draw on Vygotsky's ZPD, which is described as a place of construction of mental activity that often occurs in collaboration. Construction is defined as the process which follows and re-establishes equilibrium (after cognitive conflict) through which more powerful and effective ways of thinking are developed. Vygotsky's emphasis on 'social construction' is strongly evident in the CA approach. However, he is also associated with the following CASE Pillars: concrete preparations, metacognition and bridging (Adey & Shayer, 1994).

Influence of Feuerstein: Adey and Shayer (1994) gave particular attention to Feuerstein's Instrumental Enrichment (IE) intervention programme. In fact one of the authors drew strongly on his own findings (Shayer & Beasely, 1987) and those of others who had implemented IE. *'The best view of all the evidence is that effect-sizes on underlying thinking ability of the order of one standard deviation or an extra two years of development in mental age terms are achievable as a result of two years' use of IE.'* (Adey & Shayer, 1994:51) Feuerstein's paradigm appears to be very closely related theoretically to CA, which is well articulated in the following quotation: *'He (Feuerstein) talks of 'general enrichment' as being special instruction in the content and methods of particular subject matter, and of 'Instrumental Enrichment' as being content-free learning of basic cognitive processes applicable across all subject domains'* (Adey & Shayer, 1994:9). The authors pay specific attention to Feuerstein's emphasis on the role of the adult as mediator of learning as an effective way to encourage 'metacognition'. In addition, Feuerstein is also credited for his contribution to the following CASE Pillars: concrete preparations and bridging (Adey & Shayer, 1994).

Research and evaluation

A number of quantitative and qualitative studies of the CASE@KS1.H&F (1998-2001) have been conducted. A sample of approximately 340 learners from 10 inner-city schools was selected for this initial CASE@KS1 study. The findings from these studies were encouraging. It was found that the Year 1 learners in this study made greater cognitive gains over one school year than learners in similar classes who did not experience the intervention. These findings were supported by a qualitative study which found that the experimental learners who were likely to engage in ‘good thinking’ were also likely to explain and demonstrate their ideas and actions and make suggestions for problem-solving (Venville, Adey, Larking & Robertson, 2003). There were, however, a number of factors which limited generalization of these results. For example, the durability of the effects of this intervention could not be reported, as this will be done three years following the initial study. This was a concern as the effects reported here were attained at the end of the intervention programme. In fact, the programme authors have cautioned that, even though CA has been shown to be effective for the promotion of formal operational thought, this does not mean that it would be effective with any age group. CA effects with adolescents have lasted for at least three years after intervention (Shayer & Adey, 2002). Several large-scale studies of CA (with adolescents) have been performed using a large number of children. For example, the data from certain studies are based on over 2000 learners. These studies showed not only great improvements with respect to the performance on the Piagetian tasks, but transfer to maths, science and even English has also been observed. One could conclude from these data that the effect of CASE on learners' thinking is quite general, and that their general intellectual development has been enhanced (Shayer & Adey.)

CA research is still in progress, as discussed above, and many facets of the CA model still need to be clarified. Notwithstanding, the relevance of the CA approach is strikingly apparent for teachers, learners and schools. Klauer (2002) attributed the success of CA to two factors: Firstly, the fact that the programme trains only a few formal (or concrete) operations which guarantee that the objectives of the programme are relatively modest and secondly, that the strategies of formal (or concrete) operations chosen are very often required for intellectual performance, problem-solving and academic learning at school. The combination of these two attributes enables the programme to foster cognitive development of children appreciably. In addition, it would appear that the CA approach as introduced through CASE (in its various formats) is especially attractive to educators. The intervention activities are limited (to approximately 30 sessions) which would be manageable to include in even a relatively full school curriculum. Even so the authors concede that such a programme requires a significant shift in teacher methods. An interesting innovation regarding teacher development has therefore been with respect to the coaching of teachers in their classes (3-4 coaching sessions were provided in the above study) to demonstrate how the method works. Notwithstanding the promise of such an approach, a number of concerns especially with respect to the particular project under discussion (CASE@KS1.H&F) are raised: -

- The programme is ‘content-free’ and does not make direct connections with the learning areas in the school curriculum and would thus make additional demands on teachers.
- The difficulty of such ‘stand-alone’ thinking skills programmes has traditionally been with the bridging to school related content.
- The structured nature of the programme requires teachers to follow a prescribed series of developed activities.
- The complexity of the conceptual demands (addressed during the ‘concrete preparation’ Pillar of CASE) of the activities may require a dedicated programme to adequately prepare learners for more sophisticated learning.

The CA approach appears promising with children from disadvantaged and culturally diverse backgrounds. However, more research is still required. The programme is especially attractive in that it provides teachers, in a concise and highly structured format, with the tools to implement this theoretically challenging and didactically sophisticated programme. The programme, however, is not without its difficulties and like BS focuses exclusively on the development of cognitive operations that are required for higher order thinking. No direct linkages are made with formal school learning (e.g. reading and writing). This project differs significantly from the original project (CASE@KS3) which was context-specific and where the programme effects could be linked to specific curriculum outcomes.

3.2.3 Concept Teaching (CT)

Background, rationale and main purpose

The central postulate of CT is that basic concepts are prerequisites for effective learning. [5]Nyborg (1993), the 'father' of the CT approach contends that teaching about concepts (i.e. conceptual systems, classes of phenomena) promotes the efficient transfer of learning, which provides a basis for 'multiple abstractions' or 'analytic coding', processes required for future learning. The CT paradigm was developed into an applied educational approach using the Concept Teaching Model (CTM). The CTM systematically aims to teach basic cognitive concepts and conceptual systems to children from pre-school to elementary school age. CT was primarily developed as a way to improve teaching in order that the general ability of the learner could be enhanced.

The following categories of learners have benefited from Concept Teaching: - i) normal children within pre-school settings and in the early grades of elementary school (Hansen, 1986/1993, cited in Hansen, 2001; Nyborg, 1985), ii) children and young people with specific disabilities (e.g. language disorders), iii) children and young people with general learning difficulties, including those with lower IQ's and iv) children and young people with behavioural and psychological disorders (e.g. schizophrenia) (Karoliussen, 1994). Nyborg's CTM has also been used as a model for curriculum development as well as for the teaching of subjects such as history and geography.

Scope and structure

The CTM may be considered as a kind of map for teaching about concepts and conceptual systems (colour, shape, position, size, place, number, sound, etc.) to a verbally conscious, generalizable and transferable level (Hansen, 2001). Analytic Coding (AC) is a core theoretical construct of Concept Teaching, associated with learners becoming multiple abstractors and being

[5] Magne Nyborg (1929-1996) was a pedagogue and professor at Oslo University in Norway.

able to gain self-control over attention. AC thus assists with the recognition of the stimulus (perceptual skills), identification of the salient characteristics of the stimulus through providing parallel and associated links (perceptual-motor skills), and the reproduction and imitation of the stimulus (motor skills) (Nyborg, 1993). The process of Analytic Coding is therefore regarded as a pre-requisite for concept learning and underpins the CTM.

The CTM model consists of the following three processes: -

- **Selective Association (SA):** During this process a representative sample of class members is presented in a way that permits associations with the class name and a relevant superordinate class.
- **Selective Discrimination (SD):** During this process the learner is required to distinguish between members and non-members of the class, detecting partial differences and learning to differentiate when they are presented.
- **Selective Generalisation (SG):** During this process detected partial similarities (within classes) are described and made conscious by means of symbols/language skills. The detected similarities are mediated and made verbally conscious through an inductive conclusion.

The teaching of new concepts occurs during the above-mentioned three processes (SA, SD and SG). These processes direct and specify the actions to be carried out by the teachers, assist them to identify the resource materials for the sessions, as well as guide them towards the special didactic adaptations that might be required during the session. [6]The process of reflecting on learning (metacognition), even though not explicitly detailed by Nyborg, is an integral aspect of the learning process. The teacher's responses to the child's actions (whether correct or incorrect) are emphasized. Novice teachers are initially guided through the programme with the assistance of [7]detailed prompts (provided in a teacher's manual) until they gain experience with the CTM. The teacher-training component varies from a brief introductory

[6] Hansen's (2001) contribution to the CT paradigm has made this connection explicit.
[7] These prompts often take the form of mediational questions, a metacognitive strategy to promote learning. (See footnote 6.)

two-day training programme (which is considered as the minimum requirement to become a concept teacher) to a part-time academic course over one-and-a-half years.

CT is not regarded as a time-limited intervention programme, but is incorporated into the general curriculum and teaching approach within the school (Brittmark, 1997). When CT starts within the younger grades it may thereafter be integrated into the general curriculum as part of an approach to subject teaching (Brittmark). If the CT approach is used as a general education approach for children who need to establish pre-requisites for learning, then the following programme structure is recommended: In *School Year One* three 25 minutes sessions per week, *School Year Two* two 25 minutes sessions per week, while in *School Year Three and Four* the number of sessions could be reduced to once a week (Hansen, 1996). The programme is implemented more intensively with children who experience barriers to learning. It is also suggested that CT is implemented in small groups (or individually depending on the level of need of the learner) within the class (Hansen, 2001). There are, however, discrepancies with respect to the order and structure of teaching concepts in the CT approach. Whereas Nyborg was more systematic and prescriptive in his approach (Nyborg & Brittmark, 1995), his collaborators have tended to adopt a more flexible and individualised style (Hansen, 2001).

Transfer of learning is a critical component of the cognitive intervention programmes under discussion. Inherent in the CT approach is the claim that basic concepts provide pre-requisites for future learning. Nyborg (1993) contends that tasks are taught and learnt in a way that they can be made available for later recall. Nyborg refers to this as *'positive transfer'*. The goal of CT therefore is to promote the transfer of learning. The CTM model thus initiates a process where new concepts are identified, explored, differentiated and then generalised through a process of Analytic Coding in order that they can be applied in new contexts. These new contexts are related directly to the school curriculum. CT has therefore logically been extended to promote learning in the school curriculum as well as outside school.

Theory

Like the first two intervention programmes discussed, Nyborg's CT approach is theory-based. However, because of Nyborg's eclectic theoretical perspective (which distinguishes him from the authors of the above programmes) it is necessary to highlight in more detail some of the general theoretical foundations of this approach before presenting the linkages with the troika of theorists.

Nyborg initiated the development of his theories by probing some of the central questions about human development and human existence. *'The development from a naturally equipped being at the time of conception, to a cultivated human being at adulthood, must take place not only in terms of organic growth, but psychologically, mainly in terms of learning.*' (Nyborg, 1993, cited in Hansen, 2001:123) Nyborg therefore departed strongly from behaviourist conceptions of learning and especially its emphasis on animal development which was used to predict and explain human learning. *'…higher animals have to learn much during their development, but their development does not reach a level comparable with human learning in amount, complexity of organisation, etc.*' (Nyborg, 1993:26) Nyborg contended that human psychological development, in contrast with genetically pre-programmed organic growth, occurs through changes in the following: i) human experiences, ii) storing experiences, so that they are available for human memory and thinking when needed and iii) processing stored experiences by using thinking.

According to Nyborg (1993), the primary experience of learning in the young child is through the senses. Nyborg referred to coding as the secondary experience of learning. Coding involves learning about different acts/events and how to connect these events as well as to determine in which sequence they occur. Coding is therefore integrated with different kinds of skills and most often associated with learned positive or negative dispositions for becoming emotionally and motivationally activated. Long Term Memory is the outcome of human learning and cognition. Human cognition may be in the form of: i) images of specific phenomena, ii) systems of concepts, iii) concepts about classifications and iv) propositionally organised meanings such as explanations, definitions, principles and laws. Nyborg thus described words, numbers, and most other symbols used as names and learned as language skills, as *‘classes of phenomena’* which have to be learnt about in terms of concepts and conceptual systems. The process of detecting partial similarities and differences (as described in the CTM) between different members of a class may render the organisation of single concepts into a conceptual system. Learners are thereby able to develop the capacity to perform abstract classifications and/or to pay selective attention to abstracted aspects of phenomena (i.e. they become analytic coders). Furthermore, Nyborg would concur with Siegler’s (1998:226) socio-historical contentions: *‘…concepts develop among children in all cultures and probably at all times in history. All have their origin in development. All develop in ways that reflect the influence of the surrounding culture’.*

Influence of Piaget: Nyborg (1993) commended Piaget for his description of development in terms of the products of cognitive development, which he (Nyborg) asserted assists pedagogues to understand when development is complete and satisfactory and when it is not. Piagetian theory introduces the notion that conceptual development progresses from the more incomplete to the more complete levels of organisation. Nyborg concurred with this notion of conceptual development, for example he paid particular attention to the development of the ability in children for multiple classifications, that is, being able to focus on one specific property of an object after another and thereafter being able to describe and classify the object. However, Nyborg did not agree with the breakdown of development into a set of sequential stages where the determinants of growth were factors such as age and gender rather than the learning process itself.

Influence of Vygotsky: Nyborg asserted that Piaget’s description of conceptual development (as discussed above) coincided almost exactly with that of Vygotsky’s. However, Nyborg also stressed the greater value of Vygotskian theory with its emphasis on the role of language for promoting cognitive development as well as on the importance of teaching and learning processes. Vygotsky placed emphasis on the need for responsible, educated people to mediate the content of cultures to new generations. However, most significant is Nyborg's admission that it is Vygotsky's conceptualisation of concept systems (not Piaget's), that is used in his system of CT (Nyborg, 1993). For Vygotsky, as in the CT approach, there was no opposition between cognitive mechanisms and content knowledge, that is, both were simultaneously introduced by the mediator. The mediator therefore did not wait for the learner's spontaneous ideas to be mature before new, more sophisticated scientific ideas were introduced.

Influence of Feuerstein: Nyborg's theoretical position was similar to Feuerstein's. They both placed emphasis on the processes of learning while rejecting the focus of developmental psychology on pre-determined sets of developmental stages as determinants of growth. Nyborg in fact agreed with the following Feuersteinian postulates: i) modifiability of all children, ii) modifiability at all ages, iii) modifiability irrespective of severity of the condition and iv) mental ceiling of learners is not known (Lebeer, 1999). Nyborg (1993:11) acknowledged and made explicit mention of the role of the mediator: *'Pedagogy usually reflects and mediates the culture within which it is has been generated.'* These ideas accord with Feuerstein's notion of cultural transmission, that is the process whereby critical knowledge, mores, values and traditions are transmitted from one generation to the next thus ensuring cultural continuity. Feuerstein is credited with elaborating on the role of the human as mediator. Nyborg's (1993:13) theory of learning proposed that the quality of mediation differed depending on the extent to which a teacher was able *'to provide optimum, external conditions for learning in persons who may differ considerably in pre-requisites for learning.'*

Research and evaluation

A [8]review of the literature indicates that case studies have been the primary research methodology selected to evaluate the CT approach. Miller's (2003) evaluation of the Nyborgian method reported that there is striking objective evidence of efficacy of this approach with special-needs children, including learners with significant intellectual deficits. [9]Several small group studies and classroom applications of CT have also been administered. However, these studies were mostly of an exploratory nature (Lyngstad, 1997).

Nyborg (1993) reported on research completed by his team using the CT approach with a diverse range of children and youth (500-1000 in number). The findings from this work can be summarised through at least two *'highly reliable'* trends: i) learners benefited considerably from CT with respect to their learning and thinking and ii) negative disposition of learners towards their learning as well as themselves had changed (Nyborg, 1993:483).

The typical case-study methodology described in the literature focused on individual learners, who received intensive CT over an extended period of time, that is, for 3-5 years. The learners selected to participate in these studies had severe intellectual impairments. The improvements in IQ in the case studies reviewed are dramatic, for example there have been reported improvement of up to [10]35 IQ points (Hansen, 1998). The learners who have made these gains tend to continue to show improvements in all areas of their functioning. The learner discussed in the above example was achieving normal learning results compared with his classmates at the end of his sixth year of schooling. In addition, demonstrated effects have also been shown

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[8] The literature review was limited to journals/books articles which were translated from Norwegian into English. It is worth noting that the English translation of these articles/books was often complicated by language and translation difficulties.

[9] It should be noted that even though a number of study summaries were reviewed, the original data could not be examined as they were not available in English.

[10] This learner's IQ measured on the WISC-R improved from 66 before to 101 after intervention. He had received three years of CT.

with children in the 40-50 IQ range. The results from a study indicated that these children were able to transfer learning to 'untrained concepts' (near transfer) and also showed improvement in their language (length of utterances and percentage of grammatically correct sentences) (Sastad, 1975, 1985, cited in Lyngstad, 1997).

From the results discussed above, the CT method should have enormous appeal to those teaching young learners, especially those experiencing severe barriers to learning. However, a number of difficulties with the programme are raised: -

- The programme which was developed as a prevention/intervention programme for all children, has been implemented mainly amongst children with severe intellectual impairments.
- The programme content is not directly linked (at the start of the programme) to school learning. However, it is generally relevant to the preliminary knowledge required for school learning.
- The programme is implemented over an extended period of time and is run intensively (multiple sessions per week).
- The training of well-prepared basic concept teachers requires an extended period of time.
- The research literature has not been extensively translated into English which prevents widespread access to these ideas.

CT is an attractive approach that appears to have remarkably effective outcomes, especially for learners who experience severe barriers to learning. The programme is found to be effective when applied intensively over extended periods of time, by highly trained and dedicated teachers. The programme is taught using a three-step process (Concept Teaching Model), which would make it relatively easy to implement. Although the programme content is related to school learning (and the CTM has been adapted to teach school subjects), it has not been infused into the school curriculum. In a recent written correspondence with Hansen (a colleague of the deceased Nyborg and leading scholar of CT in Norway), he described projects that focus on curriculum infusion for Grade 1-4 learners in the mathematics and reading learning areas (Researcher's written correspondence with Hansen, October 2004).

3.2.4 Summary and evaluation (See Table 3.1, p.91.)

The programmes reviewed all contribute significantly towards the improvement of learning and enhanced teaching practice within a metacognitive framework. The main theoretical dimensions of these metacognitive frameworks are markedly similar. The distinctions within this area are subtle, but do contribute to differences in emphasis in these programmes. Both BS and CASE are influenced strongly by Piagetian and social constructivist perspectives of cognitive development. However, they vary in the levels of emphasis placed on these perspectives. BS is arguably more orientated towards social constructivism, whereas CASE is more orientated towards the Piagetian perspective. One of the main objectives of BS is to promote the cognitive functioning of learners (associated with Piaget's description of concrete operational thinking), however, the programme is assessed in terms of a range of affective-motivational, cognitive and scholastic variables. CASE@K1 shares similar objectives to BS, but places stronger emphasis on Piagetian designed tasks in determining the outcomes of the programme. CT differs with respect to both BS and CASE in that it is derived from a more eclectic theoretical basis and draws on a number of different theorists. For example, CT draws separately on Piaget's general theory of cognitive development as well as on Vygotsky's notions of spontaneous and scientific concepts.

Arguably, the most attractive programme for teachers appears to be CASE. BS and CT seem to make many more demands on teachers. CASE is a short-term, low intensity, highly structured programme that provides coaching for teachers in the classroom. The CT approach is a content-specific programme and is more related to the school curriculum, whereas BS and CASE are content-general programmes which focus on the development of cognitive functions/higher order thinking of the learners. However, all the programmes are domain-general in nature and are not directly linked to curriculum learning areas (e.g. mathematics or literacy teaching).

Carlson (2004) suggested that all cognitive intervention programmes should meet the following criteria: i) have very clear goals and objectives, ii) take into account and build on the child's prior knowledge and learning and iii) provide experiences that lead to deep processing and mindful abstraction. All three of the cognitive intervention programmes would score highly with respect to all these criteria. Molina and Vived (2004) have raised some concerns as to whether *criterion (ii)* is fulfilled in the BS programme. Carlson recommends that the dependent variable of cognitive programmes also be evaluated: i) Are the assessments directly related to the initial goals? ii) Do the assessments provide feedback for further learning? iii) Do the assessments provide measures of transfer? and iv) Do the assessments include delayed measures to determine the durability of learning? With respect to the research validity of these programmes most would score reasonably highly on these criteria, however, none of the programmes provides feedback for further learning (*criterion ii)*. The above favourable evaluation of these three metacognitive programmes is in keeping with the positive research outcomes which have been reported for these programmes.

TABLE 3.1

Summary & evaluation of three metacognitive programmes for young children: Bright Start, Cognitive Acceleration Through Science & Concept Teaching.

	Bright Start (BS)	Cognitive Acceleration Through Science (CASE@KS1)	Concept Teaching (CT)
1. Scope and coherence of theoretical base	A highly detailed theory with strong and coherent linkages with cognitive developmental theories: mediated learning theory, constructivism and socio-cultural theory.	A highly detailed theory with strong and coherent linkages with cognitive developmental theories: constructivism and socio-cultural theory. Mediated learning theory is implied, but not directly referred to by the authors.	Highly detailed, eclectic theoretical base which draws on various different perspectives: Piaget, Vygotsky, Bruner, Hebb, and Feuerstein.
2. Clarity of programme constructs and the model for implementing the programme	The programme often makes use of complex and vague terminology which would make it difficult for teachers to implement. Teachers are required to prepare extensively for the sessions. A number of different activities could be implemented during a session. Each session follows a five-step model.	The programme is set out in a clear and highly concise manner which would make it easy for teachers to implement. Teachers only need to prepare one main activity per session. The activity is implemented using a six-step model.	The programme is set out clearly which would make it easy for teachers (especially after training) to follow. Many examples of activities and mediational questions are provided in the manual. Multiple mini-learning situations are presented during the sessions. The CT sessions are implemented using a three-step model.

	Bright Start (BS)	Cognitive Acceleration Through Science (CASE@KS1)	Concept Teaching (CT)
3. Links with the school content or learning areas	*Low levels* of linkages with the content of the curriculum. This is consistent with the stated theoretical position of the programme.	*Low to Moderate levels* of linkage with the content of the curriculum. The activities are designed to teach the schemata of concrete operations. Linkages, however, have been made with the national curriculum outcomes. (This project was different from the original, context-specific (science) project for adolescents.)	*Moderate to High levels* of linkages with the content of the curriculum. The conceptual content of the programme is taught separately to the school learning areas. However, the programme content corresponds with the knowledge areas required for formal school learning. The approach could be extended to teaching school subjects.
4. Infused or added on to the school content and bridging of learning	Added on to the school curriculum. However, attempts are made to bridge learning to the school and home context. Dedicated bridging exemplars have been provided.	Added on to the school curriculum. However, attempts are made to bridge learning during the sessions to other contexts. No dedicated bridging materials have been developed.	Combination of an add on and infusion approach. Bridging is not directly specified in the CTM, however, is implied because of the content-specific nature of the programme.
5. Length of the programme	*Medium-Term:* may extend over a period of 1,5 - 2 school years (±150 sessions).	*Short-Term:* extends over one school year (±30 sessions).	*Long-Term:* could extend over a number of years even when used as a general education approach.

	Bright Start (BS)	Cognitive Acceleration Through Science (CASE@KS1)	Concept Teaching (CT)
6. Level of teacher support provided	Support structures after teacher-training are not provided.	High levels of support given to teachers. Class visitors provide coaching to teachers in their classes.	Low levels of teacher support are provided. Once teachers have been trained (i.e. a minimum of two days) they are generally thought to be prepared to implement the programme independently.
7. Nature and extent of the research	A number of quantitative studies (at least 10 studies) have been done internationally. However, there is still ongoing research.	The main study is still underway. This is a relatively large study that has used both quantitative and qualitative approaches to measure the study effects.	There have been numerous studies since the conception of CT. The research literature appears to be limited to relatively small qualitative case studies.
8. Research outcomes	The effects of the programme are encouraging. These findings are derived from multiple replication studies which were not implemented by the authors of the programme.	The effects of the intervention were promising, however, the power of the data was limited. Further long-term quantitative data still need to be gathered.	The reported effects of the (derived from small case studies) on the improvement of IQ levels and general scholastic functioning of low functioning learners, appear impressive.

	Bright Start (BS)	Cognitive Acceleration Through Science (CASE@KS1)	Concept Teaching (CT)
9. Summary of the evaluation of the programme	A strong, theoretically derived programme that appears to be effective for a broad range of learners. There are, however, difficulties with implementation which are mainly related to the content of the programme as well as the level of demands placed on teachers to implement it.	The CA approach is strongly grounded in theory. The initial findings from this project are encouraging, however, further research is required. The CA approach, provides a succinct and highly coherent model that appears to assist with implementation in large-scale studies. The main difficulty with the project is its 'separation' from school curriculum.	CT is a well-grounded theoretically-based programme and has strong effects on low functioning learners. This requires intensive interventions over extensive periods of time. The programme is clearly presented making it easy for teachers to implement, however, only after training (that may extend for 1,5 years). High levels of demands are made on teachers by this programme.

3.3 TOWARDS A SYNTHESIS OF NEW KNOWLEDGE AND PRAXIS

Why develop a new metacognitive programme, when the programmes reviewed are all adequate? All three programmes discussed, as previously intimated would on their own be appropriate but not necessarily efficacious in different settings. The programmes appeared to meet most of the cognitive programme evaluation criteria (as discussed above). However, difficulties have been identified with each programme. The programmes reviewed are regarded as making important contributions towards the development of revised knowledge, but none of the programmes on their own was deemed suitable to meet the needs of teaching-learning in the South African education context. The current study is located within the context of educational transformation in the tenth year of a developing democratic societal order in South Africa. (See Chapter One.)

'There is no one programme that is best for everybody or every place …One must learn about the principles of thinking and the programme available … and then make a careful thought out decision as to what will work best in a given setting.' (Baron & Sternberg, 1987: not found)

Therefore there was a need to devise a new metacognitive programme that would be relevant and responsive to the local context, however, drawing on the principles derived from other well-established, theoretically-grounded, metacognitive programmes for younger children.

The key tenets drawn from the cognitive programmes under discussion: -

- **Bright Start (BS)-** the programme places emphasis on mediational teaching and thus on the quality of human relationships in learning- the main mechanism used to teach the content of the programme.
- **Cognitive Acceleration Through Science (CASE)-** the programme offers a manageable, focussed and systematic approach for educators to develop the higher order thinking capacities of their learners in the context of a regular class and school environment. Support of teachers in their own settings is emphasized.
- **Concept Teaching (CT)-** the programme provides a systematic and highly detailed analysis of the teaching processes associated with the learning of basic concepts. More importantly, it provides evidence for the transformative power of conceptually structured knowledge for the development of conceptual and abstract reasoning in learners.

The above three aspects will be discussed in further detail below as well as some motivation provided for their extraction to this South African study.

i) Mediational teaching

The programmes reviewed all explicitly identify mediation as an integral component of the programme, however, it is only BS that provides a mechanism (mediational teaching) to assist teachers to develop such a teaching approach. In fact, cognitive intervention programmes very seldom provide any detail to direct the human interactions, that is the *'how do I teach this'* aspect of the programme. The mediational teaching approach, a derivation of Feuerstein's mediated learning theory, describes the mechanisms of mediation so that they can be accurately replicated. Teachers can be trained to develop their mediational skills and can accordingly be assisted to implement this approach. This is especially significant within the South African context where a majority of teachers come from backgrounds of disadvantage and have not been trained to apply socio-cultural theory to their practice. In addition, it is via the mediational teaching framework that human bonds are forged which are especially important for learners who experience barriers to learning, who often also experience a host of related socio-emotional difficulties. This is particularly pertinent to the sample in the current study. (See Chapter Five, p.139.)

ii) The general context for cognitive education

The programmes discussed, with the exception of CASE to a large extent, present numerous challenges to educators in terms of various practical implementation dimensions of such programmes. These dimensions are mentioned in the literature (e.g. Haywood, 1997), but often appear to be neglected in programme design. Haywood (1997) therefore queries: *'…is it therefore realistic to implement these programmes in schools or do we need to change the way the programmes are constructed?'* The practical implementation dimensions refer to the: length of the programme, intensity of the programme, nature of support provided to teachers who implement the programme, linkages of the programme with school learning areas and the level of complexity of the programme. Programmes are generally implemented in schools with full schedules where extensive demands are already being made of educators.

The CASE@K1 project is a sophisticated metacognitive programme that has successfully addressed many of these design concerns. CASE has created a short-term, low-intensity programme that has prepared teachers to implement (with support) the programme in regular classes. In addition, the Six Pillars of CASE used to implement the CA approach provide a comprehensive model for educators to advance higher order thinking. The need for such an 'attractive' programme for teachers is especially pertinent within the South African context, where teachers are faced with large classes of learners from diverse communities who have varying levels of ability. These teachers are also still grappling with the revisions made to the new curriculum (viz. Revised National Curriculum Statement) (Fleisch, 2002).

iii) Teaching and learning conceptually structured content

The CT approach is particularly pertinent, not only with respect to teaching basic concepts, but also with respect to the theory associated with the development of conceptual knowledge. *'Throughout history of the child's development runs a 'warfare' between spontaneous and non-spontaneous, systematically learned, concepts.'* (Vygotsky, 1986:149) The CT approach attempts to advance the development of conceptual reasoning, using a clearly defined and highly structured programme with a conceptually orientated content. While BS and CASE are also involved in teaching learners to develop deeper and more complex ways of thinking, it is CT that provides additional microscopic detail in order to teach new concepts. The theory of Analytic Coding operationalized by the Concept Teaching Model describes in a high level of detail the processes that contribute to effective concept learning. This would be an appropriate approach for teachers and particularly for those who require a more systematic and analytical approach to teaching. South African teachers were trained to teach using a simple input-output model of learning. This approach involved a lot of repetition with little or no attention given to thinking (Taylor & Vingevold, 1999). An approach similar to the CT approach would therefore assist teachers to be conscious of each detail in the process of learning.

3.3.1 Summary

The three programmes were not regarded as suitable for the South African context when viewed independently, but aspects of these programmes could be incorporated into a new programme developed for the South African context.

The new programme would need to: -

i) Create an environment where social interchange and cognitive functioning is activated using deliberate mediated teaching mechanisms;

ii) Consider the general context in which it is to be implemented and to incorporate this information into the programme design; and

iii) Facilitate the teaching of conceptual knowledge using a systematic, detailed and analytical approach (with the assistance of a condensed model to teach this conceptually-orientated content).

The proposed programme (to be discussed in depth in the following chapter) is concerned not only with training teachers to implement the programme, but also with ensuring that teachers are ‘given’ the details of how to mediate in a variety of situations. It also places importance on various design dimensions ensuring that the programme is responsive to the general context in which it is implemented. It is presumed that cognitive education programmes compete with busy teachers and/or full school schedules. This difficulty is resolved by developing short-term programmes that are relatively easy to implement within the school context. This point is critical especially if the programme is not fully infused into the curriculum. The majority of metacognitive programmes for young learners are not fully infused into the curriculum, but are instead added on to the school programme. Furthermore, much attention is given to the proposed format of the programme: clear instructions with examples of mediation, structured or semi-structured activities and a concise model to implement the programme. It is also argued that the selection of conceptually orientated content for such a programme is important in order to develop the prerequisites for further learning. In addition, the method used to teach such conceptual systems is also emphasized. A general teaching model, for example, as suggested by the CA approach does not provide sufficient detail to assist teachers to encode such preliminary concepts.

The proposed new metacognitive programme, described in Chapter Four, thus attempts to extract key tenets from these three metacognitive programmes while simultaneously attempting to overcome the difficulties of each programme to create a programme which addresses the developmental challenges of teaching-learning in South Africa.

CHAPTER FOUR

THE BASIC CONCEPTS MEDIATED LEARNING PROGRAMME (BCMLP)

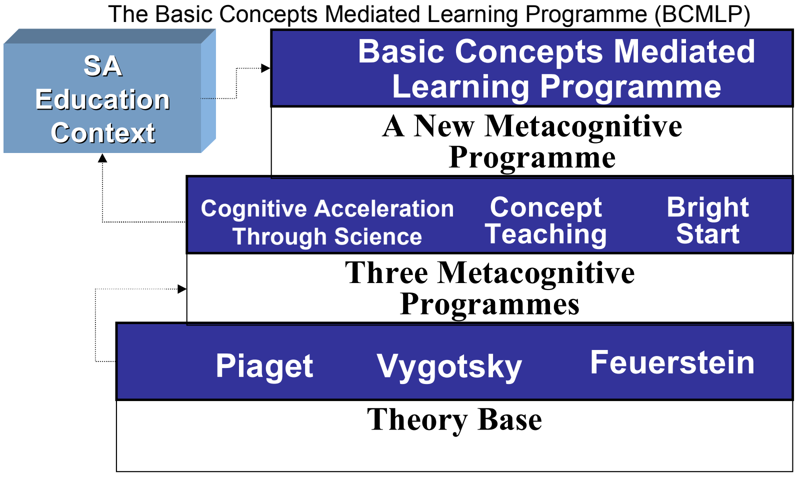
4.1 INTRODUCTION

The chapter aims to introduce the reader to the BCMLP, the cognitive programme developed for the purpose of this study. The chapter presents the background and context for the proposed programme and provides a conceptual overview of the programme. This description of the BCMLP, the educational intervention programme in this study, bridges the theoretical and the applied dimensions of the study. The description of the intervention programme, a procedure of the study, could have been placed in the methodology chapter (Chapter Five). However, it was decided to devote a separate chapter to the programme itself to provide a more comprehensive description. The adjustments that were made to the intervention programme during the Pilot Study (part 1 and part 2) and Main Study are presented in the methodology chapter. There is inevitably some overlap between these two chapters.

4.2 THE EVOLUTION OF THE PROPOSED METACOGNITIVE PROGRAMME: BACKGROUND AND CONTEXT

Although there is a significant body of research about the teaching of thinking (McGuinness, 1999) this has mainly focused on secondary and upper primary classrooms (Adey & Shayer, 1994; Feuerstein, Rand, Hoffman & Miller, 1980; Fisher 1998; Hamers & Overtoom 1997; Lipman, 1991; Venville, Adey, Larking, Robertson, 2003). This is with the exception of research into the three metacognitive programmes discussed in Chapter Three. The scarcity of research into cognitive programmes for younger children may partly be attributed to the dominance of Piaget's stage theory which led to a general underestimation of the capacity of the younger child (four to eight years old) for deep and abstract thinking (Donaldson, 1978; Goswamy & Brown, 1989). It is proposed that there is a need for more programmatic applications for younger children, particularly programmes that are based on contemporary cognitive education theory and designed to meet the specific needs of learners within different contexts.

FIGURE 4.1
Evolution of a metacognitive programme for younger children:
The Basic Concepts Mediated Learning Programme (BCMLP)



The BCMLP was built on the insights from three theoretically derived metacognitive programmes for young children. (See Figure 4.1.) The BCMLP attempts to refine the knowledge and practice involved in advancing cognitive functioning in the younger child, however, with a strong emphasis on the challenges presented within the South African education context. The whole teaching-learning environment (viz. teacher, learner and school) needed to be considered in the design of the programme for the South African context. (See Chapter One and Chapter Three for further discussion.)

The new programme needed to consider a context in which: -

i) Large numbers of learners experienced educational deficits at the start of formal schooling;

ii) Schools often had full schedules for the year and experienced difficulties taking on new, demanding, time-intensive activities; and

iii) Teachers might not be adequately trained and were required to teach in conditions under which they experienced enormous demands.

Specific attention was therefore given to ensuring that appropriate programmatic accommodations were made which took cognisance of the South African educational context. The description of the programme in the sections which follow focuses not only on the procedures and processes of the programme, but also on the appropriateness of these within the local context. The BCMLP was derived from the cognitive education principles of three metacognitive programmes. However, these programmes were found to have various features that would limit their effective implementation in the South African educational context. The BCMLP was therefore created to respond to the specific needs and challenges of the South African educational context, particularly teachers and learners within mainstream public schools. The BCMLP could also contribute a new cycle of learning for teachers and learners where knowledge is derived from action and where action leads to the creation of new knowledge in the field of cognitive education.

4.3 THE BASIC CONCEPTS MEDIATED LEARNING PROGRAMME: A REVIEW

4.3.1 Overview of the programme purposes and goals

The BCMLP is a metacognitive programme for young learners in the Foundation Phase (from Pre-school to Grade 3) of the education system. The programme systematically introduces learners to content knowledge in conjunction with several lower and higher order cognitive functions. The programme progressively introduces learners to hierarchically constructed knowledge domains (conceptual systems) that provide a template for a series of thinking activities. The purpose is to assist learners to use knowledge as a tool for higher order cognitive processing. This is achieved through highly structured mediational encounters where words are mediated as names of concepts belonging to subordinate and superordinate classifications. The transformation of words into members of classes and conceptual systems requires reorganisation and adaptation of the thinking structures in learners.

The programme goals are therefore threefold: i) to introduce an essential knowledge base (and associated vocabulary) to learners, while ii) assisting to develop certain core cognitive functions in order iii) to promote school learning.

The BCMLP attempts to address the needs of a diverse learner population that experiences a range of barriers to learning. These may be learners who have deficits in their knowledge base (often related to educational disadvantage), learners who require cognitive enrichment, or those learners who are not making school progress. The emphasis of the programme is on enhancing the structural cognitive modifiability of learners. The focus for teacher-mediators is therefore on providing appropriately structured learning opportunities. The programme thus departs from the notion of a static, diagnostic classification of learning ability, moving towards an active, modifying and interventionist approach that aims to enhance thinking and learning processes.

4.3.2 A broad description of the programme

The Basic Concepts Mediated Learning Programme is a *metacognitive*, *short-term*, *intensive*, *small group*, *semi-structured* programme for learners who experience barriers to learning. The programme to be discussed in this chapter reflects the initial design intentions of the researcher. However, as will be discussed in the methodology chapter, certain changes were made when the programme was implemented during the Pilot- and Main Study phases. [1]For example, in the study the programme was implemented by Learning Support Teachers in a small group withdrawal format, even though it was designed for Class Teachers within 'ordinary' South African classes.

[1] The Local Educational Authority from the outset of the study (Pilot Phase) decided that the programme would be implemented by Learning Support Teachers (LSTs). The LSTs were regarded (at that time) as the most appropriately placed within the school system to run such a programme.

A brief elaboration of the programme descriptors (underlined above) follows: -

- **Metacognitive:** Adey and Shayer (1994), identified two concepts that assist to clarify the term 'metacognitive': *'going above'* and *'going beyond'*. 'Going above' refers to looking down on one's own thinking, whereas 'going beyond' refers to examining one's own thinking beyond the current context. Haywood (2004) similarly defined metacognition as including two important aspects: i) thinking about one's thinking and ii) development, selection and application of personal thinking processes. In the BCMLP there is a focus on generating individualised thinking skills and strategies, as well as on the content of the programme in order to solve a range of problems. The programme also encourages learners to make connections between content during Basic Concepts Sessions and events outside these sessions (the bridging and transferring processes of the Teaching Model- see the section below).

- **Short-term:** This is regarded as a unique feature of the programme. In contrast with the length of time recommended by authors of other metacognitive programmes (e.g. Bright Start which recommends at least 150 sessions of intensive intervention), the BCMLP is implemented over ±2 school terms in 50 sessions. The barriers presented by the extensive time commitments (that could extend over a number of years) required from teachers to implement such programmes have not been addressed in most circumstances. Shortening the period of intervention (to ±two school terms) has numerous positive practical implications, especially within the South African context where there are enormous demands on educators, for example coping with large heterogeneous, inclusive, classes with limited resources. By providing educators with an estimate of the time commitment required to implement the programme and assuming that the new programme can be implemented from start to end within the school year, some of the barriers to implementation might be overcome.

- **Intensive:** The learners receive a minimum of 30 hrs of intervention over the duration of two school terms, that is, the programme is run approximately three times per week for 40 minutes. Intensity is an element consistently recommended by numerous other cognitive programmes (e.g. Hansen, 1996; Haywood, 1995). The intensity of mediational efforts assists learners with the process of developing adaptable and flexible thinking structures. Intensity of the programme, however, places greater demand on teachers. The researcher was therefore faced with the task of balancing the realities of school contexts with the level of intensity required for the programme to be effectively implemented. It could also be contended that intensity of a programme, which provides continuity and frequent feedback for teachers, might increase teachers' motivation to continue implementing the programme.

- **Small Group:** The programme was designed to be implemented by class teachers (see above comment) in a small group format with five to eight learners. There are many advantages to teaching-learning in a small group format, as the majority of similar programmes for younger learners attest to. The teacher-mediator establishes an environment where learners can begin to imitate, model and mediate to each other. This also gives the teacher-mediator time to consolidate and/or extend learning with individuals or pairs of learners during the lesson. The small group format within the South African teaching-learning context demands that teacher-mediators are organized and have well-defined structures within their classrooms, enabling them to run the programme without interference or concern regarding the time commitment required. In fact it may be beneficial for the whole class to do parallel basic concept activities (independently) while the teacher runs the programme. This would also encourage further linkages from the programme to the general teaching-learning environment, essential for extending and generalizing learning to other contexts.

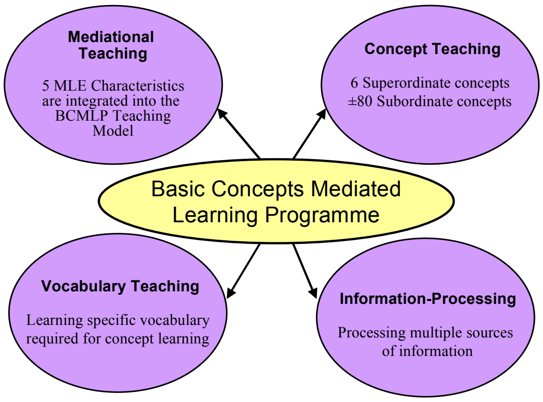
- **Semi-Structured:** Structured guidelines for mediating the conceptual domains are provided in the [2]Teacher's Manual. This includes applied examples of the Teaching Model (to be discussed below) and ideas for learning activities as well as a list of associated mediational questions. (See Appendix 27.) Teachers are required to formulate lesson plans for the Basic Concepts Sessions using a format designed for the programme. (See Appendix 3.) Teachers are thus encouraged to prepare and develop activities appropriate to their teaching context. The difficulties that are sometimes associated with planning are addressed in the in-service teacher-training programme and the classroom support component of the programme design. (See Chapter Four, p.118 and p.120.)

4.3.3 The main procedures of the programme

The programme has four procedures which provide an operational framework for teachers who intend to implement the programme. These procedures provide a succinct **teaching approach** (teaching model) for systematically mediating the **content of the programme** (superordinate and subordinate concepts) as well as **associated vocabulary** (words related to the conceptual domains), while enhancing the **information-processing** (input-elaboration-output model) capacity of the learners. These four procedures of the BCMLP are referred to as:- i) mediational teaching, ii) concept teaching: superordinate and subordinate concepts, iii) vocabulary teaching and iv) teaching to enhance information-processing. The procedures of the BCMLP are interconnected and cannot be artificially separated, however, for the purposes of conceptual clarity it is necessary to discuss and represent each of these separately. (See Figure 4.2, p.107.)

[2] The Teacher's Manual was not included in the write-up of the study because of the length of this document, however, examples from each section of the manual have been included in the Appendices. The following Appendices include content from the Teacher's Manual: 3, 5, 6, 9 and 27.

FIGURE 4.2
Main procedures of BCMLP.



4.3.3.1 Mediational teaching

Haywood (1993) defines the mediational teaching style as an approach towards teaching that involves the application of certain adult-child interactions, referred to as Mediated Learning Experiences (MLE), which are thought to play an essential part in the cognitive development of children.

'These interactions have the function of mediating the generalised meaning of the world to the children; that is, they help children to understand that events, objects, and persons have meaning beyond themselves, that the universe has predictable structure, that understanding that structure helps one to know what to do in a wide variety of future situations, that it is possible to make explanatory rules that help one to organise observations, and that it is essential to test the applicability of such rules in a wide variety of circumstances.' (Haywood, 1993:27)

Feuerstein's mediated learning characteristics (MLE) can be described and replicated in any teaching and learning context. [3]A brief overview of the MLE characteristics referred to in the programme is given below: -

[3] See Appendix 2 for a description of Feuerstein's 12 Mediated Learning Characteristics.

MLE Characteristic 1: *Intentionality and reciprocity*

This refers to any act or sequence of acts that is directed towards affecting a child's perception and understanding of the world. Reciprocity occurs when a child responds, vocally, verbally, or non-verbally to a mediator's behaviour.

MLE Characteristic 2: *Mediation of meaning*

This refers to behaviour that expresses verbal or non-verbal affect, excitement, or appreciation in relation to objects, concepts or values when attempting to learn something new. The mediator provides linkages for the learner when confronted with new learning experiences and relates these to his/her (learner's) past experiences.

MLE Characteristic 3: *Transcendence*

This refers to behaviour that is directed beyond what is necessary to satisfy the immediate need that triggered the interaction towards expanding a child's cognitive awareness. The mediator goes beyond the concrete context and tries to reach out for the general principles that are not bound by the 'here and now'.

MLE Characteristic 4: *Mediation of a feeling of competence*

This refers to behaviour, verbal or non-verbal, that identifies a specific component or components of the child's behaviour considered to contribute to the experience of success. The mediation provides feedback not only for successful performance but also for attempts at mastery.

MLE Characteristic 5: *Mediation of control of behaviour (or self-regulation)*

This refers to behaviour that models, demonstrates and/or verbally suggests to the child to regulate his/her behaviour in relation to a specific task requirement or to any other cognitive process required before overt action. This mediation is essential in order to bring the child to register the information to be learnt.

(Adapted from Klein, 2003:71-72)

Feuerstein's MLE Characteristics constitute an identifiable and important style of teaching (mediational teaching), an example of which is found in the Bright Start programme. Mediational teaching is applied and integrated within the teaching model developed for this study. The BCMLP Teaching Model is a conceptual framework that outlines both the *mediational* and *cognitive processes* associated with the teaching of the content of the programme. The learners are gradually taught through mediational teaching to recognise (focus and name), identify, apply (categorise/seriate/sequence), bridge and then to transfer learning to their school and home environment. (See below for examples of mediational teaching.) The processes of the Teaching Model are repeated for each subordinate and superordinate concept pairing. In addition, the Teaching Model is closely associated with enhancing the information-processing capacity of learners. (See the Information-Processing section below.) Mediation within the BCMLP corresponds with many of the operational elements discussed in the programmes reviewed (e.g. CASE: metacognition, cognitive conflict, social construction, concrete preparations and in the Concept Teaching Model: selective association, selective discrimination and selective generalisation).

[4]*The BCMLP Teaching Model consists of the following mediational processes:*

- **Focussing** (perception): The learner's attention is focussed on the word/object (concept) through the intentional actions of the mediator (MLE Characteristic 1: intentionality and reciprocity).

Typical Mediational Question: What do you see?

- **Naming** (verbal labelling): The name of the concept (if not already known) is taught during this step by the mediator. The mediational strategies to teach the names of concepts are closely associated with the meaning of the concept within the learner's milieu (MLE Characteristic 2: meaning).

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[4]The MLE Characteristics identified in the Teaching Model highlight only the central mediational processes associated with each process in the model. Other MLE Characteristics might therefore be associated with each of the processes.

Typical Mediational Question: What is the name of this shape?

- **Identifying** ([5]Analytic Coding): The salient characteristics of the concept are extensively explored during this step. The mediator is required to teach the concept and thus needs to have a thorough understanding of declarative and procedural knowledge related to the content. The mediational strategies required extend beyond directive teaching and teacher demonstrations. These include: - small experiments which highlight similarities and differences, and learner exploration aided by verbal elaboration and peer discourse. These actions are strongly guided by the teacher's questioning procedures that aim to promote thinking to assist with the process of knowledge transformation (MLE Characteristic 3: transcendence).

Typical Mediational Question: Yes, this is a square,
but how do you know that it is a square?

- **Internalising** (mental representation): The concept that has been taught in the above step is now interiorised. The learner is required to develop a permanent mental representation of the concept. The teacher facilitates this process by guiding the learner away from concrete representations and instead encourages abstract conceptualisations (MLE Characteristic 1, 2, 3: reciprocity, meaning and transcendence).

Typical Mediational Question: Close your eyes. Now try to see if you
can make a picture of the square in your mind.

- **Applying** (problem-solving): The concepts that have been taught are now used to solve problems that involve the application of various higher order cognitive functions (e.g. categorisation, seriation and classification). The teacher encourages the learner to approach the problems in a systematic

[5]The usage of the construct 'Analytic Coding' is consistent with Nyborg's (1993) definition of the construct. (See Chapter 3, p.81.)

manner in order to induce relationships and thereafter to deduce solutions (MLE Characteristic 4 and 5: competence, control of behaviour).

Typical Mediational Question: Can you explain how you would sort these blocks into groups according to their colour and shape?

- **Bridging** (generalising): the learner is now encouraged to make broader associations with the concepts that have been taught. The teacher ensures that the generalisations are consistent, making use of rules or principles (MLE Characteristic 3 and 4: transcendence, competence).

Typical Mediational Question: Can you see a square shape somewhere else in this room?

- **Transferring** (linking): the learner is now actively encouraged to link his/her knowledge of concepts to other areas of associated knowledge, which requires the application of cognitive functions (MLE Characteristic 3: transcendence).

*Typical Mediational Question: Look at the letter **H** in the alphabet can you tell me something about the shape of this letter?*

4.3.3.2 Concept Teaching: Superordinate and subordinate concepts

TABLE 4.1

An overview of the content of the BCMLP.

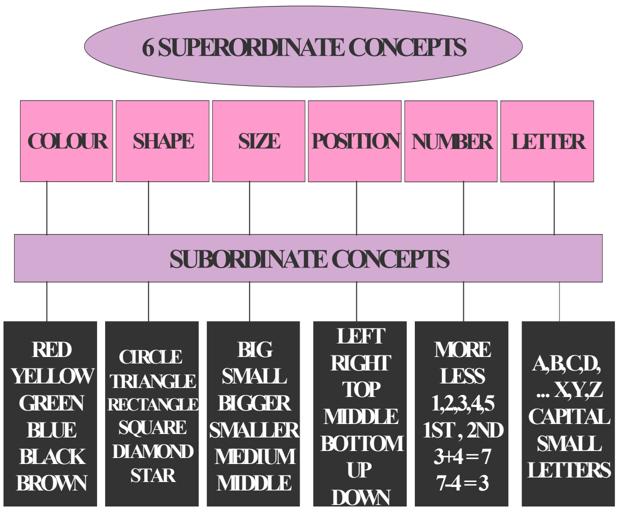
SUPERORDINATE CONCEPTS	SUBORDINATE CONCEPTS	ASSOCIATED VOCABULARY TO BE MEDIATED
1. Colour	• *Red* • *Blue* • *Yellow* • *Green* • *Brown* • *Black*	• *Dark --- Light* • *Shade* • *Hot --- Cold*

SUPERORDINATE CONCEPTS	SUBORDINATE CONCEPTS	ASSOCIATED VOCABULARY TO BE MEDIATED
2. Shape	• *Circle* • *Square* • *Triangle* • *Rectangle* • *Star* • *Diamond*	• *Angle* • *Side* • *Straight line* • *Long line --- Short line* • *Rounded line*
3. Size	• *Big- Small* • *Bigger – Smaller* • *Biggest – Smallest* • *Tall – Short* • *Taller – Shorter* • *Tallest – Shortest* • *Thick – Thin* • *Medium/Average*	• *Measure* • *Slow --- Fast* • *Compare*
4. Position	• *Left & Right* • *Top – Middle – Bottom* • *Inside & Outside* • *Up & Down* • *Forwards & Backwards* • *First & Last* • *Here & There* • *Next to* • *Beginning & End*	• *Direction* • *Map* • *Route*
5. Number and Quantity	• *More – Less* • *1 : 1 Correspondence* • *Counting* • *Ordinal Number* • *Cardinal Number* • *Mathematical Operations* • *Conservation of Number*	• *Few --- Many* • *Count* • *Altogether*
6. Letter	• **Aa, Mm, Nn, Pp, Tt, Ee, Ff, Ii, Cc, Bb, Oo, Dd, Hh, Uu, Gg, Jj, Ss, Ll, Rr, Vv, Ww, Qq, Kk, Xx, Yy, Zz* • *sequence of the alphabet* • *capital and small letters* • *phonetic awareness* • *reading small words* • *writing small words*	• *Rhyme* • *Sound* • *Word*

<u>*Note:</u> The rationale for the order of the letters in the programme (particularly the first 9 letters) was to facilitate the building of words. The mediation of the conceptual domain of letter aims to assist learners to proceed quickly from letter knowledge to the coding and decoding of words.

The BCMLP presents learners with a rich storehouse of everyday, 'spontaneous' (subordinate) concepts which are mediated in association with six 'scientific' (superordinate) conceptual domains. The approach to teaching concepts in the BCMLP is consistent with Vygotsky's interpretation of concept development and with that of Concept Teaching. Vygotsky proposed that the development of scientific concepts and spontaneous concepts were interdependent processes. He was convinced that the development of scientific concepts was dependent on the existence of a well-developed form of spontaneous concept, but also that the emergence of scientific concepts eventually transformed the existing spontaneous concepts. However, the development of scientific concepts in the process of instruction requires the very operations that are still impossible for the child. (Minick, 1987) The introduction of these scientific concepts is regarded as critical, so as to initiate the process of their acquisition. Thus, from the Vygotskian perspective, learning should be sensitively and systematically constructed so as to precede development.

FIGURE 4.3
Interdependence of conceptual knowledge in the BCMLP



In the BCMLP subordinate concepts are consequently paired with superordinate concepts in order to prepare learners for the emergence of scientific concepts. (See Figure 4.3.) The mediator leads the learner to become consciously aware of concepts. This occurs through a process of verbal interaction that directs the learner's attention to word meanings and to the systematic relationship between word meanings, which is fundamental to any organised system of scientific knowledge. The learner who has acquired knowledge of a conceptual system is thereafter better equipped to develop knowledge of other conceptual systems. This is referred to as the generative function of conceptual thinking. Thus, it becomes easier to introduce the more complex conceptual systems (e.g. number and letter) once learners have acquired knowledge of other, less abstract conceptual systems. The Teaching Model systematically guides the teacher to become a mediator of such a learning process, where subordinate concepts are mediated through a process of verbal interaction and are simultaneously linked to superordinate concepts (conceptual systems). This is a process whereby a storehouse of highly structured conceptual vocabulary is mediated through language and is used as a tool for higher order, abstract thinking. Learners are therefore not only taught to *focus, name and identify (analytic coding)* the conceptual systems, but to solve problems that require the application of various higher order cognitive functions: *classification and/or categorization and/or seriation and/or simultaneous comparison of multiple sources of information.*

As was discussed in Chapter 3, cognitive programmes should be relevant to the teaching context with corresponding content. The content of the BCMLP has observable areas of correspondence with the Learning Outcomes of the Revised South African National Curriculum Statement (RNCS) for Foundation Phase Learners (e.g. Mathematics and Language). (See Appendix 4.) Learning Outcomes for both Mathematics and Language were found to have *Moderate* to *High levels* of content correspondence with the BCMLP. In fact it was found that two of the five Learning Outcomes had high levels of content correspondence for Mathematics, whereas three of the six Learning Outcomes for Language had high levels of content correspondence. The BCMLP therefore has similar objectives when compared with the RNCS for Foundation Phase learners. This suggests that the BCMLP may be an effective means to attain Mathematics and Language Learning Outcomes.

4.3.3.3 Vocabulary Teaching

The systematic acquisition of conceptual knowledge occurs through the appropriation of higher order psychological tools primarily mediated through language. The language development of learners is therefore regarded as another main area of focus of the programme. (See Table 4.1, p.111.) The mediational framework proposed (Teaching Model) also provides an approach for language mediation that can be used together with a whole language method during the Basic Concept Sessions. The whole language concept as proposed by Goodman (1986) involves the use of students' language and experiences to increase their reading and writing abilities. This approach places emphasis on learning in the context of meaningful content. The [6]new vocabulary introduced during a Basic Concept Session is thus introduced consciously and purposefully, however, it may not always require the same degree of emphasis given to core conceptual content. Vocabulary teaching was included as a separate procedure to ensure that vocabulary prerequisites required for mediating the core content of the programme were explicitly identified (similar to the 'Concrete Preparation' Pillar of CASE, Chapter Three, p.75).

4.3.3.4 Teaching to enhance Information-Processing

The ability to process multiple sources of complex information is a prerequisite for many higher order cognitive tasks (e.g. reading, spelling, mathematics) and as such is highlighted as a separate procedure of the programme. *'Information-processing is the gateway to … all knowledge, understanding, and conceptual change… (and it is) critically implicated in the whole of cognition.' (Adey, 2003:22)* The information-processing dimensions incorporated within the Teaching Model are made explicit for learners during the Basic Concept Sessions. The teacher-mediator working from an input-elaboration-output model of information-processing (Feuerstein, 1979) directs the learner's attention to incoming information, assists the learner to systematically process and thereafter produce appropriate verbal responses

[6] The 'associated vocabulary' is identified during the Basic Concept Sessions and is therefore not 'prescribed'. These new words identified during the sessions may be directly related to the materials and thinking activities that were designed by the teacher.

or actions. Each of the processes of the Teaching Model may be associated with the input-elaboration-output phases. [7]Recognizing and Identifying are associated with the 'input phase', Internalizing and Applying with the 'elaboration phase', and Bridging and Transferring with the 'output phase'. The complexity of the learners' verbal statements/actions is regarded as an indicator of their ability to use two or more sources of information simultaneously and accordingly provides insight into their higher order cognitive functioning. The information-processing procedure of the BCMLP is also a way of evaluating the performance of the learners; that is, the extent to which learners can process more complex information, have a better understanding of complex ideas and can build more sophisticated connections between ideas.

4.3.3.5 Summary of the main procedures

The Teaching Model is arguably the central procedure of the BCMLP used in this study to advance the development of higher order cognitive functioning in learners. The content of the programme consists of six basic conceptual systems (colour, shape, size, position, number and letter) which are taught in conjunction with certain lower and higher order cognitive functions. The content also forms the foundation for all subsequent school learning and has a moderate to high level of correspondence with Mathematics and Language Learning Outcomes of the Revised National Curriculum Statement. Learners are directed to become conscious that words are part of larger categories. However, they often require additional vocabulary in order to establish such connections. Thus in order that learners develop connections between the words and categories they also need to consider more than one idea at a time. This requires an important intellectual and/or information-processing capacity. It is through the Teaching Model that a systematic information-processing approach to the mediation of the programme content is encouraged.

[7] The descriptions of the phases of cognitive processing are conceptual and therefore one might expect that there is some overlap between the different phases.

The four procedures of the BCMLP, even though not discrete entities, are considered essential to the development of higher order cognitive functioning in learners. Without the knowledge of the associated vocabulary teachers might assume that learners have prior knowledge to learn the content of the programme. Without the content of the programme teachers might not be given enough structure or might infer that content is unimportant in the teaching process. Without the information-processing procedure teachers might not be inclined to develop a systematic approach to their mediation. Without the mediational teaching procedure teachers would not have a framework to activate this metacognitive programme.

4.3.4 Recording, assessment and evaluation in the programme

In order to ensure that the recording and assessment processes were concise and not overly demanding for teachers, three short forms were developed for this purpose. Planning for Basic Concept Sessions is facilitated using the *Session Planner* (Appendix 3) and is guided by the Teacher's Manual (and is also assisted through teacher-training and classroom support). The Basic Concept Sessions are evaluated using the *Session Evaluation Sheet* (Appendix 5). Brief, point-form, running commentaries are gathered on this evaluation sheet which will inform future planning. Teachers are finally required to complete a succinct summative evaluation of every learner at the end of a conceptual domain using the *Basic Concepts Assessment Sheet (*Appendix 6) . Planning, on-going recording and evaluation of learners are thus interconnected processes. The aim of formalizing these processes is to develop the understanding of teacher-mediators of the micro-cognitive processes required to advance learning as well as to give accurate feedback on the outcomes of the programme.

4.3.5 In-service training programme for [8]Learning Support Teachers

The main purpose of the training programme was to prepare Learning Support Teachers (LSTs) in the field to administer the proposed metacognitive programme at their schools. The training programme was expected to prepare LSTs to start mediating, however, with the knowledge that they would require additional support when the programme was implemented at their schools. (See section below.) Haywood (1995) asserts that the introduction of the mediational teaching style requires a major re-orientation of the role of the teacher and of the teacher's activities in the classroom and consequently necessitates the introduction of an intensive teacher-training module. The training programme for LSTs (of the study) was planned with careful consideration of the literature that exists in this area. This was to address what Haywood (1997) describes as the '…*common disappointing experience (to those doing training with teachers to do cognitive education) - only a small percentage of the professionals trained are doing the programme which they were taught and some never started.'*

Haywood (1995) argues that theoretical input is an essential component of teacher-training and should not be avoided. The theoretical structure must address how children learn, the role of adults in children's learning, the interplay of cognitive and motivational factors, and it must be able to identify the most important cognitive operations in terms of their role in both academic and social learning (Haywood, 1995). These facets were all covered in the training programme. For example, the largest part of training time during the Pilot-part 2 and Main Study was allocated to teaching theory and basic concepts content. (See Chapter Five, p.134, for further discussion.) An analysis of the content of the training programme as implemented during the Main Study is presented in the table below.

[8] Learning Support Teachers not Class Teachers were trained during this study. (See Footnote 1 for further information.)

TABLE 4.2

Content analysis of the training programme for Learning Support Teachers (Main Study, 2003).

Basic Concepts Inputs	Technical Aspects of the BCMLP	Cognitive Inputs	Mediational Inputs
Introduction to Basic Conceptual Systems.	How the programme works.	The Learning Triangle: Learner - Mediator - Task	Demonstrations of the 6 conceptual domains.
Detailed overview of the 6 conceptual domains.	Setting goals for the BCMLP.	Superordinate and subordinate concepts.	The mediational teaching approach.
The Basic Concepts Teaching Model.	Evaluating the BCMLP.	The cognitive tools of the BCMLP.	Mediation exercises for trainees (x5).
Linking the content of the BCMLP to contexts outside the sessions.	Recording in the BCMLP.	Problem-solving activities for trainees.	
Overview of the main components of the BCMLP.	How to select group members for the study?		

The training programme was designed with an experiential orientation, linking theory with practice and the development of the required skills to implement the BCMLP. *'Significant personal learning experiences are a powerful force in learning; to enter into a dialogue with our own autobiography as learners is a helpful means to reflect on and reframe our practice as teachers and as learners.'* (Boud, Cohen & Walker, 1993:19) Thus a significant proportion of training aimed to assist LSTs to begin imitating, modelling and internalizing the mediational teaching approach. Learners were invited to certain training sessions in order to assist the teachers (LSTs) to gain confidence and experience in using this approach to teaching. Learning Support Teachers were exposed to each conceptual domain during training and gained some experience mediating each of these domains. Learning Support Teachers also had time, from one training session to the next, to apply this learning in their teaching contexts. *'Mediational teaching is concerned not only with what one teaches but primarily with how one teaches it.' (Haywood, 1993:32)* It was thus important to make the mediational processes explicit and to assist in unpacking the mediational processes needed to promote cognitive development. (See Chapter Four, p.107.) The main aim of the training programme as articulated above was to prepare LSTs to start mediating the BCMLP at their schools and thus to avoid the difficulty of not even starting to implement the programme. The development and evaluation of the training programme during the study will be discussed in more detail in Chapter Five.

4.3.6 Support component for Learning Support Teachers

This was regarded as an integral aspect of the programme. It was not assumed that Learning Support Teachers (LSTs) would automatically internalize the mediational teaching approach without additional support. Haywood (1997) concurs and argues that even teachers who have attended a good basic cognitive education workshop still require *'...longer, more constant, and more detailed learning experiences, especially as they encounter problems and questions.'*

The classroom visits were aimed primarily at guiding the development of a mediational teaching approach. Support was also given to LSTs to assist with the technical aspects of implementing the programme (e.g. planning, reporting, recording and evaluating). A structured feedback sheet for classroom visitors was developed to guide observations during these visits. (See Appendix 11.) *'Regardless of what the teachers have been trained to do in the classroom, there is little likelihood of faithful replication of the programme's principles and procedures without frequent observations and feedback to teachers' (Haywood, 1997*). The number of visits to a classroom was not specified, however, one visit per conceptual domain (i.e. six classroom visits) was regarded as optimal. Learning Support Teachers were encouraged to form their own support networks with other LSTs implementing the programme. This would reduce the number of formal classroom contacts required. The support components for LSTs as they relate to the study will be presented in more detail in the methodology chapter.

4.3.7 Summary of the theoretical base of the BCMLP (See Chapter Two for a full exposition of the theoretical base of the study.)

The theoretical base of the BCMLP is rooted not only in Piaget or Vygotsky or Feuerstein, but on the derivations from each of these theorists.

Piaget's theory implicitly underpins the programme. Two main Piagetian constructs are central to the BCMLP:

i) Development proceeds from less knowledgeable to more knowledgeable states and

ii) Mental actions (e.g. conservation, categorization, classification, seriation, perspective taking) enable shifts from intuitive, spontaneous thinking to more logical, abstract modes of thought.

Piaget's notion that on-going *transformation* and *self-regulation are processes* associated with mental structures is a key theoretical construct that has also been incorporated into the BCMLP. These two Piagetian mechanisms allow for the dynamic synthesis/construction of new ideas and cognitive performances. Piaget also provided a detailed account of the mental actions (see above) that were required to support new learning and cognitive performances. Learners who participate in the BCMLP are constantly introduced to activities that require these mental actions. For example: *Teacher- 'Describe how you sorted the marbles? Learner- 'I sorted the marbles into three groups according to number and colour.'*

Vygotsky provided further insights into how learners could be taught to produce such higher order responses. He proposed that the social nature of learning, aided especially by language, was vital to effect the transition in understanding from unmediated and meaningless symbols and signs to higher order, scientific concepts. Vygotsky introduced the concept of mediators (symbols, signs, language) which assist with the transition from spontaneous concepts to non-spontaneous (superordinate) concepts. Vygotsky thus placed emphasis on a special kind of instruction in the zone of proximal development, that is, on those aspects of development that were still in the process of maturing. Spontaneous concepts establish the path for the development of new concepts. The mediators of the BCMLP accordingly lead learners successively to new conceptual domains, not waiting for spontaneous concepts to mature, but actively initiating the process of new learning. Learning thus actively prompts development in a way not envisaged by Piaget.

Feuerstein provided further detail of the mediation processes that were required to advance development. The mediational teaching style (as articulated by Haywood (1993), a colleague of Feuerstein) aptly describes the quality of the human interactions required in learning, arguably the most important dimension of any educational process. The BCMLP teacher-mediators, faced with learners mostly from disadvantaged communities, many of whom have experienced disruptions in their upbringings, are required to respond in empathic and caring ways. This is done as they (the mediators) engage their learners in the process of learning. The primary role of the human mediator is therefore to establish the prerequisites for learning: motivated, attentive and focussed learners who are ready to receive systematic mediation in order to promote their cognitive functioning and cognitive modifiability. The aim is to produce changes that are durable, flexible and capable in turn of effecting changes in the rest of system.

The BCMLP is therefore a framework that seeks to guide teachers' attention to their role as mediators of human learning processes as well as to the symbolic tools required for higher order thinking. The BCMLP also includes complex, detailed descriptions of the developing mental actions that are required for producing the kind of changes in cognitive performance desired by such a programme.

4.4 CONCLUSION

The BCMLP was designed to address the needs of learners from backgrounds of disadvantage who experience barriers to learning. These learners require comprehensive interventions which address not only their 'learning difficulties' within a school context but also explicitly specify the human interactions needed to enhance their development and progress at school. Furthermore, the BCMLP attempted to address some of the concerns raised regarding other metacognitive programmes for younger learners. The programme was carefully designed to ensure that it was both manageable for teachers as well as relevant to the teaching-learning context. Some of the modifications that were made were: -

- Limiting the length of the programme (but not the intensity of such interventions);
- Ensuring that the programme teaching model was easy to implement;
- Creating a programme with content that was directly relevant to the teaching-learning context;
- Ensuring that the programme constructs were clearly communicated by providing many examples/ideas that could be used by teachers;
- Ensuring that teacher-training prepared teachers to implement the programme; and
- Providing classroom support and feedback to teachers.

The BCMLP is a metacognitive programme designed to address the learning needs of young learners in the South African education context. The programme is a unique integration of theory and practice for a particular context. It also contributes to an area of research that has thus far not provided adequate information for teachers working with younger learners. The proposed programme, building upon the insights of three metacognitive programmes (Bright Start, Cognitive Acceleration Through Science, Concept Teaching), emphasizes aspects of each of these programmes. These are mediational teaching, context issues for cognitive education, and the teaching of conceptually structured content, respectively. While the BCMLP is primarily intended to develop the general cognitive and information-processing abilities of learners (consistent with the three domain-general programmes reviewed in this study), it differs from these programmes in that its content corresponds directly with the school curriculum (e.g. Mathematics and Language learning areas).

CHAPTER FIVE

RESEARCH METHODOLOGY

5.1 INTRODUCTION

An appropriate research methodology was required to explore the effects of the BCMLP (intervention programme) on the cognitive and scholastic functioning of young learners. It is especially important to have an appropriate methodology in an applied human sciences research study. Applied research with human participants presents challenges and requires a thorough investigation involving multiple sources of information (Grinnell, 1998). A quantitative, quasi-experimental research design was selected for this study. Such an approach to data collection was used in order to obtain baseline data, considered important in such a preliminary study. If the findings from the study were suggestive of gains for the study participants, then a more detailed and comprehensive evaluation would be warranted, including those of a qualitative nature. Moreover, the scope of the study was extensive and necessitated a modest selection of research objectives. Thus the decision was taken to focus exclusively on the measurable effects of cognitive change. The researcher was aware of the limitations of using only quantitative data. (See Chapter One, p.2-3 for further discussion.)

The data generated by this study were derived from a range of test batteries. A broad range of tests was used in order to contribute to the veracity of the findings. In cognitive research it is insufficient to provide evidence of change on its own. In order to assert that cognitive programmes have resulted in deep structural modification, one requires evidence of the generalization and longevity of learning. However, the short-term nature of the research design of this study precluded a consideration of the longer-term effects of the intervention programme. (See Chapter Five, p.147 for further discussion.) This chapter will outline the research design which attempted to capture some of the complex changes associated with the phenomenon of learning in young children, under quasi-experimental conditions.

The chapter will first delineate the processes that contributed to the development of the study and will thereafter provide an overview of the Main Study as well as outline the procedures used to operationalize the study. The final section of this chapter will address the methods used to analyze and verify the study data and ensure an ethical research approach.

5.2 RESEARCH AIMS

The study aimed to establish whether, and to what extent, the BCMLP enhanced the knowledge of basic conceptual systems and the cognitive and scholastic functioning of learners who participated in the programme. It was hypothesized that learners who participated in this intervention programme in the Experimental group would benefit significantly more than learners who received a comparable, but alternative, intensive remedial intervention programme in the Comparison group.

Global Hypothesis

Significant differences in favour of learners in the Experimental group will be found in all four assessment areas (knowledge of basic conceptual systems, cognitive processing, cognitive modifiability and scholastic functioning) following six months of the BCMLP.

[1]Four test batteries were used to analyse the effects of the intervention programmes: -

i) Boehm Test of Basic Concepts-Revised (BTBC-R)- testing knowledge of basic conceptual systems

ii) Cognitive Assessment System (CAS)- testing cognitive functioning and information processing

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[1] To be discussed in detail in Chapter Five, p.148.

iii) Children's Inferential Thinking Modifiability Test (CITM)- testing cognitive modifiability

iv) UCT Reading Test, UCT Spelling Test, Ballard Addition- & Subtraction Tests- testing scholastic functioning

Four sub-hypotheses derived from the test batteries mentioned above were established.

Sub-Hypotheses

H1: Hypothesis 1

Significant differences in favour of learners' mean scores in the Experimental group will be found on the BTBC-R (testing knowledge of basic conceptual systems) following six months of the BCMLP.

H2: Hypothesis 2

Significant differences in favour of learners' mean scores in the Experimental group will be found on six subtests (Matching Number, Planned Codes, Number Detection, Receptive Attention, Nonverbal Matrices and Verbal-Spatial Relations) of the CAS (testing higher cognitive functioning and information-processing) following six months of the BCMLP.

[2]H3(a): Hypothesis 3(a)

Significant differences in favour of learners' mean scores in the Experimental group will be found during the pre-teaching stage on the CITM (testing cognitive modifiability) following six months of the BCMLP.

[3]H3(b): Hypothesis 3(b)

Significant differences in favour of learners' gain scores in the Experimental group will be found during the post-teaching stage on the CITM (testing cognitive modifiability) following six months of the BCMLP.

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[2] See Chapter Five, p.162 for further information on the analysis of data from the CITM.
[3] See Chapter Five, p.162 for further information on the analysis of data from the CITM.

H4: Hypothesis 4

Significant differences in favour of learners' mean scores in the Experimental group will be found on the UCT Reading Test, UCT Spelling Test and Ballard Addition- and Subtraction Tests (testing scholastic functioning) following six months of the BCMLP.

The study therefore considered the intervention programme (BCMLP) as the independent variable **(X)** and the learners' scores on a range of test batteries as the dependent variables **(Y)**. The general hypothesis of such a study follows: if **X** occurs, then **Y** will result. Thus, it is the independent variable which must be manipulated in order to effect a variation in the dependent variable. Carlson (2004), however, questions whether researchers are clear about the nature of the independent and dependent variables identified in such studies and identifies the following issues: [4]The dependent variable, as in this study, is often reflected as a test score and therefore one needs to question whether the scores derived from the test batteries are accurate reflections of the actual variable under exploration. [5]With respect to the independent variable, one needs to know how logical and empirically close its relationship is to the theoretical principles underlying it. [6]Finally, one needs to question to what extent the dependent variable is functionally related to the independent variable. These questions are important to explore if the quality and reliability of the study findings are to be regarded with confidence.

[4] This question will be addressed in Chapter Five, p.148.
[5] This question has already been addressed in the preceding chapters.
[6] This question will be addressed in Chapter Five, p.148.

5.3 RESEARCH DESIGN

The study employed a quantitative, quasi-experimental, pre-test and post-test, two-group design, using an Experimental and Comparison group. This design was deemed appropriate in light of the preliminary and applied nature of the study.

The [7]Learning Support Teachers (LSTs) who participated in the study selected the learner-participants (i.e. the study sample). These LSTs were themselves selected by their local education authorities (by Learning Support Facilitators) to participate in the study. [8]The sample for the study was therefore neither randomly selected, nor randomly assigned to the Experimental or Comparison group. Randomisation is considered a major distinction between an experimental and a quasi-experimental study (Redfield, Sivin-Kackala & Sneidderman, 2003). Grinnell and Stothers (1988) proposed that the following are essential components of a 'true' experiment: - i) manipulation of the independent variable, ii) random sampling, iii) random assignment and iv) control over intervening variables. The concept quasi means having some resemblance. They proposed that a quasi-experiment attempts to resemble a true experiment in some aspects, but lacks at least one of the four necessary components mentioned previously. The 'true' experimental component in this study was the manipulation of the independent variable (as discussed in Section 5.2). As an applied educational research study, the current study aimed to answer questions in a number of varied human contexts and situations. This precluded establishing controls for every intervening variable and therefore required that an appropriate quasi-experimental research design be used to measure the outcomes of the study.

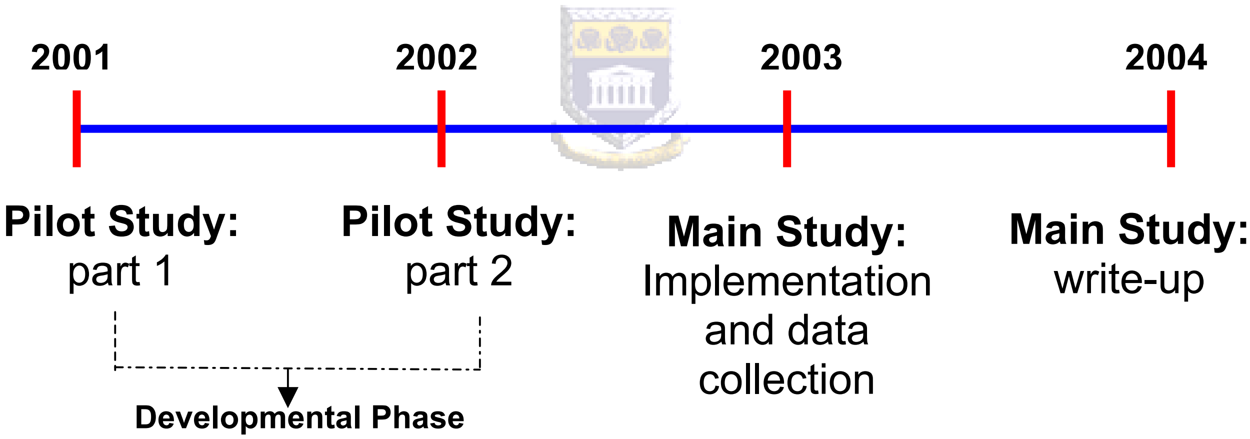
[7] LSTs (previously LSEN teachers) are responsible for addressing the needs of learners who experience barriers to learning as well as assisting Class Teachers to educate these learners. LSTs are posted at a majority of public primary schools in the Western Cape.
[8] The decision to select a non-equivalent design for this study was made mainly for reasons of practical convenience.

5.4 OVERVIEW OF THE DEVELOPMENT OF THE STUDY:

5.4.1 Introduction

The creation of a new metacognitive programme involved an extensive developmental phase, which followed a systematic and rigorous research process. (See Figure 5.1.) The project was initiated in 2001 and was piloted during this year (first year). An additional and more extensive Pilot Study was implemented during the second year (2002). The Main Study was implemented during the third year (2003). The project findings were recorded and written up during the fourth year (2004). The developmental phases of the study (viz. Pilot Study: part 1 and 2) will first be discussed, followed by the presentation of the Main Study.

FIGURE 5.1
Research study time line.



5.4.2 Developmental phase

The Pilot Study consisted of two parts and included two separate studies. These studies are presented in Appendix 7. The purpose of the developmental phase was to obtain accurate feedback from the field in order that adjustments and modifications could be made before implementing the Main Study. This phase therefore provided important insights into the research design and its associated procedures (including the training programme and support component for Learning Support Teachers) as well as the efficacy of the programme. The main achievements (outcomes) of the developmental phase of the study are reflected in the table below.

TABLE 5.1

Outcomes achieved during the developmental phase
(Pilot Study: part 1 & part 2).

Pilot Study-part 1 (2001)	**Pilot Study-part 2 (2002)**
1. Conceptualized and designed the intervention programme for the study (BCMLP).	1. Constructed an in-service training programme for LSTs and a support component for these teachers.
2. Implemented the BCMLP in an initial, investigative study in one school.	2. Trained LSTs as mediators of the BCMLP.
3. Constructed a range of different pre-test and post-test batteries.	3. Implemented the BCMLP in a second investigative study in a number of schools and supported these teachers (LSTs) with the intervention programme.
4. Implemented three test batteries.	4. Implemented four test batteries.
5. Reviewed the research findings from this study and made recommendations for a second pilot study.	5. Reviewed the research findings from this study and made recommendations for the main study.

5.4.3 Recommendations from the developmental phase

- **Pilot Study-part 1**

This initial, exploratory study provided some tentative, yet positive indications for the learners who participated in the intervention programme, however, it mainly provided support for the extension of the programme and thus the continuation of the study. The study was implemented with a group of four Grade 3 learners in a school on the ‘Cape Flats’. The study (including pre-test and post-test batteries and intervention programme) was administered by the researcher. The test batteries were considered appropriate and yielded pre- and post-test data that would have (had there been a larger sample) allowed for detailed statistical investigation. However, no statistical analysis was possible during this preliminary study. The results of this study were therefore only considered as indicators of raw data trends. Three test batteries were administered during this study, namely: Boehm Test of Basic Concepts-Revised, Children's Inferential Thinking Modifiability Test and two Scholastic Tests (viz. reading and spelling). Some adaptations were made to one test battery at the end of this study, viz. the Boehm Test of Basic Concepts-Revised. (See Appendix 8 and Chapter Five, p.151.)

The most important modification that resulted from this Pilot Study related to the programme, and specifically to the number of Basic Concept Sessions (BCS). Notwithstanding the limitations of the Pilot Study, it was found that the programme needed to be extended in length. (See Table 5.2.) It was initially proposed that the programme be implemented over [9]one school term and that it should include approximately 20 BCS. The Pilot Study recommended that the programme be extended from one to two school terms and therefore that the number of BCS be significantly extended. A total of approximately 50 BCSs was recommended.

TABLE 5.2

Changes in the number of Basic Concept Sessions.

Conceptual Systems Of The BCMLP	Number Of BCSs: Pilot Study-Part 1	Increased Number Of BCSs	Percentage Of The Increase In The Number Of BCSs
1. Colour	2	3	3.3%
2. Shape	2	5	10%
3. Size	2	6	13.3%
4. Position	3	8	16.7%
5. Number	3	10	23.3%
6. Letter	8	18	33.3%
Total	20	50	99.9%

[9] A school term corresponds to a period of approximately 2months.

A graduated increase in the number of sessions was suggested. This was to ensure that the increase in the number of sessions corresponded with the increased complexity of the conceptual systems. This was especially relevant for the last two conceptual systems (viz. number and letter) which were regarded as the most complex. The conceptual systems of number and letter together accounted for the largest portion (56.6%) of the increase in the number of sessions. The change in the number of BCSs, even though significant, did not alter the short-term nature of the study. A metacognitive programme implemented over two school terms is still regarded as a short-term programme and particularly so in the context of other metacognitive curricula. (See Chapters Three and Four.) In addition, another programmatic recommendation was made: - that Transfer Activity Sheets be included into the Teacher's Manual in order to assist with the application of learning occurring within the sessions, outside the session. The Pilot Study found that the transfer of learning, an integral aspect of the mediation process which is included within the BCMLP Teaching Model, needed to be made explicit for the learners and the Learning Support Teachers. An appendix of transfer worksheets for each conceptual domain was incorporated into the Teacher's Manual. (See Appendix 9 for an example of a Transfer Activity Worksheet.)

In summary, the results of this preliminary and exploratory study were limited, however, they also provided some positive indications. It was therefore recommended that the study be continued, however, within an expanded pilot study format in order that the entire research process be evaluated.

- **<u>Pilot Study-part 2</u>**

This quasi-experimental, pre- and post-test design study was implemented in eight schools by eight Learning Support Teachers (LSTs) in a local education authority on the 'Cape Flats'. Five learners from each school participated in the study (N=40). The sample consisted of an Experimental and Comparison group, with equivalent numbers of learners (N=20). An equal number of English and Afrikaans, male and female learners were represented in both research groupings. The limitations of the data (viz. small sample size and confounding language variables) placed restrictions on the level of data confidence and the level of inference that could be drawn from this study. However, consistent positive results were found in the English home-language, male and female learners, in the Experimental group. These learners benefited significantly ($p<0.05$) from their participation in the programme in 10 out of 13 areas assessed, whereas the English home-language speakers in the Comparison group benefited significantly ($p<0.05$) in only 4 out of 13 areas assessed. Notwithstanding the limitations of this Pilot Study, these data trends were encouraging and spurred the researcher on to continue with the study.

Various questions regarding the sample variables were raised. In particular, the weaker performance of the Afrikaans home-language learners was most notable. The lack of the reliability of the adapted test batteries translated into Afrikaans prompted the researcher to include only English home-language learners in the Main Study sample. It appeared that gender variables added little explanatory power to the study. For a majority of the areas assessed no significant gender differences were detected. However, it was decided that gender be retained as a possible explanatory variable in this study because some differences between the groupings were detected, particularly in the Experimental group in favour of male learners. (See Appendix 7.)

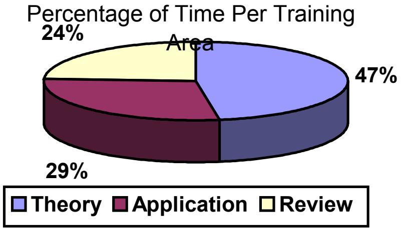
The Pilot Study was implemented over only 1.5 school terms (during the third and fourth school terms) which limited the number of Basic Concept Sessions implemented in the Conceptual Domain of Letter. It was again recommended that the programme be implemented over two full school terms (consistent with the recommendations from Pilot Study-part 1). It was therefore suggested that the programme be implemented during the second and third school terms, giving Learning Support Teachers additional time in the fourth school term, if they were unable to complete the programme. Four test batteries were implemented during this study. An additional test battery which was not used during the Pilot Study-part 1 was introduced (viz. selected subtests of the Cognitive Assessment System) as well as an additional scholastic test (viz. Ballard One-Minute Mathematics Test). No changes were made to the content of the programme.

- [10]**<u>In-Service training programme for Learning Support Teachers</u>**

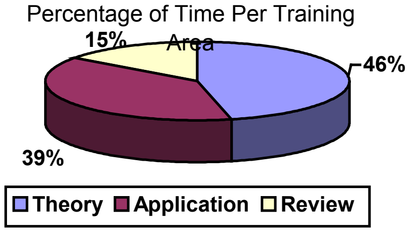
During Pilot Study-part 2 LSTs in the Experimental group received 13 hours of training from the researcher before implementing the BCMLP (i.e. 5 sessions x 160min.). The training was implemented over a period of five weeks. However, it was found that the training programme for the LSTs was not able to explore some of the conceptual systems in depth. It was therefore recommended that the training programme be extended by approximately 5hrs (i.e. from approximately 13hrs to 18hrs of training). It should be noted that [11]Learning Support Facilitators also attended the in-service training programme for LSTs during Pilot Study-part 2 and Main Study.

[12]The training programme for LSTs focussed on the following main areas: - i) theory and basic concepts content, ii) application of learning and iii) review of learning. The largest part of training time (during both the Pilot Study-part 2 and Main Study) was allocated to teaching theory and basic concepts content, the second largest part was used to demonstrate and practice the mediational teaching approach, while the shortest part of the time was used to assist the participants to review and consolidate old learning before new learning was introduced. (See Figures 5.2 and 5.3.)

<u>FIGURE 5.2</u>
Pilot Study-part 2- Teacher Training- Percentage of Time Per Training Area



<u>FIGURE 5.3</u>
Main Study- Teacher Training- Percentage of Time Per Training Area



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[10] The development of the in-service training programme for LSTs during the Pilot Study-part 2 as well the Main Study will be discussed in this section. The theoretical dimensions of the training programme as well as a content analysis of the programme were discussed in Chapter Four.
[11] Only two LSFs (from South) attended the teacher-training during both the Pilot- and Main Study. However, they did not attend all the training sessions during the Main Study.
[12] Different LSTs were trained and involved in implementing the intervention programme during the Pilot Study-part 2 and Main Study.

Two notable changes were made to the training programme for LSTs from the Pilot Study-part 2 to the Main Study. These were an increase (10%) in the percentage time allocated to the application component, and a corresponding decrease (9%) in the percentage of time spent reviewing learning from previous sessions. The percentage of time spent on the theory and basic concepts content during training was comparable during the Pilot- and Main Study (47% and 46% respectively). This was consistent with the discussion in Chapter Four regarding the training programme for LSTs and the emphasis on developing the theoretical understanding (e.g. theory of mind and theory of learning) of the core constructs which underpin the programme.

The LSTs' evaluation of the in-service training programme indicated that they had found the training to be intensive, interactive and a positive experience. (See Appendix 14 for the questionnaire given to LSTs.) The mean LST rating for nine components of the training programme during the Pilot Study-part 2 was 8.7 out of 10. These scores were found to be consistent with the evaluations completed by LSTs during the Main Study. Their average rating for the same nine components of the training programme was 8.2 out of 10. (See Appendix 10.) It should be noted that the above scores (from the Pilot Study and Main Study) also included evaluations from LSTs who were non-participants in the study.

- **[13]Support component for LSTs**

The support component of the study, as outlined in Chapter Four, was developed in response to the concerns of those who train teachers to implement metacognitive curricula (e.g. Adey & Shayer, 1994; Haywood, 1997). These theorists agree that teachers cannot automatically implement such programmes without adequate classroom-based support. The *BCMLP Observation of Mediation Sheet* (Appendix 11) was the primary tool developed

[13] The development of the support component for LSTs of the study as implemented during the Pilot Study-part 2 as well as the Main Study will be discussed in this section. The theoretical aspects of the support component of the study were discussed in Chapter Four.

to assist the Learning Support Facilitators (LSF) to provide Learning Support Teachers with feedback. This observation sheet was first used by the LSFs during Pilot Study-part 2. No major changes were made to the sheet before the Main Study. (See Appendix 28 for an example of a completed BCMLP Observation of Mediation Sheet used during the Main Study.) In addition, samples of Basic Concept Sessions from both EMDCs were video recorded by the researcher throughout the study in order to monitor the mediation processes. An extract from a transcript of a Basic Concept Session has been included in Appendix 29. The teacher mediation contained within this transcript provides some insight into the metacognitive (‘going above’ and ‘going beyond’ one’s own thinking) aspects of the programme. The mediation processes (of LSTs) were however not formally measured during the study.

It was recommended that Learning Support Teachers receive one classroom visit by an LSF per conceptual system (i.e. a total of 6 classroom visits). However, during the Pilot Study-part 2, LSTs received an average of two classroom visits per conceptual system compared with one classroom visit per conceptual system during the Main Study. During the Pilot Study-part 2 the LSFs were trained by the researcher to give teachers (LSTs) feedback. This training was done on-site, that is, during the LSFs’ visits to their teachers (LSTs) who were running the programme. The researcher’s appointments with the LSFs at the schools may also account for the high number of classroom contacts (see above) during the Pilot Phase-part 2 of the study. In contrast, during the Main Study the LSFs were trained by the researcher in a brief, once-off training session. Learning Support Teachers were also encouraged (during the Pilot- and Main Study) to form their own support networks with other LSTs who were trained to implement the programme. No formal record was taken of these informal LST meetings, however, the researcher was aware that some LST subgroups were formed and did meet during the study.

5.5 THE MAIN STUDY

5.5.1 Sample

TABLE 5.3

Study sample: Number of male & female learners in the Experimental & Comparison groups in the South & Central EMDCs.

	Experimental Group		Comparison Group		Total Learners by EMDC
	male	female	male	female	
South	15	14	20	9	**58**
Central	15	10	15	11	**51**
Total by Gender	**30**	**24**	**35**	**20**	
Total Learners	**54**		**55**		**109**

5.5.1.1 Overview of sample

The sample for the study was selected from 22 schools (predominantly on the 'Cape Flats') from two local education authorities (South and Central). An equivalent number of Learning Support Teachers from schools in each of these local education authorities participated in the study. A total of 109 learners at these schools were selected to participate in the study, i.e. five learners in each school. This was with the exception of one school in the Experimental group, which had four learners. The size of the sample was therefore regarded as adequate, from the perspective of both statistical analysis (greater than 30 participants) and being representative of the population (greater than 100) (Seaberg, 1981). Seaberg argued that the general convention of sample size is 10% of the population, which would give reasonable control over sampling error. The Western Cape Annual Statistics Report for Public Ordinary Schools (2003) reported that there were a total of 2899 learners with special education needs in mainstream education in the seven local education authorities. This would translate into an average of approximately 414 learners with special education needs per education authority. The study sample would then consist of approximately 13% of the learners with special education needs in each of the two education authorities. There were approximately 20% more male than female learners in both the Experimental and Comparison groups. The study sample was therefore consistent with the internationally accepted trend that suggests a higher incidence of learning difficulties for male learners compared with female learners (Mwamwenda, 2004). When evaluating the distribution of learners by gender between the research groupings these were found to be relatively similar: In the Experimental Group there were 30 Male and 24 Female learners and in the Comparison Group there were 35 Male and 20 Female learners.

5.5.1.2 Selection of sample

Grade 2 learners who had previously been identified by Learning Support Teachers as having barriers to learning and were already participating in a learning support programme were selected to participate in the study. Learners were required to obtain signed parental/guardian consent before participating in the study. (See Appendix 17 a&b.) According to the sample criteria, only English home-language learners were to be identified as participants. The study aimed to establish the efficacy of the BCMLP and thus attempted to exclude language as an intervening variable. However, it was not possible to entirely exclude intervening language variables from the study, as a large proportion of the learner-participants came from bilingual/mixed language environments. (See section below.) In the context of the 'Cape Flats', this often implies that neither language (English or Afrikaans) has been fully established and often a combination of both these languages is used. The selection criteria for the learners in both research groupings (Experimental and Comparison) were identical. (See Appendix 13 a&b.)

5.5.1.2.1 Biodemographic data of sample (learners)

TABLE 5.4

Summary of categorical biodemographic data for learners.

Category	Experimental Group		Comparison Group		Total	
	Number of Learners	Percentage of Learners	*Number of Learners*	Percentage of Learners	*Number of Learners*	Percentage of Learners
1a. Religion: Christian	**41**	**76%**	**37**	**67%**	**78**	**72%**
1b. Religion: Muslim	**12**	**22%**	**18**	**33%**	**30**	**27%**
1c. Religion: Other	**1**	**2%**	**-**	**-**	**1**	**1%**
2a. Language: English	**26**	**48%**	**24**	**44%**	**50**	**46%**
2b. Language: Afrikaans	**8**	**15%**	**15**	**27%**	**23**	**21%**
2c. Language: Bilingual	**20**	**37%**	**13**	**24%**	**33**	**30%**
2d. Language: Other	**-**	**-**	**3**	**5%**	**3**	**3%**
3a. Family Circumstances: Lives with both parents	**34**	**62%**	**37**	**67%**	**71**	**65%**
3b. Family Circumstances: Lives with mother	**13**	**25%**	**11**	**20%**	**24**	**22%**
3c. Family Circumstances: Lives with other	**7**	**13%**	**7**	**13%**	**14**	**13%**
4a. Family Circumstances: Home life is unstable (See Note 1 below.)	**9**	**17%**	**13**	**24%**	**22**	**20%**
4b. Family Circumstances: Home life is problematic (See Note 2 below.)	**21**	**39%**	**14**	**25%**	**35**	**32%**
4c. Family Circumstances: Not known	**24**	**44%**	**28**	**51%**	**52**	**48%**
5a. Socio-economic Status: father employed	**32**	**59,2%**	**34**	**62%**	**66**	**61%**
5b. Socio-economic Status: father not employed	**11**	**20,4%**	**10**	**18%**	**21**	**19%**
5c. Fathers' Employment Status: Not known	**11**	**20,4%**	**11**	**20%**	**22**	**20%**

Category	Experimental Group		Comparison Group		Total	
	Number of Learners	Percentage of Learners	*Number of Learners*	Percentage of Learners	*Number of Learners*	Percentage of Learners
6a. Socio-economic Status: Mother employed	**33**	**61%**	**35**	**64%**	**68**	**62%**
6b. Socio-economic Status: mother not employed	**18**	**33%**	**17**	**31%**	**35**	**32%**
6c. Mothers' Employment Status: Not known	**3**	**6%**	**3**	**5%**	**6**	**6%**
7a. Socio-economic Status: receive food at school	**22**	**41%**	**22**	**40%**	**44**	**40%**
7b. Socio-economic Status: do not receive food at school	**29**	**54%**	**24**	**44%**	**53**	**49%**
7c. Receives Food at School: Not known	**3**	**5%**	**9**	**16%**	**12**	**11%**
8a. Education: Attended pre-school	**26**	**48%**	**34**	**62%**	**60**	**55%**
8b. Education: Did not Attend pre-school	**23**	**43%**	**11**	**20%**	**34**	**31%**
8c. Pre School Education: Not known	**5**	**9%**	**10**	**18%**	**15**	**14%**
9a. Education: Attended Grade R	**32**	**59%**	**36**	**66%**	**68**	**62%**
9b. Education: Did not attend Grade R	**21**	**39%**	**12**	**22%**	**33**	**30%**
9c. Grade R Education: Not known	**1**	**2%**	**7**	**12%**	**8**	**8%**

Note:
1. Unstable: high levels of family conflict and/or the learner was abused within the home context.
2. Problematic: experiences some form of difficulty within the home environment, e.g. financial, emotional, bereavement, parental neglect.

The biodemographic data of the sample showed vividly the environment from which the sample was selected. (See Chapter One, p.11.) Thirty two percent of the learners' mothers were unemployed and 19% of the learners' fathers were unemployed. Thirty six percent of the learners did not live with both of their parents and a similar percentage of learners (40%) participated in feeding programmes at their schools. Furthermore, 56% and 49% of the learners in the Experimental- and Comparison groups respectively came from homes that were not stable (Note 1 and 2). Thirty one percent of the learners did not attend pre-school and 30% did not attend Grade R. Scaled data indicated that an average of 5.9 people lived in the learners' homes. The number of people living in each household ranged between 2 and 14. The learners in the Experimental and Comparison groups were found to be similar with respect to these data categories. Chi-square analyses found that learners in the Comparison group were significantly ($p<0.05$) more likely to have attended early childhood education provisions (Pre-school and Grade R) than learners in the Experimental group *(Pre-school: Chi-square value*=6.960 *; df=2 ; p*=.031* & *Grade R: Chi-square value*=7.181 *; df=2 ; p*=.028**).*

A majority of the learners selected to participate in the study were Christians (72%), while the second largest grouping of learners were Muslims, and constituted 27% of sample. The mean age of the learners in the sample was 7.1 years (there were no marked differences between the mean age of the sample in the Experimental and Comparison groups: 7.1 and 7.2 respectively). The language variables of the sample also reflected the complex environment from which the sample was drawn. Only 46% of the learners selected to participate in the study were described as English home-language learners, even though teachers were requested to select only English home-language learners to participate in the study. Nearly 30% of the sample was bilingual and 21% were Afrikaans home-language learners. It would, however, be difficult to regard these categories as accurate classifications of these learners owing to the complexities of the language environment from which these learners were drawn. The language differences between learners in the Experimental and Comparison groups therefore cannot be accurately interpreted. The Experimental group appeared to include more bilingual learners (37%) than the Comparison group (24%), whereas the Comparison appeared to have more Afrikaans learners (27%) than the Experimental group (15%). However, if both these categories were combined, then Afrikaans and Bilingual learners would account for nearly the same percentage of learners in both groups (52% and 51% in the Experimental and Comparison groups respectively).

5.5.1.3 Selection of Learning Support Teachers

The Learning Support Facilitators (LSFs) at South and Central EMDCs were responsible for the selection of the Learning Support Teachers (LSTs). These teachers (LSTs) were known to the LSFs (in both research groupings) from their [14]school circuits. This aspect of the study proved beneficial as it enabled the LSFs to continue with their roles at their schools, which entailed supporting teachers (LSTs) with the implementation of new and existing intervention programmes. Nevertheless, LSTs who participated in the study were required to obtain written consent from their Principals as well as give a formal commitment to implement the BCMLP. (See Appendix 12.) The Learning Support Teachers in the Comparison Group were identified in a similar manner, however these teachers were not directly informed that they were to be involved in the study. The learners at these schools were selected according to the selection criteria discussed above (Chapter Five, p.138), but were identified as study participants by Class Teachers. The Learning Support Teachers at the Comparison schools were informed simply that their learners were to be [15]pre-tested and post-tested during the year.

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[14] The LSFs are responsible for a number of schools in a circuit.

[15]The LSTs at these schools were told that their learners were part of a general monitoring project. However, specific information regarding the testing was not given to these teachers.

5.5.1.3.1 Biodemographic data of Learning Support Teachers

TABLE 5.5

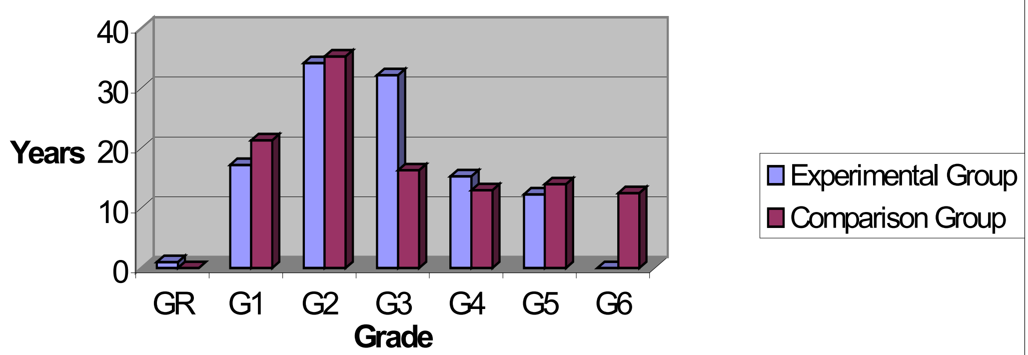
Summary of categorical biodemographic data for Learning Support Teachers.

Category	Experimental Group		Comparison Group		Total	
	Number of Teachers	Percentage of Teachers	Number of Teachers	Percentage of Teachers	Number of Teachers	Percentage of Teachers
Gender: Male Teachers	**1**	**9%**	**0**	**-**	**1**	**5%**
Gender: Female Teachers	**10**	**91%**	**11**	**100%**	**21**	**95%**
Language Background: Speak English at home	**5**	**46%**	**5**	**46%**	**10**	**45%**
Language Background: Speak Afrikaans at home	**2**	**18%**	**3**	**27%**	**5**	**23%**
Language Background: Speak English & Afrikaans at home	**4**	**36%**	**3**	**27%**	**7**	**32%**

With the exception of one male LST in the Experimental group, all the Learning Support Teachers (LSTs) in the study were female. The language background of the LSTs in the Experimental and Comparison groups was similar. These data provide further support for the researcher's contention of a 'mixed' language milieu. For example, 23% of the LSTs spoke Afrikaans at home, but instructed their learners in English at school. The number of years of teaching experience of the LSTs in the study was similar, with a mean of 16.4yrs and 16.3yrs for LSTs in the Experimental and Comparison groups respectively. The range of the number of years of teaching experience was also similar: 7 to 29yrs and 2 to 28yrs for LSTs in the Experimental and Comparison groups respectively. Furthermore, it was found that the LSTs had also accumulated similar experience as Grade teachers in the Foundation- and Intermediate Phases of the education system. (See Figure 5.4.)

FIGURE 5.4

Comparison of the number of years of teaching experience for LSTs in the Experimental and Comparison groups.



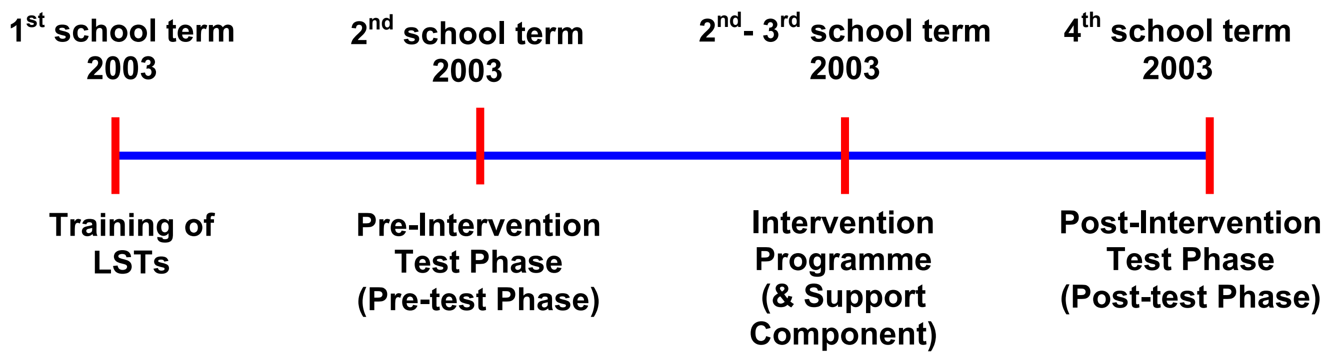
It was particularly interesting to note that the LSTs from both the Experimental and Comparison groups had garnered most experience teaching Grade 2 learners, the same Grade targeted in this study. Most of the LSTs had had at least three years of experience teaching Grade 2 learners. The professional training of the LSTs in the Experimental and Comparison groups was also similar. The mean number of years of professional training received by the LSTs in the Experimental and Comparison groups was 5.5yrs and 5.3yrs respectively.

Even though the learner sample for the study was neither randomly selected nor assigned, the distribution of learner characteristics in the Experimental and Comparison groups in South and Central was relatively homogeneous. The only exception was the provision of early educational opportunities. Significantly more learners in the Comparison group had received exposure to early childhood education ($p<0.05$). The biodemographic information of Learning Support Teachers (LSTs) was found to have high levels of equivalence. From the comparability of the biodemographic information of the learners and LSTs from the two research groupings it could be inferred that study effects were not mainly attributable to biodemographic factors.

5.5.2 Overview of the Main Study

FIGURE 5.5

Main Study time line.



The main study was implemented in four stages.

Stage One: Training of LSTs

The training programme began 4.5 weeks after the start of the school year in 2003 and continued over a period of 5 consecutive weeks. During this time LSTs were required to select and prepare group members (learners) for the study. The LSTs were also requested to plan their sessions for the intervention programme and to schedule these sessions into their term timetables. They also used this time (before the implementation of the programme) to prepare the materials required for the Basic Concept Sessions. Class Teachers in the control schools (Comparison group) were concurrently approached to select learners for the study.

Stage Two: Pre-Intervention Test Phase

The Learning Support Facilitators (LSFs) from South and Central were trained to administer the test batteries in a once-off group session during the first school term. The pre-intervention test phase was initiated at the beginning of the second school term. Two LSFs from South who had received this training during the Pilot Study-part 2 again participated in the training. A team of three LSFs from South and four LSFs from Central were each responsible for the assessment of the learners from 11 schools. In addition, a research assistant was trained to aid the LSFs in both local education authorities with the administration of the test batteries. The researcher also assisted with the administration of the test batteries in a few situations where the above personnel were not able to do the testing themselves. The test phase took approximately four weeks to complete in all 22 schools. The programme for the administration of the test batteries detailing the order and sequence of the testing is included in Appendix 15.

Stage Three: Intervention Programme

The BCMLP was initiated after the pre-intervention test phase had been completed. The intervention programmes for learners in the Experimental and Comparison groups needed to be extended and were only terminated towards the end of the fourth term. This was because the targeted number of sessions had not been attained by the end of the third term. However, even towards the end of the fourth term a majority of LSTs in the Experimental group (9 out of 11) had still not completed the programme. The feedback received from these LSTs indicated that they required another approximately [16]six sessions to complete the programme, however, this might have been an underestimate as the analysis of LSTs' records indicated that they had only begun to implement sessions in the Conceptual Domain of Letter. The LSTs in the Experimental schools administered an average of 34 Basic Concept Sessions, whereas LSTs in Comparison schools administered an average of 23 remedial sessions. The reason for the discrepancy in the number of sessions between the research groupings might have been because of the emphasis placed on LSTs in the Experimental group to run more than one session per week with their learners. The discrepancy in the number of sessions between the research groupings appeared to markedly favour learners in the Experimental group. However, it should be noted that on average the content of the remedial sessions in the Comparison group focussed almost exclusively (87%) on school related learning areas (±20 of the 23 sessions), whereas in the Experimental group on average only 41% of the sessions focussed on school related learning areas (±14 of the 34 sessions).

Learning Support Facilitators (LSFs) provided teachers (LSTs) with support in their classrooms during this stage of the study. (See Chapter Five, p.135.) The LSFs concurrently continued to provide support to the teachers (LSTs) in the Comparison schools. The LSFs were therefore required to give support to teachers (LSTs), irrespective of their assignment to the Experimental or Comparison group. During the study the LSFs continued to receive assistance from their local education authorities (EMDCs) with their support roles to Class Teachers and Learning Support Teachers at their designated schools. LSFs are members of multi-disciplinary teams (psychologists, doctors, nurses, curriculum experts, etc.) at the EMDCs.

[16] 18 sessions are recommended for the Conceptual Domain of Letter. The researcher thus contends that the LSTs may have underestimated the number of sessions that they needed in this conceptual domain. This was the first time these LSTs had implemented the programme.

Stage Four: Post-Intervention Test Phase

The post-intervention test phase was initiated in the Experimental and Comparison schools during the fourth school term, during the last month of the school year. The post-intervention test batteries were the same as the pre-intervention test batteries, that is, no changes were made to the structure of the administration of the test batteries or to the content of the test batteries.

Delayed post-intervention test batteries are still to be administered. This will only be done two years after the main study (2006) and thus did not form part of this study. The longer-term effects of such an intervention programme could therefore not be reported on within this study.

5.5.3 Procedures

The study procedures refer to: -

- The intervention programme (viz. BCMLP),
- the training programme for LSTs and support component for these teachers,
- the structured interview schedules which included the use of rating scales to gather categorical data, and
- the test batteries that were used to gather the pre- and post-intervention programme data.

The above-mentioned procedures were crucial for the implementation of the study and were either designed or adapted specifically for the study. The procedures will be discussed both in terms of their technical-measurement and design features as well as their associations with the theoretical framework of the study. An extensive review of the intervention programme, training programme and the support component of the study were presented in Chapter Four. In addition, the training programme and support components of the study were also presented at the start of this chapter. These aspects of the study procedures will therefore not be discussed again in this section of the chapter.

5.5.3.1 Test batteries

5.5.3.1.1 General overview and rationale

This quantitative, quasi-experimental pre-test and post-test design study was constructed to measure the effects of the BCMLP on the knowledge of basic conceptual systems, cognitive and scholastic functioning of Foundation Phase learners who experienced barriers to learning. It was important that appropriately designed test batteries which reflected current knowledge about cognitive development and learning be used. This would include an understanding of learning as the organization and reorganization of structured knowledge, processed through attentional and working memory systems and organized and stored in long-term memory. Both domain-general and domain-specific mechanisms are involved in these cognitive processes.

The assessment areas decided upon corresponded directly with the hypotheses of the study (Chapter Five, p.125-127), as well as reflecting contemporary ideas about cognitive education. The areas of assessment also aimed to provide a broad understanding of the learners' general and specific cognitive processes. Cognitively orientated studies have been criticised for their almost exclusive focus on abstract reasoning that does not always have a direct relationship to school learning or to the demands that are required in daily problem-solving contexts (Burden & Williams, 1998). However, there has been increasing support for the infusion of cognitive programmes into school curricula (e.g. Adey & Shayer, 1994; Halpern, 1992) and therefore there is a growing need to develop ways of evaluating them.

The test batteries were designed to obtain insight into four key areas of the learners' general and specific cognitive functioning: -

i) Knowledge of basic conceptual systems: The knowledge base of the learners was assessed as well as the learners' ability to build on and develop new conceptual knowledge. This information is regarded as an important indicator for future learning. For example, the relationship between basic relational concept knowledge and school achievement has been supported by numerous studies (Nason, 1986; Piersel & McAndrews, 1982; Steinbauer &

Heller, 1978). The test battery selected was also regarded as a test of near-transfer of the content covered during the programme. (See Chapter Five, p.151, for more information.)

<u>ii) Higher cognitive functioning and information-processing:</u> The higher cognitive functioning and information-processing ability of learners was assessed. The information-processing model of intellectual assessment was used, thus shifting the emphasis away from ability testing (e.g. IQ and Aptitude Testing) and rather placing the focus on the essential cognitive processes. This perspective on assessment challenges the view that intelligence is fixed and instead emphasizes that children/adults deal with the same problems in many different ways.

<u>iii) Cognitive modifiability:</u> The focus on cognitive modifiability during an interactive assessment (or dynamic assessment) procedure provides insight into the degree to which learners are able to modify their thinking. Like the information-processing model of assessment, dynamic assessment is premised on the belief that human beings have a capacity to modify their cognitive functioning. This approach to assessment attempts to determine the gains that can be made by learners, taking into account the effects of a teaching (mediation) stage during the testing procedure. Similarly, the BCMLP (a metacognitive education programme) aims to develop and enhance flexibility in thought structures. The test battery was used to assess the modifiability of learners' cognitive functioning as well as the ability of learners to generalize or independently transfer learning during testing. The goals of the assessment battery used were therefore consistent with those of cognitive education.

The above two assessment areas (assessment area (ii) and iii)) were deemed especially appropriate for groups of learners who are disadvantaged by traditional test batteries (e.g. IQ Tests). These are learners who experience barriers to learning, come from disadvantaged communities, and who differ significantly from the majority of the population on whom traditional tests have been normed (Campione & Brown, 1987; Feuerstein, Rand & Hoffman, 1979;

Gould, 1981; Gupta & Coxhead, 1988). The above is pertinent to the current study as the learner-participants for this study came from disadvantaged communities and experienced barriers to learning.

iv) Scholastic functioning: The scholastic functioning of the learners was assessed using a battery of tests to determine their knowledge in three scholastic domains (viz. spelling, reading and mathematics). The acquisition of specific knowledge is integrally connected with the development of cognitive structures. *'A structure of knowledge binds knowledge, cognition and behavioural skills within a content area.'* (Jensen, 2003:109) Thus, it is proposed that the teaching of content is not possible in the absence of adequately developed cognitive functions. However, cognitive functions cannot be acquired in the absence of a structured content domain. Therefore, assessing scholastic functioning also provides insight into the cognitive development of the learners.

The test batteries were constructed to meet certain practical design needs of the study. In most cases this required the adjustment of individually administered tests to group administered tests. This adaptation was made to reduce the amount of time required for many of these tests in order to reach a larger and more representative sample of learners in the population. The test batteries were administered over three full school days. Other smaller adaptations were made to individual tests which will be discussed below. These minor adaptations to the test batteries were the result of the insights garnered during the developmental phase of the study. (See Chapter Five, p.129.) The norms associated with the test batteries were not referred to in this study. This was done for a number of reasons, but mainly because the adaptations that were made to the test batteries had invalidated the test norms. In addition, the norms for a majority of the test batteries were not appropriate for South African learners. These test batteries had been developed for learners outside South Africa. The raw scores for the test batteries were therefore used to calculate the mean scores which were in turn used for the analysis of the study data. (See Chapter Five, p.160.)

5.5.3.1.2 Description of the test batteries

i) Knowledge of basic conceptual systems

- Name of the test battery:

  Boehm Test of Basic Concepts-Revised (BTBC-R)

- Rationale for the use of this test battery:

  The instrument is designed to assess beginning school children's (Grade One and Grade Two) knowledge of frequently used basic concepts. The BTBC-R is used to evaluate the effectiveness of instruction aimed at the development of basic concepts. In addition, the BTBC-R may also be used as one of a battery of tests for purposes of assessing school readiness or for identifying children who may be at risk of learning failure (Beech, 1980, 1981). The BTBC-R was included in the test battery as a test of near-transfer. There is a high level of content correspondence on the BTBC-R and the BCMLP. Seventy eight percent of the content (39 out of 50 test items) on the BTBC-R is also used (i.e. is the same, similar or may be inferred) in the BCMLP. (See Appendix 16.)

- Information about the test battery:

  The test consists of 50 pictorial items arranged in approximate order of increasing difficulty and divided evenly between two booklets. The BTBC-R consists of two different, but parallel forms (Form C and Form D). Research indicates that the means and standard deviations of the two forms are virtually identical at each grade level studied (Boehm, 1986). Form D was administered in this study. The test has acceptable reliability and validity scores. The reliability coefficient ranges from 0.55 to 0.87.

- Standardized administration of the test battery:

  The test is administered in a group format. Questions about the pictures are read aloud by the examiner, while the learners are instructed to mark the picture that best answers each question. It is recommended that the battery be administered in two test sessions.

- Adaptations to the standardized administration of the test battery:

  No major adaptations were made to the procedures for test administration. The test was however administered in one session, counter to the recommendations of the test author. This was done to limit the amount of time required for the administration of the test. Four adaptations were made to the content of the test. These adaptations were made (after Pilot Study-part 1) as a result of the language/conceptual difficulty of the words used in the original text. In three of the four questions, alternative synonyms were inserted. In one question the concept was changed to a word already used in the test. (See Appendix 8.)

ii) Higher cognitive functioning and information-processing

- <u>Name of the test battery:</u>
  Cognitive Assessment System (CAS)
- <u>Rationale for the use of this test battery:</u>
  The CAS is a standardized test which is designed to assess cognitive processes, based on an information-processing model of intelligence. The test battery, designed as a cognitive diagnostic assessment system, is considered to be an appropriate test to evaluate changes in cognitive functioning (Das, Nagelieri & Kirby, 1994). This test battery has demonstrated a relationship to academic achievement, specifically reading and mathematics (Lidz, 1997; Naglieri & Rojahn, 2004; Naglieri & Ronning, 2000). Reid, Kok & van der Merwe (2002) undertook an initial probe into the CAS as a fair diagnostic tool within South African schools. The results from this study were promising.
- <u>Information about the test battery:</u>
  The CAS provides information about four mental processes (PASS: Planning -- Attention – Successive Processing – Simultaneous Processing), derived from the theory and research of the Russian neurologist, Luria (1966). The Standard Battery comprises 12 subtests, whereas the Basic Battery comprises eight subtests. Extensive reliability and validity data have been provided in the CAS Interpretative Handbook (Naglieri & Das, 1997b). The Full Scale reliability coefficient ranges from a low of .95 to a high of .97. The average reliabilities for the Standard Battery PASS Scales are .88 (Planning), .88 (Attention), .93 (Simultaneous Processing) and .93 (Successive Processing).

A brief description of the CAS subtests used during the study follows: -

Planning

i) *Matching Numbers:* The learners are required to find and circle two numbers that are exactly the same among others (e.g. **22**, 12, 21, **22**). More digits are added as the subtest progresses.

ii) *Planned Codes:* The learners are required to transfer a set of letter-codes (e.g. A = OO) into corresponding boxes on the test page. The subtest items become more challenging when the order of the alphabetically arranged letter-code set is changed on the test page.

Attention

iii) *Number Detection:* The learners are asked to underline numbers that look physically the same and to exclude those numbers which are different (e.g. 1,2,3 but not **1, 2, 3**). The items become more complex as the subtest progresses.

iv) *Receptive Attention:* The subtest involves rows of letter pairs. The learners are required to circle, row by row, all the letter pairs that are exactly the same (e.g. HH but not Hh).

Simultaneous Processing

v) *Nonverbal Matrices:* The learners choose one of five/six options that best complete an abstract, pictorially represented analogy.

vi) *Verbal-Spatial Relations:* The test involves a number of sentences that are read aloud to the learners. The learners are required to circle one of the six pictures that most accurately correspond with the verbal-spatial relationship/s in the sentence.

- <u>Standardized administration of the test battery:</u>

  The CAS is an individually administered, paper and pencil, test battery. Detailed descriptions are provided for the administration and scoring of the subtests in the test manual.

- <u>Adaptations to the standardized administration of the test battery:</u>

  The CAS was adapted to a group-administered test. Six of the CAS subtests were selected and modified. These subtests are associated with three of the PASS mental processes. (See above.) The main changes made to the group-administered version of the test involved the provision of a standard time for test completion, rather than open-ended time allowed for individual administrations. The maximum times for the test items therefore also became the minimum time for test items. The number of items in the two simultaneous processing subtests was reduced. This was done to limit the length of time required for test administration. All the test instructions were read to the learners, requiring no significant changes to the standardized administration procedures. The adaptation of the CAS into a group-administered test was based on Lidz's (1997) adaptation of the same test. It was not possible to adapt one of the processes, namely successive processing, to a group-administered test and this was consequently not assessed. The lack of data from the Successive Scale in this study would therefore need to be considered when interpreting the findings from this test battery.

iii) Cognitive modifiability

- Name of the test battery:

  Children's Inferential Thinking Modifiability Test (CITM)

- Rationale for the use of this test battery:

  The CITM is a strategy based, dynamic assessment (test-teach-test) procedure that attempts to determine how much learners have benefited from instruction (mediation). Learner responsiveness to mediation provides information with respect to their cognitive modifiability. The CITM has been used to determine the efficacy of various cognitive intervention programmes, e.g. Bright Start (Tzuriel, 2001; Tzuriel, Kaniel, Zeliger, Friedman & Haywood, 1998). Learner modifiability is calculated by considering the gains made by learners from the pre- to post-intervention phase of the study. Tzuriel asserts that 'modifiability scores' are better predictors of academic success in young children than static tests (Tzuriel, 2000; Tzuriel, Kaniel, Zeliger, Friedman & Haywood, 1998).

- Information about the test battery:

  The ability to solve inferential-hypothetical problems is considered to be a higher order cognitive function. Inferential reasoning draws on a number of cognitive functions: simultaneous consideration of two or more sources of information, planned and systematic approach to task and spontaneous comparative behaviour. The CITM is composed of four sets of problems for pre-teaching (Set A), teaching (Set L), post-teaching (Set B) and transfer stages (Set TR). The problems are composed of figural ‘sentences’. Each ‘sentence’ presents information about the possible location of objects in houses with different coloured roofs. To solve the problem, information in each of the sentences first needs to be systematically explored while making use of ‘if-then’ reasoning. The reliability coefficient for the pre- and post-teaching phases is 0.82. The CITM validity has been established in several developmental and educational studies (Tzuriel, 1989; Tzuriel & Eran, 1990; Tzuriel & Kaufman, 1999; Tzuriel & Weiss, 1998).

- <u>Recommended procedures for the administration of the test battery:</u>
  The CITM is an individually administered test. The research version of this test (as used during this study) is administered in three separate stages with breaks during each testing stage. The testing stages are not time-limited and can be implemented in one day.
- <u>Adaptations to the recommended procedures for test administration:</u>
  The CITM was adapted to a group administered test. No changes were made to the content of the assessment battery, however, adaptations were made to the materials for the pre- and post-teaching stages of test administration. One transfer item was included in the pre- and post-teaching stages. The adaptation of the CITM to a group-administered format required only a small technical adjustment from the original format. The insertion of velcro into the test books allowed learners to independently attach pictures into the houses (as was required by the test), and therefore removed the need for assistance during these stages of the test administration. Each learner received one-on-one mediation during the teaching stage. Learners were exposed to the pre-teaching problem set (Set A) instead of to the teaching problem set (Set L) during mediation. This was done for practical reasons. The researcher argues that using Set A for teaching did not impact on the CITM pre-teaching

stage or inhibit the mediation/teaching stage which followed the pre-teaching stage.

iv) Scholastic functioning

- Name of the test battery:

  University of Cape Town Graded Reading Test (UCT Reading Test), University of Cape Town Graded Spelling Test (UCT Spelling Test), Ballard One-Minute Mathematics Test (Ballard Addition- & Subtraction Tests).

- Rationale for the use of this test battery:

  The above-mentioned standardised, diagnostic tests are designed to obtain information about the scholastic performance of learners in the areas of reading, spelling and mathematics (addition and subtraction) respectively. The test battery was included in the study to provide a measure of the changes in the scholastic functioning of learners who participated in this study.

- Information about the test battery:

  [17]The UCT Reading Test and UCT Spelling Test were normed for [18]Coloured learners in the Western Cape in 1985 by the University of Cape Town. These tests were therefore appropriate for the learners participating in the study. The reading and spelling tests consist of a bank of high frequency words which were selected according to the age and grade levels of the standardization sample. The Ballard Addition- and Subtraction Tests each consist of 28 graded questions. The questions include basic calculations involving single- and double-digit bonds for each operation.

- Standardized administration of the test battery:

  The scholastic tests are administered in a group format, with the exception of the reading test which is administered individually. The procedures for the administration of these tests are simple, as very few administration instructions are required. The length of time for the administration of the

[17]The norms for these scholastic tests were not referred to. This was mainly to ensure consistency in the analysis of the study data, that is, only raw scores were used during the study.
[18]The term 'Coloured' was discussed in Chapter One, p.11.

reading and spelling tests may vary depending on the progress of the learners, that is, the more successful the learner, the longer the time required for test administration. In contrast, learners are given one minute for each operation in the Ballard Addition- and Subtraction Tests.

- Adaptations to the standardized administration of the test battery:

  No adaptations were made to these tests. New test-administration and recording sheets for the reading and spelling tests were however developed for the purposes of the study. This was primarily done to facilitate the scoring of these tests as well as to derive further diagnostic information about the learners. (See Appendix 18 for an example of the administration and recording sheet developed for the UCT Reading Test.) The scholastic test battery was administered in the following order: - mathematics (addition), mathematics (subtraction), spelling and reading.

5.5.3.1.3 Consistency of test battery measurements: Inter- and intra-battery correlations

A series of correlational analyses (Bravais-Pearson Correlations) were conducted to determine the inter- and intra-battery correlations.

TABLE 5.6

Pre-test inter- & intra-battery correlations for learners in the Experimental & Comparison group.

BTBC-R	BTBC-R	CAS	CITM-Pre teaching	CITM-Post teaching	Scholastics
		.481**	.198*	.463**	.419**
CAS	**BTBC-R**	**CAS**	**CITM-Pre teaching**	**CITM-Post teaching**	**Scholastics**
Matching Number	.423**	.534**	-.026	.355**	.396**
Planned Codes	.385**	.644**	.015	.320**	.330**
Number Detection	.263**	.639**	.142	.240*	.303**
Receptive Attention	.205*	.593**	.109	.283**	.440**
Nonverbal Matrices	.449**	.504**	.106	.288**	.403**
Verbal-Spatial Relations	.371**	.426**	.250**	.229*	.205*
CAS Total	.481**		.183	.405**	.564**
CITM	**BTBC-R**	**CAS**	**CITM-Pre teaching**	**CITM-Post teaching**	**Scholastics**
CITM-Pre teaching	.198*	.183		.344**	.122
CITM-Post teaching	.463**	.405**	.344**		.305**

Scholastics	BTBC-R	CAS	CITM-Pre teaching	CITM-Post teaching	Scholastics
Reading	.311**	.442**	.025	.162	.919**
Spelling	.343**	.397**	.112	.246**	.895**
Mathematics (addition)	.424**	.551**	.116	.335**	.613**
Mathematics (subtraction)	.295**	.485**	.241*	.358**	.560**
Scholastics Total	.419**	.564**	.122	.305**	

** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

The test scores on all the batteries were significantly correlated at the pre-test phase of the study, with the exception of the CITM-Pre teaching. Interestingly, the results for the CITM-Post teaching were significantly correlated with all the tests, with the exception of reading. The *strongest correlations* (<.05) were understandably found between subtests of the same test battery (viz. Scholastics and CAS). A *strong* inter-test battery correlation was found between the CAS and Scholastics (.564), *medium correlations* (<.03-.49) were found between CAS and BTBC-R (.481), Scholastics and BTBC-R (.419), and CITM-Post teaching and all the tests (Scholastics: .305; CAS: .463; BTBC-R: .405), and a *weak correlation* (<.01-.29) was found between the CITM-Pre teaching and BTBC-R (.198). In summary, a reasonable level of measurement consistency was found between the test batteries, that is, high/low scores on one test battery were associated with high/low scores on other test batteries.

5.5.3.2 Structured interviews

- Biodemographic Questionnaire for the Study Sample (See Appendix 19.)

This questionnaire was used to gather background learner information. The questionnaire provided information about a number of different areas: - i) identifying information, ii) family background, iii) social and economic indices and iv) education history. Information was gathered from 18 data categories. Information from eight data categories was not reported on. In four of these data categories incomplete information was provided, whereas in the other four areas, the data was not reported because it did not add explanatory value to the study. (See Appendix 21.)

The questionnaire provided a wide range of data regarding learners participating in the study. Such information was important to gather, especially as learners in the study were drawn from different education authorities and were selected purposively (not randomly) by teachers. The study sample in the Experimental and Comparison groups needed to be comparable if valid inferences were to be drawn from this study.

- <u>Biodemographic questionnaire for Learning Support Teachers</u>
  (See Appendix 20.)

This questionnaire was used to gather background information about the Learning Support Teachers (LSTs). This information was gathered to provide further understanding and insight into these LSTs. Information was gathered from six data categories. One data category was not reported on, as it did not contribute any additional explanatory value to the study. The LSTs were considered an important intervening variable in the study because they were expected to intervene in the scholastic and cognitive functioning of their learners. Thus it was important to explore the comparability of the two teacher groupings even though the study did not directly attempt to establish equivalence between these groupings. The information derived from this questionnaire was thus intended to provide insight into the influence of biodemographic factors of LSTs on the outcomes of the study.

- <u>Teacher evaluation of learners</u> (See Appendix 22.)

The questionnaire was developed in order to receive teacher (Learning Support Teachers and Class Teachers) feedback regarding their learners who participated in the study, at the end of the intervention programme. This post-intervention programme questionnaire was designed with open- and close-ended questions. The close-ended questions mainly made use of rating scales. The questionnaire was only administered to LSTs and Class Teachers in the Experimental group. This was done mainly as a result of practical reasons. The questionnaire focused on the following areas of learner functioning: i) general scholastic functioning, ii) reading, iii) spelling, iv) writing, v) mathematics, vi) confidence, vii) motivation, viii) general behaviour,

ix) expressive language, x) understanding of basic concepts and xi) thinking abilities. It was hoped that information from this interview schedule would further validate the study findings. The accuracy of the Learning Support Teachers' responses to the questions was monitored, as the same questionnaire was administered to Class Teachers at these schools. It was therefore possible to use this post-intervention programme questionnaire with a reasonable level of confidence.

5.6 DATA ANALYSIS

The quasi-experimental nature of the study required that an appropriate method of data analysis be employed. The researcher therefore selected a [19]descriptive research design: - a pre-test---post-test for non-equivalent comparison group design. It was assumed that the two research groupings (Experimental and Comparison) would probably not be [20]entirely equivalent since the learners had not been randomly assigned to the two groupings. However, the pre-test results would allow one to know in what respects the learners differed and thus how these results might affect the post-test results.

The main method of data analysis used was a series of independent- and paired *t*-test analyses. The latter are also referred to as repeated or correlated *t*-tests. Such a parametric method of data analysis was deemed appropriate, especially as certain population parameters were not known (McCall, 1986:197). A *t*-test is a parametric test used to determine whether two means are significantly different from one another. The appropriate *t* distribution is determined not by sample size, N, but by its degrees of freedom (N - 1) (McCall, 1986:213). The independent *t*-test is used to compare means from two independent groups of individuals, whereas the paired *t*-test is used to

[19]The main difference between an explanatory research design and a descriptive research design is that in explanatory research designs people are usually randomly selected and randomly assigned to the research groupings, whereas in a descriptive research design they are not.

[20]The biodemographic data found that the background circumstances (family & socio-economic circumstances, age, religion, gender) of the learners were highly consonant. However, some early education advantage was attributed to learners in the Comparison group.

compare the means of two sets of observations from the same individuals or from pairs of individuals (Brace, Kemp & Snelgar, 2003).

A one-way ANOVA (F-test) was performed in order to determine whether the pre-test results between research groupings influenced the post-test study results. The purpose of an analysis of variance is to determine the probability that the deviation of the mean of several groups of scores from one another is merely a sampling error. F-tests are preferably used when there is a factor with more than 2 levels. A significant F-ratio tells one that the dependent variable varies with the levels of the factor, but there is then a need to turn to other devices to analyse the data in more detail. The Bonferroni (post-hoc) measure was therefore selected for this purpose. It allows one to compare means in a variety of ways and also assists with the interpretation of the results, that is, deciding which results are significant.

The Kruskal-Wallis Test is a [21]non-parametric equivalent of the one-way analysis of variance (ANOVA). The Kruskal-Wallis Test was simultaneously employed as an additional means of confirming and supporting the parametric statistics. The findings derived from the non-parametric statistics will be reported on together with the parametric data, however, only when this information is [22]inconsistent with the parametric analyses. (See Appendix 24 for a summary of the data from the Kruskal-Wallis Test.)

Two further methods of data analysis were also employed during the study and will be discussed below.

- **ANCOVA** was used to analyze the UCT Spelling Test. The ANCOVA is similar to the ANOVA in that it attempts to determine the effect of the independent variable on various dependent variables, however, it also acknowledges the influence of another variable (a covariate: - e.g. spelling

[21] Parametric statistics make use of statistical techniques that represent tests of the values of certain parameters and which make certain assumptions about other parameters, whereas non-parametric statistics do not test hypotheses about specific parameters and require different and sometimes fewer assumptions.
[22] Data from the Kruskal-Wallis, group x location analysis was not reported on in the main body of the text.

in this case). The ANCOVA attempts to remove the effect of the covariate by using a regression equation to measure its influence. The BTBC-R and CAS test batteries were selected as the dependent variables, while group, gender and group x gender were selected as the independent variables.

- **Pre- to Post-Intervention Gain Scores** were formulated in order to analyze the CITM. In contrast with the conventional single pre-test and post-test design of the test batteries, the CITM battery includes three separate stages (*pre-teaching---teaching---post-teaching*) which are administered during the pre-intervention and post-intervention phases of the study. (See Table 5.7.) The aim of the dynamic assessment battery is to establish the level of learner modifiability from pre-teaching to the post-teaching stage, however, the primary objective in this study was to determine the level of learner modifiability from pre-intervention to post-intervention phase of the study. The researcher therefore did not intend to examine changes during the pre-intervention or post-intervention phases separately. Changes were instead analyzed only from the pre-intervention to the post-intervention phases of the study.

  The main method of data analysis recommended in the literature (e.g. Tzuriel, Kaniel, Kanner & Haywood, 1999) is the use of residual Post-teaching scores. The residual Post-teaching scores are based on a regression analysis of the Post-teaching by the Pre-teaching score of the same parallel test. The residual Post-teaching score is thus considered as an indication of cognitive modifiability since it reflects the child's Post-teaching performance after controlling for the initial Pre-teaching performance (Tzuriel, 2001). However, as indicated above, the current study was more concerned about changes not within the same parallel test, but with changes from the pre- to the post-intervention phase of the study and thus required another method of data analysis.

An alternative method of data analysis, based on different gain score formulations was therefore developed for the purpose of this study. It was possible to obtain [23]two gain score permutations from the pre-intervention to the post-intervention phase of the study. (See Table 5.7.) This approach was selected as it provided a way to consider the effects of varying levels of teaching and non-teaching on learner modifiability from the pre-intervention to post-intervention phase of the study. These cross-intervention phase gain scores therefore compare ‘qualitative’ (horizontal) gains of learners- taking into account their position in the Zone of Proximal Development during the study. This approach also attempts to address the concerns that have been raised about gain scores in the literature (Sternberg, 2002). It has been argued that the initial gains of learners during dynamic assessment might not be comparable: learners with lower scores appear to gain more than learners who attain higher scores. The proposed approach compares the outcomes of learners during different test phases. Learners are therefore not compared with their immediate post-teaching scores, but with their performance after the intervention. This approach would therefore rule out, to some extent, the difficulties associated with a simple pre-teaching---post-teaching gain score.

TABLE 5.7

CITM pre- & post-intervention matrix used to formulate the study gain scores.

CITM Pre-Intervention	**CITM Post-Intervention**
Stages of CITM	Stages of CITM

[23] It would have been possible to formulate a third gain score: pre-teaching – pre-teaching from the pre- and post-intervention phase of the study. This ‘gain score’ was calculated using the *t*-test analyses described above.

Gain Scores 1: post-teaching (Post-Intervention) - post-teaching(Pre-Intervention)

Gain Scores 2: post-teaching (Post-Intervention) - pre-teaching (Pre-Intervention)

Rationale of the gain scores:

Gain Score 1: This score indicates the amount of change after teaching/mediation from the pre- to the post-intervention phases. This score reflects the learner's *'potential (optimal) level'* of functioning in the ZPD.

Gain Score 2: This score indicates the amount of change from before teaching/mediation in the pre-intervention phase to after teaching/mediation during the post-intervention phase. This score reflects the learner's *'actual level'* of functioning as well as his/her *'potential (optimal) level'* of functioning in the ZPD.

The gain scores for the study were calculated using the formulae above. (See Appendix 23.) The gain scores were then analyzed using independent- and paired sample *t*-tests.

5.7 RESEARCH ETHICS

Ethical considerations were an important aspect of the study design in order to ensure that the learner-participants would not be adversely affected by the research. The main aim of the study was to promote and enhance the cognitive functioning of learners who experienced a range of barriers to learning. However, it was not assumed that all learners (and guardians of learners) selected to participate in the programme would freely agree to do so. It was therefore important that parental consent was sought before learners participated in the study. (See Appendix 17a&b.) In addition, LSTs and schools were also requested to consent to their participation in the study so as to allow teachers and schools the opportunity to demonstrate their support or lack of support for the study. (See Appendix 12a&b.) The anonymity of all the study participants (LSTs, Class Teachers, Schools and Learners) was protected. Furthermore, all learners who participated in the study, irrespective of their assignment to the Experimental or Comparison group, received a comparable form of intervention. No non-intervention control group was used during the study. In addition, learners not included in the study sample who experienced barriers to learning and received learning support interventions prior to the study, continued to receive these interventions during the study.

5.8 SUMMARY

This chapter defined and described the procedures of the study. The functional relationship between cognitive educational theory (as presented in this study) and the assessment areas (dependent variable) as well as their close connection to the intervention programme (independent variable) were outlined in this chapter. The study hypotheses, discussed in this chapter and to be further explored in the following chapters, reflect the close interrelationships between the study aims, assessment areas and cognitive educational theory reviewed. The study results will be presented and explored in the next chapter.

CHAPTER SIX

RESULTS

6.1 INTRODUCTION

The chapter presents and explores the results of this quantitative, quasi-experimental study. The results of the study assist to determine whether the BCMLP is an effective intervention programme for learners who experience barriers to learning in the Foundation Phase. The data were gathered from four pre-test and post-test batteries. A detailed exposition of the test batteries is provided in Chapter Five. The test batteries were administered at the start and at the end of the study in order to measure the effects of the *intervention programme* (**independent variable**) on *the cognitive and scholastic functioning of learners* (**dependent variables**) who participated in this study. The chapter explores these results in relation to the global hypothesis and sub-hypotheses of the study as outlined in Chapter Five.

The chapter first discusses the effects of a number of intervening variables on the study findings, an essential component of a quasi-experimental research study. *'The task confronting persons who try to interpret the results from quasi-experiments is basically one of separating the effects of a treatment from those due to the initial non-compatibility…' (Cook & Campbell, 1979:*6). The chapter then presents a detailed analysis of the results from each test battery. The hypotheses of the study are evaluated together with a summary of the results from the test batteries. Further analyses performed on certain of the results are also presented. Evaluation of learners in the Experimental group by Learning Support Teachers and Class Teachers are then reviewed. Interpretations and inferences drawn from the findings presented in this chapter are discussed in Chapter Seven.

6.2 INTERVENING VARIABLES

The results of the study as presented in the following section should be considered cautiously and should take into account the effects of a number of pre-test intervening variables. These variables were not possible to control in this quasi-experimental study. The meaning and value of results from non-equivalent research groupings would influence the validity of the inferences drawn from the results. The researcher has therefore explicitly identified certain threats to the validity of the study (which random assignment would have ruled out) in order that sound causal inferences may be derived.

A number of variables were identified which could have impacted on the results:

- *Gender:* Did the gender of the study participants (learners) influence the results?
- *Location*: Did the area in which the study was conducted (EMDC Central and EMDC South) influence the results?
- *Learning Support Teachers:* Did the teachers have an undue influence on the results?

The gender and location data of learners in the Experimental and Comparison groups were organized according to four groupings (viz. Experimental Male & Female and Comparison Male & Female; Experimental Central & South and Comparison Central & South). The means and standard deviations of these groupings are presented and thereafter the results of the analysis of variance (ANOVA and /or Kruskal-Wallis) are reported on. Only those test means (after the analysis of variance) that were found to be statistically significant are reported. The (non-parametric) analysis of the LST data was drawn from the entire sample of these teachers (N=21).

6.2.1 Gender

TABLE 6.1

Gender groupings: Pre-test means & standard deviations for learners in the Experimental & Comparison groups (N=109).

	BTBC-R		CAS		CITM		Scholastics	
Groupings	*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*
Experimental Female	36.71	5.295	119.50	39.546	15.00	5.175	29.21	12.065
Experimental Male	37.57	3.711	94.97	37.013	16.13	6.021	21.37	14.414
Comparison Female	33.14	8.311	100.18	74.283	13.82	3.737	18.91	15.556
Comparison Male	35.01	6.349	100.36	53.323	16.70	5.108	18.76	17.136

No statistically significant pre-test differences were found in the means between gender groupings, that is, between male and female learners in the Experimental and Comparison groups.

TABLE 6.2

Pre-test outcomes of the Analysis of Variance (Kruskal-Wallis): Group (Experimental & Comparison) x gender (N =109).

	BTBC-R	CAS	CITM	Scholastics
Chi-Square	4.617	4.813	4.719	10.659
df	3	3	3	3
p	.202	.186	.194	.014*

* Difference in means statistically significant ($p<0.05$)

The results of the Kruskal-Wallis revealed that the gender of the learners in the Experimental and Comparison groups was found to have a significant effect, but only for the pre-test scholastic scores ($p<0.05$). However, in order to interpret this finding one needs to consider the mean rankings generated by the Kruskal-Wallis. Only the highest and lowest mean rankings are reported. (See Appendix 25 for a full review of the Kruskal-Wallis mean rankings.)

TABLE 6.3

Kruskal-Wallis: Highest & lowest mean rankings-

Group (Experimental & Comparison) x gender.

TEST BATTERY	CATEGORY	GROUPING	N	*MEAN RANKING
Scholastics	Highest Ranking	Experimental: Female	24	72.40
	Lowest Ranking	Comparison: Male	33	46.50

The highest mean ranking was attributed to female learners in the Experimental group (72.40) and the lowest mean ranking to male learners in the Comparison group (46.50).

No statistically significant pre-test *group x gender* differences were found in the parametric analysis, whereas significant differences in the mean scholastic rankings were found in the non-parametric analysis. One would, however, attribute more interpretative power to parametric- than to non-parametric procedures. The more specific the assumptions that can be made about the nature of the data, the more powerful will be the statistical test (McCall, 1986). However, the non-parametric analysis of the scholastic battery found that female learners in the Experimental group performed at a significantly higher level than male learners in the Comparison group. Therefore, although no significant *group x gender* differences were detected in the parametric analysis, some caution should be exercised when interpreting the scholastic findings.

6.2.2 Location

TABLE 6.4

Location groupings: Pre-test means & standard deviations for learners in the Experimental & Comparison groups (N=109).

	BTBC-R		**CAS**		**CITM**		**Scholastics**	
Groupings	*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*
Experimental South	36.59	4.762*	114.34	34.307*	16.21	5.918	28.41	13.603*
Experimental Central	37.88	4.065*	96.04	43.909*	14.96	5.334	20.72	13.256
Comparison South	31.70	7.580*	69.90	37.531*	15.30	4.893	12.10	11.391*
Comparison Central	37.40	5.323*	136.76	38.800*	15.84	4.741	26.88	17.954*

* Difference in means statistically significant ($p<0.05$)

Significant differences were found across locations in the means of three test batteries (BTBC-R, CAS and Scholastics) ($p<0.05$), however, no statistically significant differences were found across locations in the means of the CITM. In addition, no statistically significant differences were found in the means for learners from Experimental Central in the Scholastic Battery.

TABLE 6.5

Pre-test outcomes of the Analysis of Variance (ANOVA):
Group (Experimental & Comparison) x location (Central & South) (N=109).

Grouping	BTBC-R			CAS			Scholastics		
	df	***F***	***p***	***df***	***F***	***p***	***df***	***F***	***p***
Between Groups	3	7.188	.000*	3	14.857	.000*	3	7.982	.000*
Within Groups	105			105			105		

* Difference in means statistically significant ($p<0.05$)

The location of the learners in the Experimental and Comparison groups from the South and Central EMDCs were found to have a significant effect on the pre-test study scores in three test batteries ($p<0.05$). *BTBC-R: $F(3, 105) = 7.188$; ($p<0.05$). CAS: $F(3, 105) = 14.857$; ($p<0.05$). Scholastics: $F(3, 105) = 7.982$; ($p<0.05$).* However, the Bonferroni (Post Hoc Test) was required in order to interpret these three significant test battery findings. Only significant results are reported.

TABLE 6.6

Bonferroni: Group (Experimental & Comparison) x location (Central & South).

BTBC-R	Grouping	N	Std. Error	p
	Experimental: Central > Comparison South	25	*1.536*	*.001**
	Experimental: South > Comparison South	29	*1.477*	*.008**
	Comparison: Central > Comparison South	25	*1.536*	*.002**
CAS	**Grouping**	**N**	**Std. Error**	**p**
Matching Number	Comparison: Central > Experimental: Central Comparison: Central > Experimental: South Comparison: Central > Comparison: South	25	*1.237* *1.193* *1.184*	*.010** *.020** *.000**
Planned Codes	Comparison: Central > Comparison: South	25	*3.963*	*.004**
Receptive Attention	Comparison: Central > Experimental: Central Comparison: Central > Comparison: South	25	*2.617* *2.506*	*.002** *.004**
Nonverbal Matrices	Experimental: South > Comparison: South	29	*.714*	*.003**
	Comparison: Central > Comparison: South	25	*.742*	*.001**
Verbal-Spatial Relations	Comparison: Central > Comparison: South	25	*.616*	*.009**
CAS TOTAL	Experimental South > Comparison: South	29	*10.044*	*.000**
	Comparison Central > Experimental Central Comparison Central > Comparison South	25	*10.909* *10.445*	*.002** *.000**
SCHOLASTICS	**Grouping**	**N**	**Std. Error**	**p**
Reading	Experimental: South > Comparison South	29	*1.828*	*.004**
	Comparison: Central > Comparison South	25	*1.901*	*.011**
Spelling	Experimental: South > Comparison South	29	*1.353*	*.000**
Mathematics (+)	Experimental: South > Comparison South	29	*.813*	*.048**
	Comparison: Central > Comparison South	25	*.846*	*.002**
Mathematics (-)	Experimental: South > Comparison South	29	*.722*	*.035**
	Comparison: Central > Comparison South	25	*.750*	*.050**
Scholastics Total	Experimental South > Comparison South	29	3.674	.000*
	Comparison Central > Comparison South	25	3.820	.001*

* Difference in means statistically significant ($p<0.05$)

BTBC-R:

The Bonferroni yielded significant differences between the groupings: Experimental Central & South > Comparison South ($p<0.05$) and Comparison Central > Comparison South ($p<0.05$).

CAS:

The Bonferroni yielded significant differences between the groupings on all the CAS subtests, with the exception of Number Detection: i) *Matching Number:* Comparison Central > Experimental Central & South & Comparison

South ($p<0.05$), ii) *Planned Codes:* Comparison Central > Comparison South ($p<0.05$), iii) *Receptive Attention:* Comparison Central > Experimental Central & Comparison South ($p<0.05$), iv) *Nonverbal Matrices:* Experimental South > Comparison Central ($p<0.05$) and Comparison Central > Comparison South ($p<0.05$), v) *Verbal-Spatial Relations:* Comparison Central > Comparison South ($p<0.05$).

Scholastic Battery:
The Bonferroni yielded significant differences between the groupings on all the scholastic subtests: i) *UCT Spelling Test:* Experimental South > Comparison South ($p<0.05$), ii) *UCT Graded Reading Test:* Experimental South > Comparison South ($p<0.05$) and Comparison Central > Comparison South ($p<0.05$), iii) *Mathematics (addition):* Experimental South > Comparison South ($p<0.05$) and Comparison Central > Comparison South ($p<0.05$), iv) *Mathematics (subtraction):* Experimental South > Comparison South ($p<0.05$) and Comparison Central > Comparison South ($p<0.05$).

The *group x location* effects (reflected in both sets of statistical analyses) described above mainly reflect the poor pre-test performance of the learners from Comparison South in three of the test batteries. The learners in the Experimental group (Central and South) were equivalent in all the areas assessed, whereas the learners in the Comparison group (Central and South) were equivalent only in one test battery (viz. CITM) and one scholastic subtest (viz. spelling). The learners in the Experimental group (Central and South) and the Comparison group (Central) were equivalent in all areas assessed (with the exception of the CAS where learners from Comparison Central indicated significant strengths). A similar pattern of findings was detected when evaluating the equivalence of learners from different education authorities. The learners from Central attained similar results with respect to all the test batteries, with the exception of the CAS where significant differences were found in two subtests for learners from Comparison Central. In contrast, significant differences were found between learners from South.

This would imply that caution should be exercised when evaluating the results of the learners in the Comparison group.

6.2.3 Learning Support Teacher (LST)

The Kruskal-Wallis Test was the only method of analysis selected because of the small size of the units of analysis (viz. 11 teachers and 5 learners per school). Notwithstanding, the reader should be cautioned regarding the limitations of the power attributed to such analyses.

TABLE 6.7

Pre-test outcomes of the Analysis of Variance (Kruskal-Wallis):
Group (Experimental & Comparison) x Learning Support Teacher (N=109).

	BTBC-R	CAS	CITM	Scholastics
Chi-Square	42.921	54.635	26.743	44.320
df	21	21	21	21
p	.003*	.000*	.180	.002*

* Difference in means statistically significant (p<0.05)

The results of the Kruskal-Wallis revealed that the LSTs in the Experimental and Comparison groups were found to have a significant effect on the pre-test study scores in three test batteries (viz. BTBC-R, CAS and Scholastics) ($p<0.05$). However, in order to interpret this finding one needs to consider the mean rankings generated by the Kruskal-Wallis. Only the highest and lowest mean rankings are reported. (See Appendix 25 for a full review of the Kruskal-Wallis mean rankings.)

TABLE 6.8

Kruskal-Wallis: Pre-test highest & lowest mean rankings-
Group (Experimental & Comparison) x Learning Support Teacher.

Category	BTBC-R*			CAS*			Scholastics*		
	Teacher	*N*	*Mean Rank*	*Teacher*	*N*	*Mean Rank*	*Teacher*	*N*	*Mean Rank*
Highest Ranking	**Teacher 6 (E Group)**	**5**	**94.00**	**Teacher 10 (C Group)**	**5**	**92.9**	**Teacher 10 (C Group)**	**5**	**100.60**
Lowest Ranking	**Teacher 2 (C Group)**	**5**	**16.1**	**Teacher 2 (C Group)**	**5**	**15.1**	**Teacher 2 (C Group)**	**5**	**10.40**

E Group = Experimental Group and C Group = Comparison Group

BTBC-R:

Through inspection of the data, significant effects were shown in the mean LST rankings. The highest LST ranking was in the Experimental group (Teacher 6: 94.00), while the lowest LST rankings were in the Comparison group (Teacher 2: 16.1).

CAS:

Through inspection of the data, significant effects were shown in the mean LST rankings. The highest and lowest LST ranking was in the Comparison group (Teacher 10: 92.9 and Teacher 2: 15.1).

Scholastic Battery:

Through inspection of the data, significant effects were shown in the mean LST rankings. The highest and lowest LST rankings were in the Comparison group (Teacher 10: 100.60 and Teacher 2: 10.40).

A pattern with respect to the highest and lowest rankings was detected for two LSTs in the Comparison group (Teacher 2 and Teacher 10). Teacher 2 is associated with low test scores in three of the test batteries, whereas Teacher 10 is associated with high test scores in two of the test batteries. The highest mean LST ranking was also attributed to a LST (Teacher 6) in the Experimental group in one test battery. The variability of the LST rankings in the Comparison group thus appeared to be consistent with the above (group x location) findings- where a sub-grouping of learners (that is not all the learners) in the Comparison group contributed significantly to the variance in the test data. However, no significant differences were found in the LST rankings on the CITM. This finding is also consistent with the findings in the above section (group x location). The LST effects with respect to the Comparison group could, however, be attributed to greater learner variability, rather than to teacher differences. It could thus be inferred that teacher (or learner) variability could have unduly influenced the test results. However, it could also be contended that the low mean rankings were counterbalanced by the high mean rankings in the same research grouping (viz. Comparison group). In contrast, it appeared that there was less variability in the

Experimental group. This would suggest that LSTs in the Experimental group (with the main exception of Teacher 6) were more comparable and therefore did not unduly influence the results of the study.

6.3 LEARNER TEST DATA

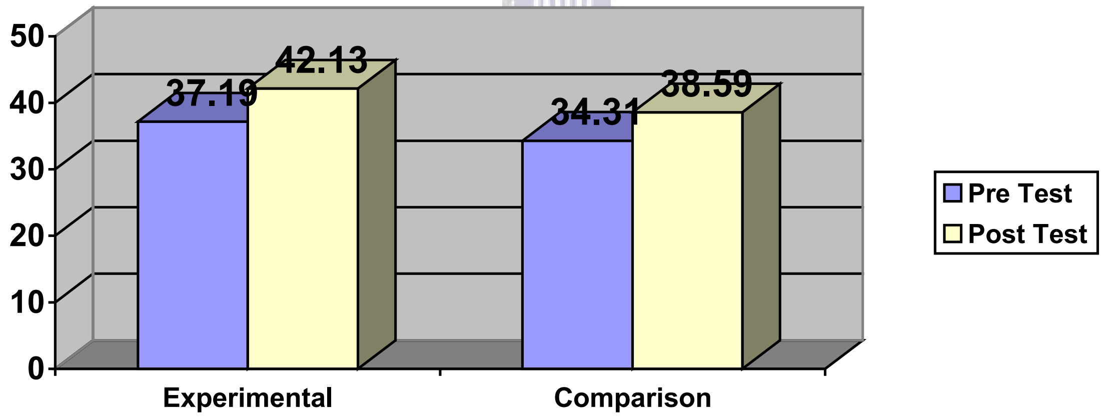
6.3.1 Presentation of study results by test battery

The pre-test and post-test means are represented graphically and thereafter explained. The analysis of the study results derived from a series of independent- and paired *t*-tests for each test battery will then be presented. These results will be presented in a tabular format and thereafter described.

6.3.1.1 Boehm Test of Basic Concepts-Revised (BTBC-R)

FIGURE 6.1

Boehm Test of Basic Concepts-Revised: Comparison of pre-test & post-test means in the Experimental & Comparison groups.



Learners in the Experimental group attained significantly higher scores on the Boehm Test of Basic Concepts during the pre-test and post-test phase of the study than learners in the Comparison group (p<0.05). The learners in the Experimental and Comparison groups made significant pre-test to post-test gains during the study (p<0.05).

TABLE 6.9

Boehm Test of Basic Concepts-Revised (Paired Samples Test): Pre-test to post-test means in the Experimental & Comparison groups.

Boehm Test of Basic Concepts	Experimental Group (n=54)			Comparison Group (n =54)		
	t	*df*	*p*	*t*	*df*	*p*
	-11.459	53	.000*	-6.250	53	.000*

* Difference is statistically significant (p<0.05)

Significant pre-test to post-test gains were found for learners in the Experimental group. t (53) = -11.459 ; p<0.05. Significant pre-test to post-test gains were also found for learners in the Comparison group. t (53) = -6.250 ; p<0.05.

TABLE 6.10

Boehm Test of Basic Concepts-Revised (Independent Samples Test): Comparison of pre-test (N=109) & post-test (N=108) means in the Experimental & Comparison groups.

Boehm Test of Basic Concepts	*t*	*df*	*p*
Pre-test	2.531	107 90.482	.013* (E group)
Post-test	3.531	106 95.282	.001* (E group)

* Difference is statistically significant (p<0.05)
Note: Group with highest mean score is indicated in brackets (E Group = Experimental Group).

The learners in the Experimental group attained significantly higher scores at the pre-test phase of the study than learners in the Comparison group. *t (107, 90.482) = 2.531 ; p<0.05.* The learners in the Experimental group also attained significantly higher scores during the post-test phase of the study than their peers in the Comparison group. *t (106, 95.282) = 3.531 ; p<0.05.*

6.3.1.2 Cognitive Assessment System (CAS)

Four of the six CAS subtests (Matching Number, Planned Codes, Number Detection and Receptive Attention) have been grouped together and are presented first. The last two subtests (Nonverbal Matrices and Verbal-Spatial Relations) are then presented separately.

Matching Number, Planned Codes, Number Detection & Receptive Attention

FIGURE 6.2
Matching Number: Comparison of pre-test & post-test means in the Experimental & Comparison groups.

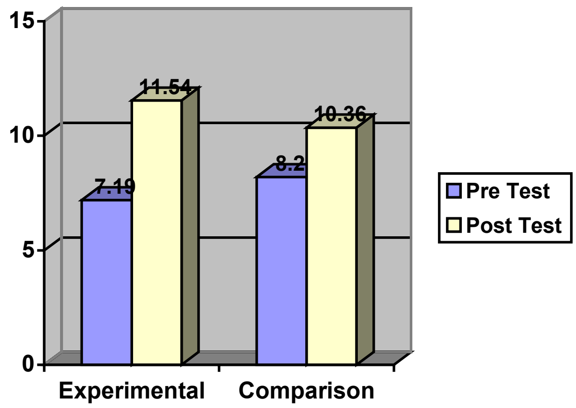


FIGURE 6.3
Planned Codes: Comparison of pre-test & post-test means in the Experimental & Comparison groups.

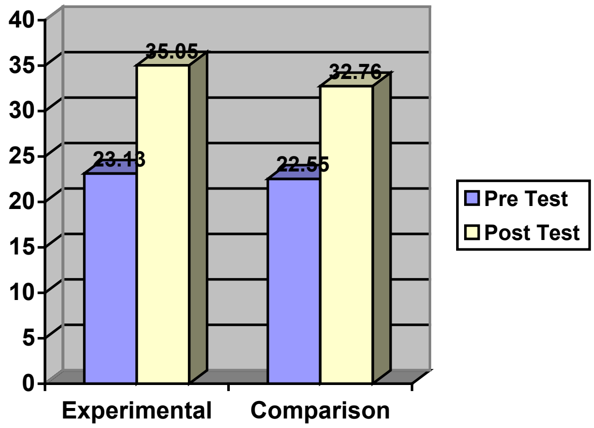


FIGURE 6.4
Number Detection: Comparison of pre-test & post-test means in the Experimental & Comparison groups.

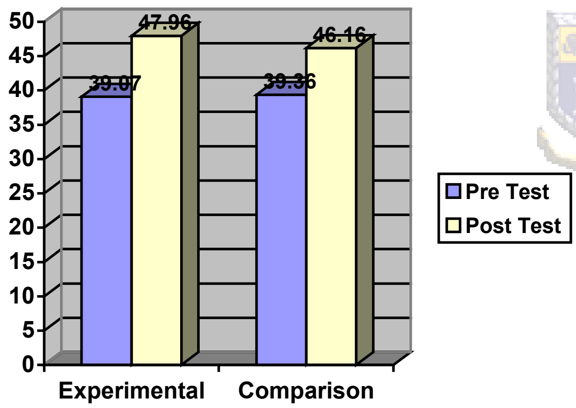
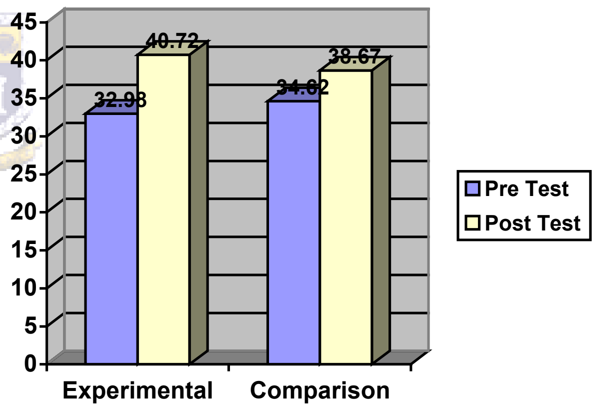


FIGURE 6.5
Receptive Attention: Comparison of pre-test & post-test means in the Experimental & Comparison groups.



The learners in the Experimental and Comparison groups made significant pre-test to post-test gains on the above subtests during the study ($p<0.05$). However, there were no other results that attained levels of statistical significance.

TABLE 6.11

Cognitive Assessment System (Paired Samples Test): Pre-test to post-test means in the Experimental & Comparison groups.

Cognitive Assessment System	Experimental Group (N=54)			Comparison Group (N =55)		
	t	*df*	*p*	*t*	*df*	*p*
Matching Number	-7.325	53	.000*	-3.093	54	.003*
Planned Codes	-5.699	53	.000*	-4.361	54	.000*
Number Detection	-3.766	53	.000*	-2.962	54	.005*
Receptive Attention	-4.609	53	.000*	-2.446	54	.018*

* Difference is statistically significant ($p<0.05$)

Significant pre-test to post-test gains were found on all these subtests for learners in the Experimental group. *Matching Numbers: t (53) = -7.325 ; p<0.05. Planned Code: t (53) = -5.699 ; p<0.05. Number Detection: t (53) = -3.766 ; p<0.05. Receptive Attention: t (53) = -4.609 ; p<0.05.* Significant pre-test to post-test gains were found on all these subtests for learners in the Comparison group. *Matching Numbers: t (53) = -3.093 ; p<0.05. Planned Code: t (53) = -4.361 ; p<0.05. Number Detection: t (53) = -2.962 ; p<0.05. Receptive Attention: t (53) = -2.446 ; p<0.05.*

TABLE 6.12

Cognitive Assessment System (Independent Samples Test): Comparison of pre-test (N=109) & post-test (N=109) means in the Experimental & Comparison groups.

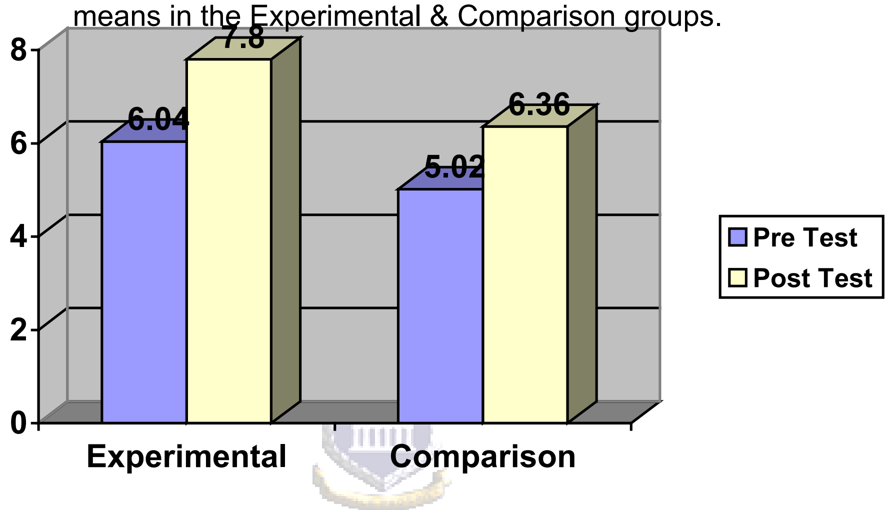
Cognitive Assessment System	***t***	***df***	***p***
Matching Number (pre)	-1.132	107 95.292	.260
Matching Number (post)	.998	107 93.677	.321
Planned Codes (pre)	.199	107 106.951	.843
Planned Codes (post)	.615	107 106.715	.540
Number Detection (pre)	-.099	107 106.998	.921
Number Detection (post)	.650	107 106.759	.517
Receptive Attention (pre)	-.861	107 106.528	.391
Receptive Attention (post)	1.063	107 103.170	.290

The CAS scores of both research groupings were similar during the pre-test and post-test phase of the study, that is, no statistically significant differences were found between the research groupings on these subtests during the study.

Nonverbal Matrices

FIGURE 6.6

Nonverbal Matrices: Comparison of pre-test & post-test means in the Experimental & Comparison groups.



The scores of both research groupings were similar during the pre-test phase of the study. Learners in the Experimental group attained significantly higher scores than learners in the Comparison group during the post-test phase of the study ($p<0.05$). Learners in the Experimental and Comparison groups both made significant gains from the pre-test to the post-test phase of the study ($p<0.05$).

TABLE 6.13

Nonverbal Matrices (Paired Samples Test): Pre-test to post-test means in the Experimental & Comparison groups.

Cognitive Assessment System	Experimental Group (N=54)			Comparison Group (N =55)		
	t	*df*	*p*	*t*	*df*	*p*
Nonverbal Matrices	-4.604	53	.000*	-3.245	54	.002*

* Difference is statistically significant ($p<0.05$)

Significant pre-test to post-test gains were found for learners in the Experimental group. $t\ (53) = -4.604\ ;\ p<0.05$. Significant pre-test to post-test gains were also found for learners in the Comparison group. $t\ (53) = -3.245\ ;\ p<0.05$.

TABLE 6.14

Nonverbal Matrices (Independent Samples Test):

Comparison of pre-test (N=109) & post-test (N=109) means in the Experimental & Comparison groups.

Cognitive Assessment System	*t*	*df*	*p*
Nonverbal Matrices (pre)	1.831	107 106.285	.070
Nonverbal Matrices (post)	2.341	107 106.853	.021* (E group)

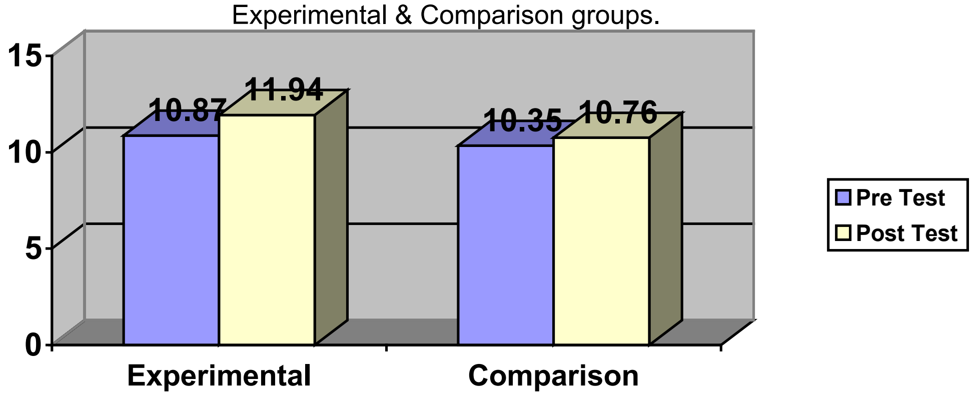
* Difference is statistically significant (p<0.05)
Note: Group with highest mean score is indicated in brackets (E Group = Experimental Group).

No statistically significant differences were found between learners in the research groupings during the pre-test phase of the study. The learners in the Experimental group attained significantly higher scores during the post-test phase of the study than learners in the Comparison group. $t\ (107,\ 106.853) = 2.341\ ;\ p<0.05$.

Verbal-Spatial Relations

FIGURE 6.7

Verbal-Spatial Relations: Comparison of pre- & post-test means in the Experimental & Comparison groups.



The scores of both research groupings were similar during the pre-test phase of the study. Learners in the Experimental group attained significantly higher scores than learners in the Comparison group during the post-test phase of the study ($p<0.05$). The pre-test to post-test improvements were, however, significant for learners *only* in the Experimental group ($p<0.05$).

TABLE 6.15

Verbal-Spatial Relations (Paired Samples Test): Pre-test to post-test means in the Experimental & Comparison groups.

Cognitive Assessment System	Experimental Group (N=54)			Comparison Group (N=55)		
	t	*df*	*p*	*t*	*df*	*p*
Verbal-Spatial Relations	-3.388	53	.001*	-.911	54	.366

* Difference is statistically significant ($p<0.05$)

Significant pre-test to post-test gains were only found for learners in the Experimental group. *t (53) = -3.388 ; p<0.05*.

TABLE 6.16

Verbal-Spatial Relations (Independent Samples Test): Comparison of pre-test (N=109) & post-test (N=109) means in the Experimental & Comparison groups.

Cognitive Assessment System	***t***	***df***	***p***
Verbal-Spatial Relations (pre)	1.163	107 93.501	.248
Verbal-Spatial Relations (post)	2.828	107 88.432	.006* (E group)

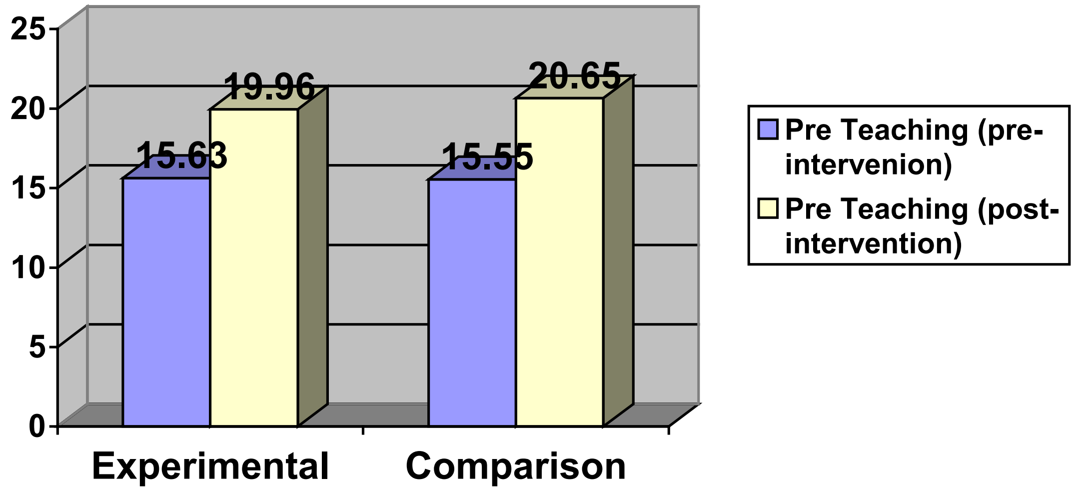
* Difference is statistically significant ($p<0.05$)
Note: Group with highest mean score is indicated in brackets (E Group = Experimental Group).

No statistically significant differences were found between learners in the research groupings during the pre-test phase of the study. The learners in the Experimental group attained significantly higher scores during the post-test phase of the study than learners in the Comparison group. *t (107, 88.432) = 2.828 ; p<0.05.*

6.3.1.3 Children's Inferential Thinking Modifiability Test (CITM)

FIGURE 6.8

Children's Inferential Thinking Modifiability Test: Comparison of pre-test & post-test means in the Experimental & Comparison groups.



The learners in the Experimental and Comparison groups made significant pre-test to post-test gains on this conventional, [1]static administration (pre-teaching stage) of the CITM ($p<0.05$). No other results attained levels of statistical significance.

TABLE 6.17

Children's Inferential Thinking Modifiability Test (Paired Samples Test): Pre-test to post-test means in the Experimental & Comparison groups.

Children's Inferential Thinking Modifiability Test	Experimental Group (N=54)			Comparison Group (N=55)		
	t	*df*	*p*	*t*	*df*	*p*
Pre-teaching (Set A)	-4.150	53	.000*	-4.918	54	.000*

* Difference is statistically significant (p<0.05)

[1] These scores did not include the effect of the teaching stage during testing. The CITM consists of a pre-teaching---teaching---post-teaching stage, administered before and after the intervention programme.

Significant pre-test to post-test gains were found for learners in the Experimental group. t (53) = -4.150 ; $p<0.05$. Significant pre-test to post-test gains were also found for learners in the Comparison group. t (54) = -4.918 ; $p<0.05$.

TABLE 6.18

Children's Inferential Thinking Modifiability Test (Independent Samples Test): Comparison of pre-test (N=109) & post-test (N=109) means in the Experimental & Comparison groups.

Children's Inferential Thinking Modifiability Test	*t*	*df*	*p*
Pre-teaching (Set A) (pre)	.084	107 103.630	.933
Pre-teaching (Set A) (post)	-.509	107 106.895	.612

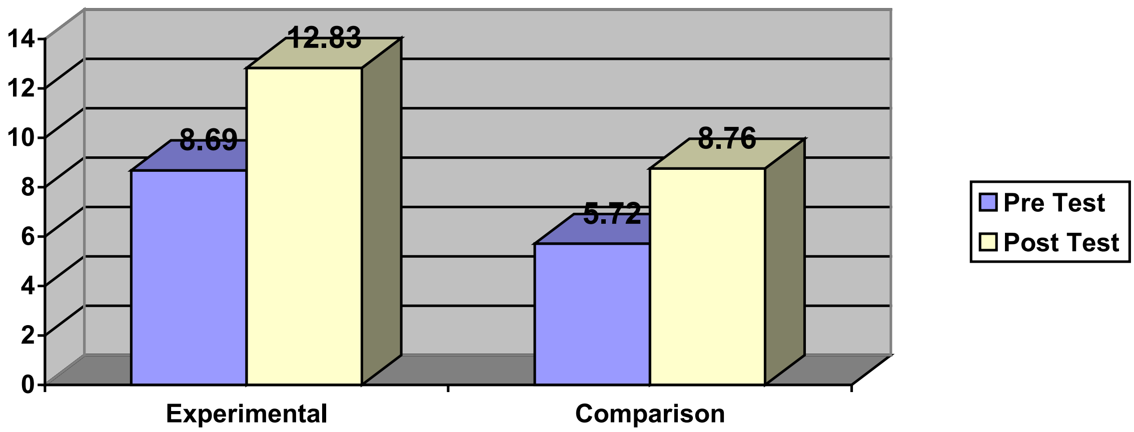
Differences in scores on this conventional, static administration (pre-teaching stage) of the CITM were not statistically significant. The CITM is, however, a dynamic assessment battery which aims to determine the effects of teaching/mediation during testing on learner modifiability. The dynamic aspect (incorporating the teaching stage) of the CITM results will be analyzed further in section 6.4 (p.192).

6.3.1.4 Scholastic Battery

UCT Spelling Test

FIGURE 6.9

UCT Spelling Test: Comparison of pre-test and post-test means in the Experimental & Comparison groups.



Learners in the Experimental group attained significantly higher scores than learners in the Comparison group during the pre-test and post-test phases of the study ($p<0.05$). Learners in the Experimental and Comparison groups both made significant gains in their spelling scores from the pre-test to the post-test phase of the study ($p<0.05$).

The influence of the pre-test spelling results (in favour of the Experimental learners) might have impacted on the overall results of the study and are therefore explored in further detail in section 6.4 (p.191).

TABLE 6.19

UCT Spelling Test (Paired Samples Test): Pre-test to post-test means in the Experimental & Comparison groups.

Scholastic Battery	Experimental Group (N=54)			Comparison Group (N =54)		
	t	*df*	*p*	*t*	*df*	*p*
UCT Spelling	-6.682	53	.000*	-5.871	53	.000*

* Difference is statistically significant ($p<0.05$)

Significant pre-test to post-test gains were found for learners in the Experimental group. $t\ (53) = -6.682\ ;\ p<0.05$. Significant pre-test to post-test gains were found for learners in the Comparison group. $t\ (53) = -5.871\ ;\ p<0.05$.

TABLE 6.20

UCT Spelling Test (Independent Samples Test): Comparison of pre-test (N=109) & post-test (N=108) means in the Experimental & Comparison groups.

Scholastic Battery	***T***	***df***	***p***
UCT Spelling (pre)	2.951	107 106.628	.004* (E Group)
UCT Spelling (post)	3.206	106 105.171	.002* (E Group)

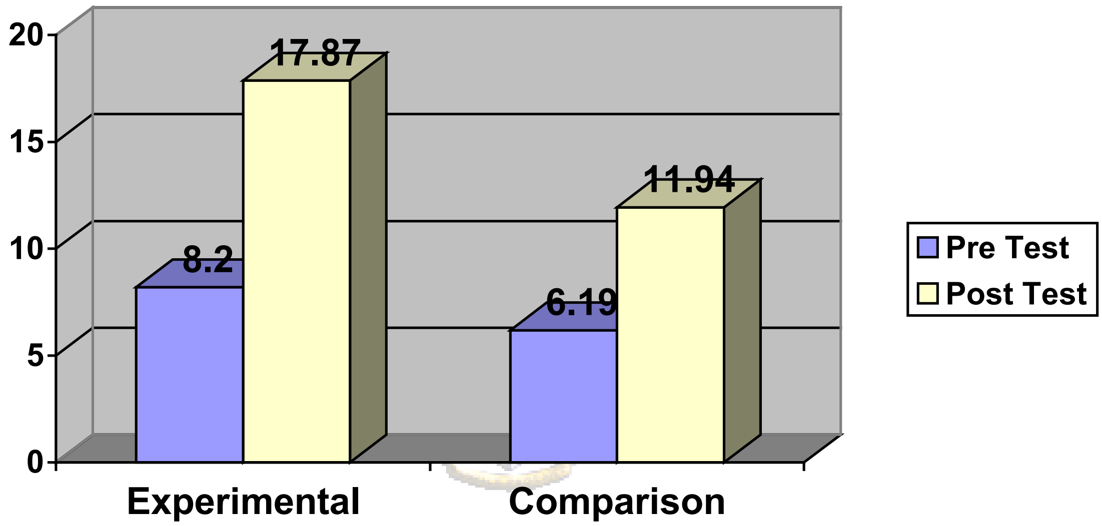
* Difference is statistically significant ($p<0.05$)
Note: Group with highest mean score is indicated in brackets (E Group = Experimental Group)

The learners in the Experimental group attained significantly higher scores during the pre-test phase (*t (107, 106.628) = 2.951 ; p<0.05)* and post-test phase (*t (106, 105.171) = 3.206 ; p<0.05)* of the study than the learners in the Comparison group.

UCT Reading Test

FIGURE 6.10

UCT Reading Test: Comparison of pre-test and post-test means in the Experimental & Comparison groups.



The reading levels of both research groupings were similar during the pre-test phase of the study. Learners in the Experimental group attained significantly higher scores than learners in the Comparison group during the post-test phase of the study (p<0.05). Learners in the Experimental and Comparison groups both made significant gains in their reading scores from the pre-test to the post-test phase of the study (p<0.05).

TABLE 6.21

UCT Reading Test (Paired Samples Test): Pre-test to post-test means in the Experimental & Comparison groups.

Scholastic Battery	Experimental Group (N=54)			Comparison Group (N =54)		
	t	*df*	*p*	*t*	*df*	*p*
UCT Reading	-11.026	53	.000*	-6.430	53	.000*

* Difference is statistically significant (p<0.05)

Significant pre-test to post-test gains were found for learners in the Experimental group. *t (53) = -11.026 ; p<0.05.* Significant pre-test to post-test gains were found for learners in the Comparison group. *t (53)* = -6.430 *; p<0.05.*

TABLE 6.22

UCT Reading Test (Independent Samples Test): Comparison of pre-test (N=109) & post-test (N=108) means in the Experimental & Comparison groups.

Scholastic Battery	***t***	***df***	***p***
UCT Reading (pre)	1.508	107 105.320	.134
UCT Reading (post)	3.058	106 101.248	.003* (E Group)

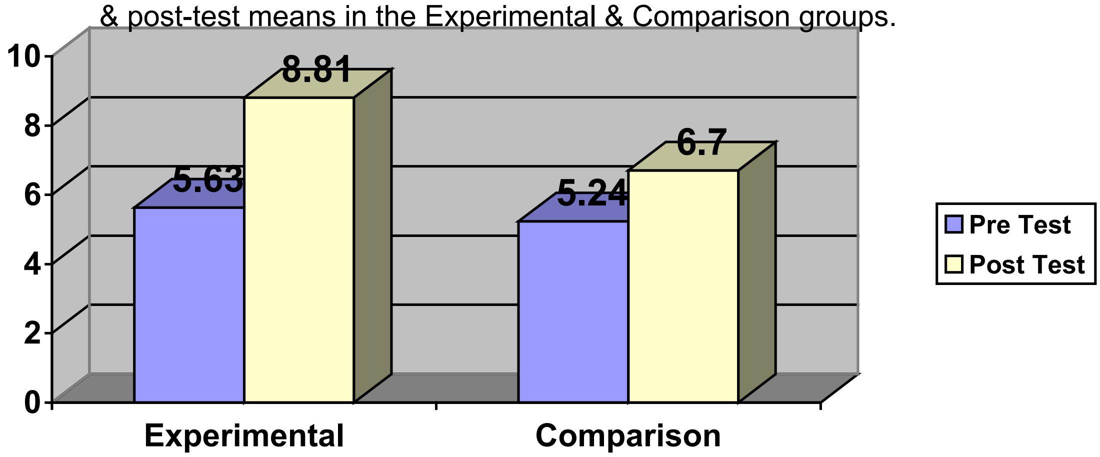
* Difference is statistically significant (p<0.05)
Note: Group with highest mean score is indicated in brackets (E Group = Experimental Group).

No statistically significant differences were found between learners in the research groupings during the pre-test phase of the study. The learners in the Experimental group attained significantly higher scores during the post-test phase of the study than the learners in the Comparison group. *t (106, 101.248) = 3.058 ; p<0.05*.

Ballard One-Minute Mathematics Test: Addition

FIGURE 6.11

Ballard One-Minute Mathematics Test (Addition):Comparison of pre-test & post-test means in the Experimental & Comparison groups.



The mathematics (addition) level of both research groupings were similar during the pre-test phase of the study. Learners in the Experimental group attained significantly higher scores than learners in the Comparison group during the post-test phase of the study ($p<0.05$). Learners in the Experimental and Comparison groups both made significant gains in their mathematics (addition) scores from the pre-test to the post-test phase of the study ($p<0.05$).

TABLE 6.23

Ballard One-Minute Mathematics Test (Addition) (Paired Samples Test): Pre-test to post-test means in the Experimental & Comparison groups.

Scholastic Battery	Experimental Group (N=54)			Comparison Group (N =54)		
	t	*df*	*p*	*t*	*df*	*p*
Mathematics (+)	-5.253	53	.000*	-3.582	53	.001*

* Difference is statistically significant ($p<0.05$)

Significant pre-test to post-test gains were found for learners in the Experimental group. $t\ (53) = -5.253$; $p<0.05$. Significant pre-test to post-test gains were found for learners in the Comparison group. $t\ (53) = -3.582$; $p<0.05$.

TABLE 6.24

Ballard One-Minute Mathematics Test (Addition) (Independent Samples Test): Comparison of pre-test (N=109) & post-test (N=108) means in the Experimental & Comparison groups.

Scholastic Battery	***t***	***df***	***p***
Mathematics (+) (pre)	.563	107 106.258	.575
Mathematics (+) (post)	2.548	106 105.802	.012* (E Group)

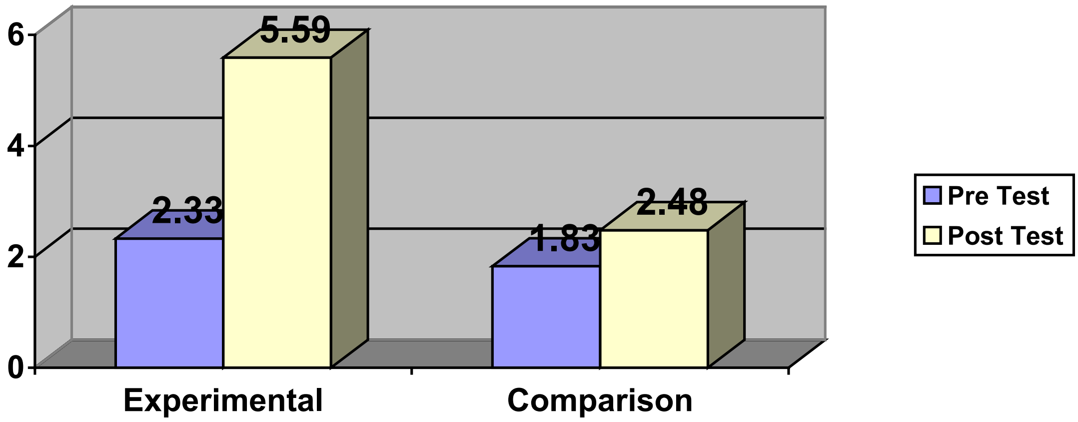
* Difference is statistically significant ($p<0.05$)
Note: Group with highest mean score is indicated in brackets (E Group = Experimental Group).

No statistically significant differences were found between learners in the research groupings during the pre-test phase of the study. The learners in the Experimental group attained significantly higher scores during the post-test phase of the study than the learners in the Comparison group. *t (106, 105.802) = 2.548 ; p<0.05.*

Ballard One-Minute Mathematics Test: Subtraction

TABLE 6.12

Ballard One-Minute Mathematics Test (Subtraction):Comparison of pre-test & post-test means in the Experimental & Comparison groups.



The mathematics (subtraction) level of both research groupings were similar during the pre-test phase of the study. Learners in the Experimental group attained significantly higher scores than learners in the Comparison group during the post-test phase of the study (p<0.05). Pre-test to post-test improvements were significant for learners *only* in the Experimental group (p<0.05).

TABLE 6.25

Ballard One-Minute Mathematics Test (Subtraction) (Paired Samples Test): Pre-test to post-test means in the Experimental & Comparison groups.

Scholastic Battery	Experimental Group (N=54)			Comparison Group (N =54)		
	t	*df*	*p*	*t*	*df*	*p*
Mathematics (-)	-5.638	53	.000*	-1.547	53	.128

* Difference is statistically significant (p<0.05)

Significant pre-test to post-test gains were found for learners *only* in the Experimental group. *t (53) = -5.638 ; p<0.05.*

TABLE 6.26

Ballard One-Minute Mathematics Test (Subtraction) (Independent Samples Test): Comparison of pre-test (N=109) & post-test (N=108) means in the Experimental & Comparison groups.

Scholastic Battery	***t***	***df***	***p***
Mathematics (-) (pre)	.933	107 97.059	.353
Mathematics (-) (post)	4.031	106 100.841	.000* (E Group)

* Difference is statistically significant (p<0.05)
Note: Group with highest mean score is indicated in brackets (E Group = Experimental Group).

No statistically significant differences were found between learners in the research groupings during the pre-test phase of the study. The learners in the Experimental group attained significantly higher scores during the post-test phase of the study than the learners in the Comparison group. *t (106, 100.841) = 4.031 ; p<0.05.*

6.3.2 Summary of results by test battery and evaluation of study hypotheses

TABLE 6.27

A summary of statistically significant & statistically non-significant findings: 1) from pre-test to post-test within each group & 2) differences between Experimental & Comparison groups.

Test Battery	**1) From Pre-Test To Post-Test Within Each Group**		**2) Differences Between Experimental & Comparison Groups** (See Note 1 below table.)	
1. Boehm Test of Basic Concepts-Revised	**Experimental**	**Comparison**	**Pre-test**	**Post-test**
	*	*	*	*
2. Cognitive Assessment System	**Experimental**	**Comparison**	**Pre-test**	**Post-test**
Matching Number	*	*	**X**	**X**
Planned Codes	*	*	**X**	**X**
Number Detection	*	*	**X**	**X**
Receptive Attention	*	*	**X**	**X**
Nonverbal Matrices	*	*	**X**	*

Test Battery	1) From Pre-test To Post-test Within Each Group		2) Differences Between Experimental & Comparison Groups See Note 1 below table.	
2. Cognitive Assessment System	**Experimental**	**Comparison**	**Pre-test**	**Post-test**
Verbal-Spatial Relations	*	X	X	*
CAS Total	*	*	X	X
3. Children's Inferential Thinking Modifiability Test	**Experimental**	**Comparison**	**Pre-test**	**Post-test**
Pre-Teaching (Set A)	*	*	X	X
4. Scholastics	**Experimental**	**Comparison**	**Pre-test**	**Post-test**
Spelling	*	*	*	*
Reading	*	*	X	*
Ballard: Addition	*	*	X	*
Ballard: Subtraction	*	X	X	*
Scholastics Total	*	*	*	*

Key: * = statistically significant **X** = not statistically significant

Statistical significance is calculated when the difference in means is $p<0.05$.

Note 1: Where significant differences did exist these were all in favour of the Experimental group.

The study findings indicated that all learners (Experimental and Comparison) made significant gains from the pre-test to post test phase of the study in all four test batteries. The only exceptions were two areas (viz. Mathematics (subtraction) in the Scholastic Battery and Verbal-Spatial Relations in the CAS) for learners in the Comparison group. Moreover at post-test learners in the Experimental group attained significantly higher scores in 7 out of the 12 areas assessed. The [2]**Global Hypothesis** for the study was therefore partially confirmed. Learners in the Experimental group did not attain significantly higher post-test scores than learners in the Comparison group on the following test measures: CAS (matching number, planned codes, number detection and receptive attention) and the CITM (pre-teaching). It should also

[2] See Chapter Five, p.125, for the Global Hypothesis.

be acknowledged that learners in the Experimental group at pre-test attained significantly higher scores in 2 out of the 12 areas assessed, than their peers in the Comparison group.

Learners in the Experimental group attained significantly higher scores than Comparison group learners on the BTBC-R. [3]**Hypothesis 1** thus appeared to be confirmed. Learners in the Experimental group attained significantly higher scores on two simultaneous subtests (Nonverbal Matrices and Verbal-Spatial Relations) of the CAS than Comparison group learners. **Hypothesis 2** was thus partially confirmed. Learners in the Experimental group did not attain significantly higher scores than Comparison group learners on the CITM pre-teaching stage. **Hypothesis 3a** was thus not confirmed. Learners in the Experimental group attained significantly higher scores than Comparison group learners on the CITM post-teaching: Gain Score 1. Learners in the Experimental group, however, did not attain significantly higher scores than Comparison learners on the CITM post-teaching: Gain Score 2. [4]**Hypothesis 3b** was thus partially confirmed. Learners in the Experimental group attained significantly higher scores than Comparison group learners on the Scholastic Battery. **Hypothesis 4** was thus confirmed.

6.4 FURTHER ANALYSES

Two further sets of analyses were performed based on the results presented in the previous section. The first analysis was performed in order to determine whether the pre-intervention spelling advantage attributed to the learners in the Experimental group also influenced the results on other test batteries. The second analysis was performed on the CITM in order to assess the gains made in learners' responsiveness to teaching/mediation from the pre-intervention to the post-intervention phase of the study.

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[3] See Chapter Five, p.126 for the Sub-Hypotheses of the study.
[4] These test results are to be discussed in the section below (p.192).

6.4.1 Further analysis of UCT Spelling Test

TABLE 6.28

Analysis of Covariance: Effects of gains on the BTBC-R & CAS after removing the effects of pre-test UCT Spelling Test scores (N=108).

Test Measure	Independent Variable	Mean Square	F	p
Boehm Test of Basic Concepts	Group	**26.383**	**1.479**	**.227**
	Gender	**1.787**	**.100**	**.752**
	Group x Gender	**16.932**	**.949**	**.332**
Test Measure	**Independent Variable**	**Mean Square**	**F**	**p**
Cognitive Assessment System	Group	**4226.820**	**2.948**	**.089**
	Gender	**103.539**	**.072**	**.789**
	Group x Gender	**53.611**	**.037**	**.847**

In both of the above analyses neither group, gender, or group x gender differences were found to have a significant effect on BTBC-R or CAS gain scores after removing the effects of spelling. Conversely, it could be concluded that the advantage of the pre-intervention spelling results for Experimental learners was not significantly related to gains on other (viz. BTBC-R or CAS) test batteries.

6.4.2 Further analysis of CITM

See the table below for a presentation of means and standard deviations calculated after the full administration of the CITM (pre-teaching and post-teaching tests which were employed during the pre-intervention and post-intervention phase of the study). Four sets of scores are therefore presented for learners in the Experimental and Comparison groups. The reader is reminded that teaching was inserted between the pre-teaching and post-teaching stages of the test during both pre-intervention and post-intervention phases of the study.

TABLE 6.29

Children's Inferential Thinking Modifiability Test: Pre-intervention (pre-teaching & post-teaching) & post-intervention (pre-teaching & post-teaching) means & standard deviations in the Experimental & Comparison groups.

Test Measure	Group	Pre-Intervention		Post-Intervention	
Children's Inferential Thinking Modifiability Test		Pre-Teaching Means---SD	Post-Teaching Means---SD	Pre-Teaching Means---SD	Post-Teaching Means---SD
	Experimental (N=54)	15.63---5.638	25.54---8.303	19.96---6.912	32.00---7.092
	Comparison (N=55)	15.55---4.787	27.45---7.986	20.65---7.265	29.45---7.044

The above-mentioned scores were used to derive gain scores (Chapter Five, p.162 and Appendix 23) from pre-intervention to the post-intervention phase of the study. The gain scores were thereafter analysed. The results of these analyses are reflected in the table below.

TABLE 6.30

Children's Inferential Thinking Modifiability Test (Paired & Independent Samples Tests): Analysis of gain scores calculated for learners in the Experimental & Comparison groups.

Test Measure	Paired Samples Test	Gain Score 1	Gain Score 2
CITM		*t score--- df ---p value*	*t score--- df ---p value*
	Experimental	6.356---53---.000*	14.874---53---.000*
	Comparison	1.707---54---.094	13.386---54---.000*
Test Measure	**Independent Samples Test**	**Gain Score 1**	**Gain Score 2**
CITM		*t score--- df ---p value*	*t score--- df ---p value*
		2.873---105.181---.005* (Experimental Group)	1.626---106.525---.107

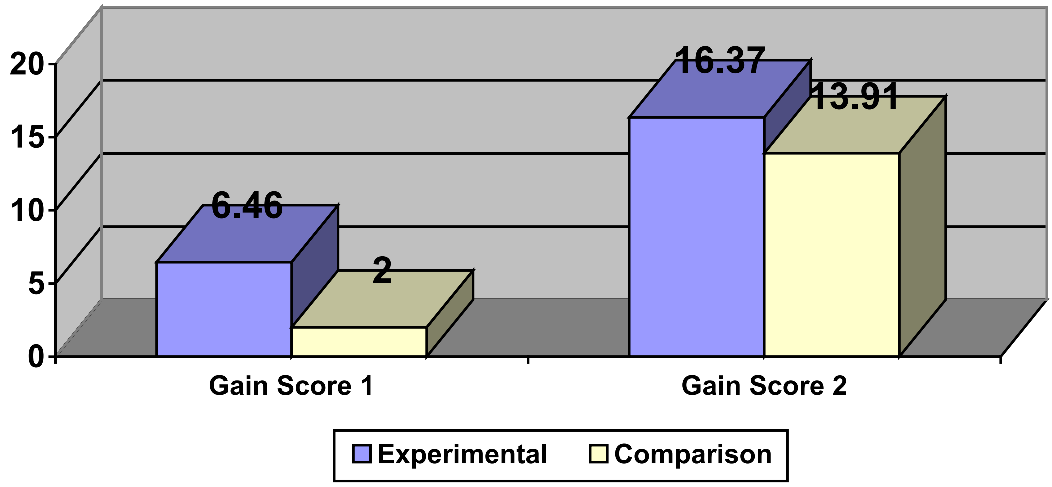
* Difference is statistically significant (p<0.05)
Note: Group with highest mean score is indicated in brackets.

Gain Score 1- Learners in the Experimental group made significant pre-intervention to post-intervention gains ($t\ (53) = 6.356$; $p<0.05$), whereas no statistically significant gains were made by learners in the Comparison group. Learners in the Experimental group made significantly greater gains than learners in the Comparison group. $t\ (107,105.181) = 2.873$; $p<0.05$.

Gain Score 2- Learners in the Experimental and Comparison groups made significant pre-intervention to post-intervention gains *(Experimental Group:* $t\ (53) = 14.874$; $p<0.05$ *and Comparison Group:* $t\ (54) = 13.386$; $p<0.05$). No statistically significant differences were found when comparing learners in the Experimental and Comparison groups.

FIGURE 6.13

Children's Inferential Thinking Modifiability Test: Comparative analysis of gain scores in the Experimental & Comparison groups.



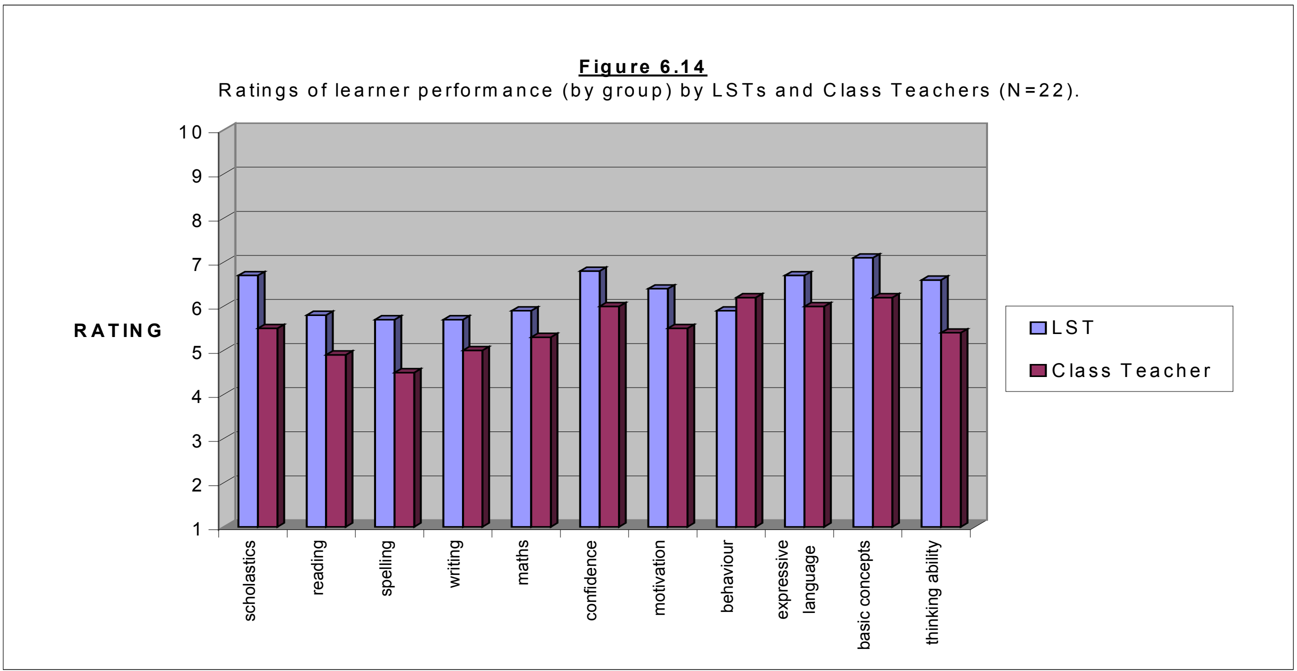
The results for Gain Score 2 indicated that learners from both research groupings had improved significantly from the pre-intervention to the post-intervention phase of the study. The results for Gain Score 2 in the Experimental and Comparison groups were not found to be significantly different from each other. The results for Gain Score 1 were found to be significantly different for learners in the Experimental group when compared with learners in the Comparison group. It is also important to note that the performance of learners continued to improve during the study (from pre-intervention to post-intervention), that is, there was no [5]ceiling effect problem encountered during the administration of the test battery.

6.5 TEACHER RATINGS

6.5.1 Teacher ratings of learner performance

The Learning Support Teachers (LST) and Class Teachers ratings of their learners in the Experimental group after their participation in the intervention programme suggested evidence of gains. (See Figure 6.14, p.196.) All the ratings with the exception of two categories (with respect to the evaluations by Class Teachers) were 5 or above. The Class Teachers thus tended to agree (in 9 out of 11 categories evaluated) with the evaluations of the LSTs that learner progress was evident. The ratings of the LSTs were higher than their colleagues in all categories, with the exception of 1 category (viz. behaviour). However, the differences in the mean ratings between the teacher groupings showed no marked differences (0.8), with the exception of three categories where the mean difference was slightly larger 1.2 (viz. [6]scholastics, spelling and thinking ability). In conclusion, the findings indicate a general similarity in the evaluation of teachers (whether LST or Class Teacher), with the possible exception of three categories.

[5] Ceiling effect is a problem that has been noted in the literature in relation to this test battery and with dynamic assessment batteries in general (e.g. Sternberg, 2002 ; Tuzriel, 2001). The highest mean score attained by the learners during post-intervention (post-teaching) was 32 out of 41.
[6] For further discussion see the section below.

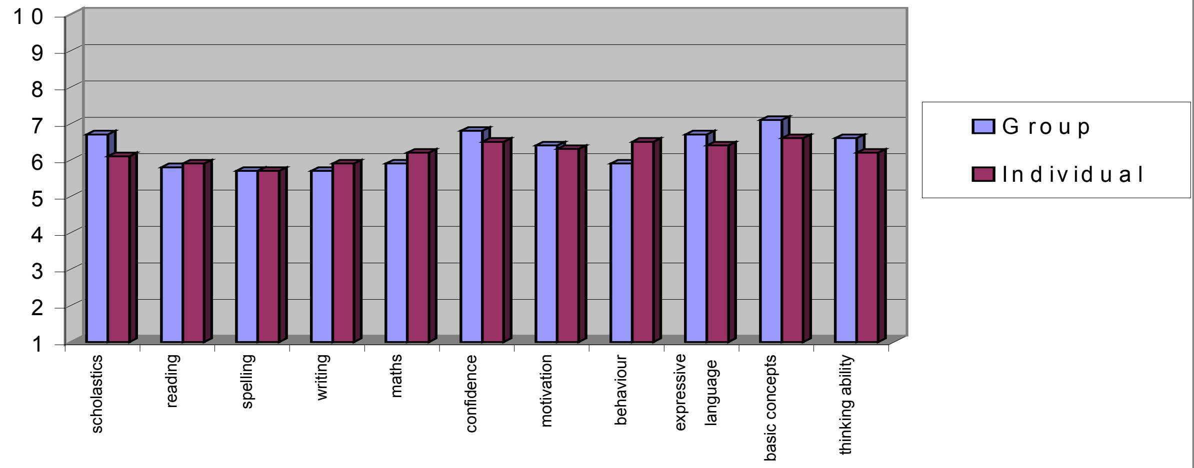


Key for Rating Scale: (10 point rating scale)
1 = no evidence of gains **5** = some evidence of gains **10** = lots of evidence of gains

The findings in the figure below (Figure 6.15) found high levels of consistency for the ratings of group and individual learners by the LSTs. The mean difference in the ratings for group and individual learners was similar. There was a 0.1 mean difference in the ratings in favour of the group ratings. The teacher ratings for the learners in the group were slightly raised in 6 categories, whereas in 4 categories the ratings were slightly raised in favour of individual learners. In one category the rating was the same. The largest discrepancy was the scholastic category with a difference of 0.6 in favour of the group rating. However, after a mean score for the scholastic categories (reading, spelling, writing and mathematics) was calculated, much of this difference was erased (5.8 and 5.9 for group and individual learners respectively). There was a slightly larger range in the ratings for the group (5.7-7.1), than for individual learners (5.7-6.6). However, a majority of the categories (whether for group or individual) received ratings of 6 or above. Basic concepts were awarded the highest rating (group and individual), whereas spelling was awarded the lowest rating (group and individual). Thus it could be concluded that evaluations of the LSTs, whether for group or individual learners, were highly consistent.

Figure 6.15

Ratings of learner performance (group and individual) by LSTs (N=11).



Key for Rating Scale: (10 point rating scale)
1 = no evidence of gains **5** = some evidence of gains **10** = lots of evidence of gains

6.5.2 Teacher ratings of learner promotability and maintenance of learning gains

TABLE 6.31

A comparison of the number & percentage of learners in the Experimental group to be promoted & the expected durability of the BCMLP as evaluated by LSTs and Class Teachers.

	LSTs		**Class Teachers**	
Learner Promotion	*No.*	*Percent-age*	*No.*	*Percent-age*
yes	45	**83%**	38	**84%**
no	9	**17%**	7	**16%**
TOTAL	54	**100%**	45	**100%**
Maintenance of Learning	*No.*	*Percent-age*	*No.*	*Percent-age*
yes	40	**76%**	25	**54%**
no	4	**8%**	4	**9%**
maybe	8	**15%**	17	**37%**
TOTAL	52	**100%**	46	**100%**

The teachers (LST and Class Teachers) agreed that a majority of the learners who participated in the programme were likely to be promoted at the end of the year. It was expected that this data might correspond, as these teachers

[7]could have decided together about the promotion of these learners. However, it appeared that there were certain differences between teachers with respect to their conceptions regarding the durability of the effects of the programme. LSTs were more optimistic about the durability of the programme effects (76%) than Class Teachers who were more cautious about the durability of the programme effects (54%). A Chi-square analysis found that LSTs were more likely ($p<0.05$) to consider the effects of the study findings to be durable than Class Teachers *(Chi-square value= 6.358 ; df = 2 ; p = .042*).*

6.6 SUMMARY

The aim of this study was to determine whether the BCMLP is an effective intervention programme for Foundation Phase learners who experience barriers to learning. The results reported in this chapter were derived from a quantitative, quasi-experimental pre-test and post-test design study. It was important to determine whether benefits could be directly attributed to the intervention programme. Therefore, before examining the main contention of the study, it was important that issues of learner equivalence be explored.

An examination of the overall effects of intervening variables (*gender, location, teacher*) on the study outcomes found that limited pre-test advantage could be attributed to the Experimental group. However, it was found that this was mainly as a result of weaknesses in certain sub-groupings within the Comparison group. The following areas of weakness were found in the Comparison group: -

- *gender:* a sub-grouping of learners in the Comparison group, male learners from South, received lower scholastics scores than their peers (only found in the non-parametric analysis).
- *location:* a sub-grouping of learners in the Comparison group from South consistently received lower scores than their peers.

[7] However, the instruction given to the LSTs and Class Teachers was that they should fill in the 'LSTs' Evaluation of Learners' questionnaire independently. (See Appendix 22.)

- *teacher:* two teachers (or groups of learners) in the Comparison group - one from South and the other from Central - were associated with some of the lowest and highest mean rankings respectively.

The learners in the Comparison group from South were thus consistently associated with poor performances in the study sample. It was however interesting to note that a teacher (or a group of learners) from Comparison Central was also associated with some of the highest test scores in the study sample. Notwithstanding the above-mentioned differences between the research groupings, an overall similarity in the pre-test data was found. Significant pre-test differences were found in favour of learners from the Experimental group in only 2 of the 12 pre-tests (viz basic concepts and spelling). However, further analysis of the spelling scores found that the learners' spelling was not significantly related to gains on other test batteries (viz. BTBC-R or CAS). Thus, one could infer that pre-test spelling scores had no observable influence on the overall study results. It can be concluded that, although some general caution should be taken when interpreting the study findings (especially for learners in the Comparison group from South, and with respect to the above two test measures), reasonable levels of learner equivalence can be assumed.

The learners in the Experimental group attained significantly higher mean scores in 7 out of the 12 post-tests. In addition, after further analysis of the CITM it was found that learners in the Experimental group were more responsive to teaching than learners in the Comparison group (Gain Score 1). The findings for learners in the Experimental group were also supported by positive teacher ratings (Learning Support Teachers and Class Teachers) of their learners' performance during the study. However, it should be acknowledged that [8]all learners (female and male, Central and South, and

[8] This was with the exception of one test measure for learners from Central (Verbal-Spatial Relations) and three test measures for learners from the Comparison group (Ballard: Subtraction, Verbal-Spatial Relations & CITM: Gain Score 2) which did not have significant pre- to post-test results. Female learners did not make significant gains on one CAS subtest (Verbal-Spatial Relations).

Experimental and Comparison) made significant gains during the study and improved significantly in most areas assessed (basic concepts, cognitive functioning, cognitive modifiability, and scholastic functioning).

The results as outlined in this chapter can therefore be accepted with reasonable levels of confidence. Intervening variables were found to provide limited advantage for learners in the Experimental group and therefore some caution is also suggested when making further inferences from the study results. This is discussed in the following chapter.

CHAPTER SEVEN

DISCUSSION OF STUDY RESULTS - THE BCMLP A METACOGNITIVE PROGRAMME DEVELOPED FOR THE SOUTH AFRICAN EDUCATIONAL CONTEXT

7.1 INTRODUCTION

This chapter aims to interpret and discuss the study results as presented in the preceding chapter. The study findings are examined in relation to the aims and hypotheses of this theoretically derived metacognitive programme. The four key assessment areas as outlined in the study methodology (Chapter Five, p.148-150) were tightly connected with the study hypotheses. The discussion consequently reflects the close functional inter-relationships between the study hypotheses, assessment measures and theoretical base. (See Table 7.1, p.202.)

The chapter first presents the sub-hypotheses and discusses the results reported in Chapter Six. These include learner results gathered by the test batteries as well as ratings gathered from teachers (Learning Support Teachers and Class Teachers). Detailed descriptions of the cognitive change effected during the study as well as issues related to the domain-general---domain-specific aspects of cognitive education are explored. Curriculum infusion versus content-free approaches to cognitive education are discussed in relation to the programme that this study describes and evaluates (viz. BCMLP). Furthermore, the BCMLP is compared with the three metacognitive programmes reviewed in Chapter Three. The discussion does not, however, directly evaluate any of the unique design aspects (procedures and processes) of the programme, as these were not directly investigated during this study. The implications of this study within the South African context are also explored. The chapter finally presents the limitations of the study and makes a set of recommendations to improve its validity and to enhance the efficacy of the programme. It also suggests ways in which the programme might be introduced in the South African context.

TABLE 7.1

Functional relationships between study hypotheses, assessment areas & theoretical base of the study.

Sub-Hypotheses (expressed as goals)	Assessment Areas	Theoretical Base of the Study
H1:To develop a basic concepts knowledge base	• Boehm Test of Basic Concepts-Revised (BTBC-R)	• Knowledge develops and can be built on. • Knowledge of basic conceptual systems enables one to learn about other conceptual systems- generative function of concept learning.
H2 + H3a&b: To promote the advancement of higher order cognitive functioning and cognitive modifiability	• Cognitive Assessment System (CAS) • Children's Inferential Thinking Modifiability Test (CITM)	• Children's thinking develops from intuitive and spontaneous thinking to more logical abstract modes of thought (e.g. mental actions associated with Piaget's stage of Concrete Operational Thought). • Key information-processing capacities and higher order cognitive functions are pre-requisites for effective learning. • Cognitive modifiability is associated with the generalization and durability of learning, that is, learners are able to show evidence that they can bridge and transfer cognitive skills to new areas.
H4: To promote the scholastic functioning of learners	• Scholastic Battery i) UCT Reading ii) UCT Spelling iii) Ballard: Addition iv)Ballard: Subtraction	• The development of cognitive functioning is closely connected with success in school learning. • Cognitive development is thought to have a domain-specific and a domain-general component.

7.2 DISCUSSION OF STUDY FINDINGS

7.2.1 Test batteries

7.2.1.1 BTBC-R

<u>Hypothesis 1:</u>

Significant differences in favour of learners' mean scores in the Experimental group will be found on the BTBC-R (testing knowledge of basic conceptual systems) following six months of the BCMLP.

Learners in the Experimental group attained significantly higher scores than the learners in the Comparison group at the post-test phase of the study ($p<0.05$). The results thus appeared to confirm Hypothesis 1.

It should be noted that learners in the Experimental group attained significantly higher scores in this area compared with learners in the Comparison group before and after the intervention programmes. The learners in the Experimental group thus had an advantage in this assessment area at the start of the study. The gains of the learners in the Experimental group could not therefore be attributed only to their participation in the BCMLP. However, it might be argued that gains at the higher end of the test scale were more difficult to attain ([1]The Experimental Group's mean score increased from 37 to 42 out of 50 while the Comparison Group's mean score increased from 34 to 38 out of 50) and might be partially attributed to the intervention programme.

The study found that learners from both the Experimental and Comparison groups were able to build on their knowledge of basic conceptual systems and the vocabulary associated with this knowledge base. Learners from both research groupings were therefore able to generate knowledge of new conceptual systems. The study findings thus concur with Siegler's (1998) socio-historical contentions (Chapter Three, p.85) that conceptual

[1]Small differences in BTBC-R raw scores reflect large variations in standard scores. For example, the norms for this test indicate that Grade 2 learners (low socio-economic class) who receive scores of 42 or 38 out of 50 fall in the 10th and 3rd percentile respectively.

development among children occurs in all cultures and is influenced by culture, however, has its source in biological development. This universal developmental position is one that corresponds closely with the perspectives of the troika of theorists as discussed in Chapter Two (Piaget, Vygotsky and Feuerstein) which underpin the study.

Knowledge of basic concepts is regarded as an essential aspect required for school learning. This contention is supported by the literature, for example BTBC-R research has found the test to be a reasonable predictor of later school achievement (Boehm, 1986). Furthermore, as noted in Chapter Five (p.148), the relationship between basic relational concept knowledge and school achievement has been supported by numerous studies (Nason, 1986; Piersel & McAndrews, 1982; Steinbauer & Heller, 1978). The study findings confirm that learning new conceptual knowledge is an intrinsic aspect of school learning (and other general life experiences) of the learners. The conceptual knowledge included in this test has many associations with the vocabulary of the Revised National Curriculum Statement (RNCS). For example, Curriculum Outcome 5 (Languages) for Grade 2 requires that: *'learners use language to develop concepts …(and should demonstrate understanding of) the conceptual language of different areas necessary at this level and in preparation for the next level' (Department of Education, Languages, 2002:47).* The inference drawn from the BTBC-R findings, therefore, is that learners in the population from which the study sample was selected might also make corresponding gains in their school achievement if they were to receive instruction in small groups in either of the forms described in this study.

7.2.1.2 CAS

Hypothesis 2:

Significant differences in favour of learners' mean scores in the Experimental group will be found on six subtests (Matching Number, Planned Codes, Number Detection, Receptive Attention, Nonverbal Matrices and Verbal-Spatial Relations) of the CAS (testing higher cognitive functioning and information-processing) following six months of the BCMLP.

Learners in the Experimental group attained significantly higher scores than the learners in the Comparison group on two subtests (viz. Nonverbal Matrices and Verbal-Spatial Relations) at the post-test phase of the study ($p<0.05$). The results thus partially confirmed Hypothesis 2.

[2]The study found that learners from both the Experimental and Comparison groups improved in their ability to solve problems that required planning, attention and simultaneous processing. Both research groupings demonstrated enhanced cognitive (information-processing) abilities. These findings illustrate the potential of learners to improve their information-processing capacities in the course of their daily educational encounters. The improvement of the information-processing ability of these learners could be attributed to some extent to maturational processes which unfolded during the course of the study (over a period of approximately six months). However, it is also likely that some of these improvements were attributable to the small group programmes and/or the teaching/mediation the learners received during the study. (See Chapter Seven, p.220.) Neo-Piagetians, Neo-Vygotskians and Feuersteinians all placed strong emphasis on the dynamic nature of cognitive developmental processes and on the role of the teacher/mediator to question/challenge learners.

With respect to the Simultaneous Scale, learners in the Experimental group attained significantly higher post-test scores than their peers in the Comparison group in two subtests (Nonverbal Matrices and Verbal-Spatial Relations). In addition, it was found that learners in the Comparison group did not make significant pre- to post-test gains on one ‘simultaneous subtest’, namely Verbal-Spatial Relations. This was also the only subtest (of the CAS) where significant pre- to post-test gains were not made by all learners during the study.

[2] The CAS could not be adapted to assess the successive processing ability of the study participants. (See Chapter Five, p.152 for further discussion.)

The ‘simultaneous subtests’ require learners to simultaneously interpret and process multiple sources of pictorial and [3]auditory information. *‘Simultaneous processing is a mental process by which the individual integrates separate stimuli into a single whole or group’* (Luria, 1970:78). It is contended that the Nonverbal Matrices and Verbal-Spatial Relation subtests are more complex in cognitive demand, than the Matching Number, Planned Codes, Number Detection and Receptive Attention subtests (‘planning and attention subtests’) which are particularly related to perceptual integration processes, a common school focus.

The cognitive processes associated with the CAS (planning, attention, simultaneous-, and successive processing) are considered to be the underlying processes required for learning to read and spell (Das, 2000). This claim was supported by the strong pre-test correlations found between the former three areas of the CAS and the Scholastic Battery (.564) during the study. (See Table 5.6, p.157.) This was the highest pre-test inter-test battery correlation found during the study. It was therefore of particular interest that learners in the Experimental group (who had attained significantly higher scores on certain areas of the Simultaneous Scale) also improved significantly in their scholastic functioning when compared with learners in the Comparison group. (See sections below.) In contrast, learners in the Comparison group were found to have a weakness in a ‘simultaneous subtest’ (Verbal-Spatial Relations). This might predict a relative weakness for tasks related to this area and therefore illuminate related learning- and information-processing difficulties. The above findings might also reflect the type of interventions received (or not received) by learners during the study.

The literature indicates that all four PASS (Planning, Attention, Simultaneous-, and Successive Processing) processes are involved in reading and mathematics (Naglieri & Rojahn, 2004). Ideally, successive processing subtests should have been included in the battery. For practical reasons, the

[3] This mainly applies to the Verbal-Spatial Relations subtest.

learners' ability in the area of [4]successive processing was not assessed during the study. However it could be inferred that such processing was required for learners to understand the oral test instructions during the study. It could also be argued that teachers in South African schools are reasonably familiar with 'sequential approaches' to teaching with the result that learners from both research groupings would have already internalized the cognitive requirements for successive processing tasks.

7.2.1.3 CITM (These findings were derived from two sets of analyses.)

Hypothesis 3(a):

Significant differences in favour of learners' mean scores in the Experimental group will be found during the pre-teaching stage of the CITM (testing cognitive modifiability) following six months of the BCMLP.

No statistically significant differences were found between the learners from the Experimental and Comparison groups at the post-intervention phase of the study ($p>0.05$). The results thus did not confirm Hypothesis 3(a).

Hypothesis 3(b):

Significant differences in favour of learners' gain scores in the Experimental group will be found during the post-teaching stage of the CITM (testing cognitive modifiability) following six months of the BCMLP.

- Gain Score 1- Learners in the Experimental group made significant gains from the pre- to the post-intervention phase of the study ($p<0.05$). No statistically significant gains were found for learners in the Comparison group from the pre- to the post-intervention phase ($p>0.05$). The gain scores for learners in the Experimental group were significantly greater than for learners in the Comparison group ($p<0.05$).

[4] A process related to linguistic tasks that are required for understanding sentences based on syntactic relationships (Das & Naglieri, 1997).

- Gain Score 2- Learners in the Experimental and Comparison groups made significant gains from the pre- to the post-intervention phase of the study ($p<0.05$). No statistically significant differences were found between the gain scores for learners in the Experimental and Comparison groups ($p>0.05$).

The results thus partially confirmed (for Gain Score 1 and not Gain Score 2) Hypothesis 3(b).

The study found that learners from both the Experimental and [5]Comparison groups were modifiable (from the pre- to post-intervention phase of the study). Both research groupings demonstrated gains post-intervention before and after the teaching/mediation phase. These findings are consistent with the other study findings: that all learners who participated in the study had improved significantly in most areas assessed.

The study found that learners in the Experimental group were more responsive to instruction than their peers in the Comparison group at the end of the study (Gain Score 1). In contrast, it was found that learners in the Comparison group did not continue to make significant gains in their scores at the end of the study (Gain Score 1). These findings suggest that learners in the Experimental group continued to benefit from instruction (from pre- to post-intervention), whereas the learners in the Comparison group appeared to have reached a ‘ceiling’ and were not responsive to additional teaching/mediation. It is posited that although the learners in the Comparison group had learnt the rules and strategies to solve inferential-hypothetical problems, they were not yet able to internalize these rules and strategies in order to use them independently. The mental actions required for solving these complex, inferential-hypothetical problems might therefore have been beyond the developmental readiness of these learners, as indicated by their independent performance (Gain Score 1). These difficulties might have also

[5] This is with the exception of Gain Score 1 for learners in the Comparison group. (See the section below.)

been present in the Experimental group had they not received the mediational intervention from the BCMLP.

The differences between the research groupings were most apparent after teaching/mediation during both pre- and post-intervention phases of the study, that is, after instruction in the Zone of Proximal Development (Gain Score 1). These findings concur with Tzuriel's assertion that 'modifiability scores' are better predictors of academic success in young children than static tests (Tzuriel, 2000; Tzuriel, Kaniel, Zeliger, Friedman & Haywood, 1998). The previous discussion might also provide some insight into the hypotheses that were not confirmed (Hypothesis 3a) or were partially confirmed (Hypothesis 3b: Gain Score 2), that is, when teaching/mediation was not present during both the pre- and post-intervention phases learners in the Experimental group did not achieve higher mean scores. The researcher is also aware that the findings associated with Gain Score 1 (and the CITM scores generally) could not be attributed to learner modifiability alone, but would also be influenced by other variables, such as the quality of mediation provided during testing. The study was unable to monitor and control these variables.

By the end of the study, learners in the Experimental group appeared to be more modifiable and open to cognitive challenge than learners in the Comparison group. It is proposed that the cognitive modifiability observed in learners in the Experimental group was mainly due to the mediation effects which enabled an advance in their cognitive functioning as they progressed towards the upper limits of their Zone of Proximal Development (Vygotsky, 1978). One might thus expect learners from the two research groupings to respond differently to tasks presenting cognitive challenge and requiring flexible adjustments in thinking processes. This might explain the Comparison group's lower scores on a test of subtraction, which is more complex than addition. (See below.)

7.2.1.4 Scholastic Battery

<u>Hypothesis 4:</u>

Significant differences in favour of learners' mean scores in the Experimental group will be found on the UCT Reading Test, UCT Spelling Test and Ballard Addition- & Subtraction Tests (testing scholastic functioning) following six months of the BCMLP.

Learners in the Experimental group attained significantly higher scores than the learners in the Comparison group on all the scholastic test measures (UCT Reading Test, UCT Spelling Test and Ballard Addition- & Subtraction Tests) at the post-test phase of the study ($p<0.05$). The results thus confirmed Hypothesis 4.

The study found that learners from both the Experimental and Comparison groups made significant gains in their scholastic functioning. It is hypothesized that these gains in scholastic functioning were primarily attributable to their participation in the intervention programmes. [6]There would be some agreement amongst the troika of theorists that an expanded knowledge-base alongside enhanced cognitive functioning would account for corresponding gains in school learning. (See Table 7.1, p.202.)

Learners in the Experimental group attained significantly higher scores than their peers in the Comparison group on all the scholastic measures during the post-test phase of the study. Learners in the Comparison group in fact displayed a weakness with respect to one of the scholastic measures (viz. mathematics (subtraction)) at the end of the study. It is important to note that learners in the Experimental group had started the study with a limited advantage for spelling. However, further analysis of the pre-test spelling results (using the ANCOVA) in relation to other results found that spelling did not account for changes in other areas of the learners' functioning. No other

[6] Feuerstein, however, would not directly agree that the effects of changes in the general cognitive functioning would result in immediate benefits for scholastic functioning.

pre-test scholastic advantage was found for the learners in the Experimental group.

The greater improvement in the scholastic functioning of learners from the Experimental group suggests a qualitative improvement in the general thinking ability of these learners, in comparison with their peers in the Comparison group. It is important to note that learners in the Comparison group also made significant scholastic gains on most of these test measures during the study and achieved corresponding improvement in their general cognitive functioning, however, certain specific areas of weakness were also found. For example, a weaknesses in Mathematics (subtraction) (a task that requires learners to think flexibly) which might be related to certain information-processing difficulties as reflected in their CITM (Gain Score 1) and Verbal-Spatial Relations subtest (of the CAS) scores.

7.2.2 Teacher ratings ([7]Experimental Group)

- Learning Support Teachers and Class Teachers indicated that learners had made cognitive, scholastic and affective-motivational gains during the study.
- [8]Learning Support Teachers and Class Teachers (83% and 84% respectively) concurred that a majority of learners would be promoted at the end of the school year.
- Learning Support Teachers and Class Teachers (76% and 54% respectively) were optimistic that gains made during the programme would be maintained in the future. LSTs were significantly more optimistic about the durability of the study findings than Class Teachers ($p<0.05$).

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[7]See Chapter Five (p.159) for reasons for only administering this interview schedule to teachers (LSTs and Class Teachers) in the Experimental Group.
[8]The researcher is aware that decisions about learner promotion are not totally teacher directed, as current education policy in South Africa directs that learners should only repeat a grade once during a three year education phase.

The LST and Class Teacher (post-intervention) ratings support the above discussion of the test battery findings. They agreed that learners benefited (cognitively and scholastically) from their participation in the programme. LSTs' ratings also indicated positive effects with respect to the learners' confidence, motivation and classroom behaviour. These affective-motivational aspects of the study were however not independently assessed. Notwithstanding, such findings would be consistent with the literature reviewed (Piaget, Vygotsky and Feuerstein) and the stated importance of both social and intellectual factors in development. The confidence of these teachers in the programme effects was evidenced in their decision to promote a majority of their learners. This would also support the LSTs' and Class Teachers' positive ratings concerning the maintenance of the programme effects for the learners. However, LSTs were significantly more optimistic about the durability of the study findings than the Class Teachers, which might suggest a more complex understanding of their learners' cognitive and scholastic functioning. (See Chapter Seven, p.216.)

7.2.3 Summary of discussion of study findings

The above discussion reveals that significant gains were made by the study participants in most areas assessed irrespective of their designation to the Experimental or Comparison group. The cognitive development of the learners who participated in the study was enhanced, that is, they had an improved ability to organize and adapt their knowledge through the activation of attention and working memory systems. The improved cognitive and scholastic functioning of the learners during the study is attributed to their participation in the short-term, small group programmes implemented by Learning Support Teachers (LSTs). It is therefore postulated that LSTs and various environmental factors played an important role in both research groupings in stimulating learning and development.

However, there were also differences in the results attained by the two groupings. Learners in the Experimental group attained significantly higher scores during the post-intervention phase than learners in the Comparison group, with the exception of four subtests of the CAS. In the CAS, learners in the Experimental group achieved significantly higher scores than learners in the Comparison group for key cognitive processing subtests associated with simultaneous processing. The most impressive results in favour of learners in the Experimental group were seen in the scholastic battery where significant gains were made in all areas. The Comparison group did not improve to the same extent and no gains were made in mathematics (subtraction). In addition, learners in the Comparison group made no gains in an important information-processing subtest on the Simultaneous Scale of the CAS. Furthermore, while learners in the Experimental group seemed to continue to benefit from instruction on the CITM (an indicator of learner modifiability) from the pre- to the post-intervention phase of the study, learners in the Comparison group appeared to have reached a ceiling which restricted their responsiveness to further instruction.

The greater improvements in cognitive functioning of learners in the Experimental group during the study are attributed to the active development and enhancement of key information-processing capacities (attention, planning, simultaneous processing) and conceptual knowledge (basic concepts) in these learners. The participation of learners in the short-term, small group intervention programmes in both research groupings was effective. However, the generally higher cognitive and scholastic gains for learners in the Experimental group suggest that these learners appeared to have become more cognitively modifiable.

7.3 COGNITIVE MODIFIABILITY VERSUS COGNITIVE CHANGE

The above-mentioned constructs will first be defined and thereafter discussed in relation to the summary of the study findings. Distinctions have been proposed between the kinds of cognitive change possible within learners after exposure to a variety of learning experiences. (See Table 7.2, p.214.) Pena (2000: 89) defines cognitive modifiability as *'changes that are meaningful, substantial, durable, and depart from a trend of development that has been predicted on the basis of the individual's traditionally measured level of performance'.* In contrast Feuerstein & Rand (1997:7) define cognitive change as '*more limited in scope, more specific and localized, and often showing low levels of durability over time and weak resistance to the impact of environmental influences.'* The above definitions provide a framework for a nuanced, descriptive and theoretically grounded approach to the evaluation of cognitive change.

TABLE 7.2

Descriptors of cognitive change: -

Cognitive modifiability versus cognitive change.

	COGNITIVE MODIFIABILITY	***COGNITIVE CHANGE***
1. Durability of change	*Highly durable over long periods of time.*	*Limited - may not be maintained.*
2. Scope of change	*Extensive and generalized: will result in deep cognitive structural change.*	*Limited and specific: will result in surface change and within a specific area of functioning.*
3. Resistance to environmental impact	*High- resistant to external influence.*	*Weak: not resistant to external influence.*
4. Predictability of change	*May vary from the expected developmental trend based on traditional measures.*	*May conform to expectations based on traditional assessment measures.*

(Adapted from Feuerstein & Rand, 1997:7)

The four above-mentioned descriptors of cognitive change will be discussed with reference to the study findings: -

- **Evaluation of the Durability of the Cognitive Change**

The durability (long-term effects) of the cognitive and scholastic gains made during the study were not possible to evaluate during the current study owing to the short-term nature of the study, but further investigation is planned. (See Chapter Five, p.147.)

- **Evaluation of the Scope of Cognitive Change**

Extent of the change

The researcher posited that the assessment measures designed to assess the higher order cognitive functioning of the learners (CAS and CITM) would provide some indication of the extent of cognitive change. As discussed in the above section, all learners improved significantly in their performance on these test measures. However, there were some important exceptions for learners in the Comparison group and changes were greater in the Experimental group. The cognitive changes of learners in the Experimental and Comparison groups were attributed to their improved information-processing capacity and cognitive functioning. These findings thus suggest a significant improvement in the general efficiency and/or depth of thinking of all learners during the study, with some exceptions for learners in the Comparison group (e.g. for simultaneous processing tasks). One would therefore expect corresponding gains across the board, however, particularly for learners in the Experimental group.

Generalizability of thinking

The researcher posited that the assessment measures which assess how learners benefited from learning (e.g. Scholastic Battery and CITM) would also provide some indication of their ability to generalize knowledge contained within mental structures. The test batteries differed in the way they demonstrated generalization of learning. In the Scholastic Battery the generalization of learning was associated with the ability of learners to transfer knowledge linked to symbols and higher order psychological tools to reading, spelling and mathematical tasks. There was a concern that transfer of learning (or performance) within this assessment area might have been influenced by prior learning experiences of the learners. However, as learners were all in the initial phase of their schooling careers and had experienced difficulties acquiring these skills, this battery could still be considered as an appropriate measure of learning transfer. In the CITM generalization of learning was demonstrated by learner modifiability during test phases (from pre- to the post-intervention phase of the study), that is, the ability of learners to benefit independently from instruction.

The scholastic performance of the learners in the Experimental and Comparison groups (with the exception of one subtest) improved significantly during the study, indicating transfer of learning. These findings indicate that learners from both research groupings had benefited from their participation in the intervention programmes and suggest improved capacity for information-processing (transfer). However, significant differences were found between the research groupings in this area (as discussed in the above section) and were suggestive of variations in the efficiency and/or depth of cognitive functioning of the learners, in favour of learners in the Experimental group.

Furthermore, both research groupings were modifiable and responsive to instruction and improved significantly in their capacity to solve inferential-hypothetical problems on the CITM. These findings are consistent with the above contention, that learners from both groupings had improved significantly in their ability to generalize and transfer learning. However, differences between the groupings were [9]found in their capacity to derive benefit from instruction during the advanced stages of the CITM (from the post-teaching stage (pre-intervention) to the post-teaching stage (post-intervention)), in favour of learners in the Experimental group. These differences between the research groupings were consistent with the above contention: that the learners in the Experimental group had attained greater efficiency of information-processing. Furthermore, it is postulated that the differences in information-processing between the research groupings are attributable to the metacognitive orientation of the BCMLP which guided the engagement of learners in the Experimental group in activities and provided them with structured feedback. (See Chapter Seven, p.220.)

- **Resistance to environmental impact**

This aspect of the cognitive change could not be assessed in the current study, however, certain inferences will be made in the following section.

- **Predictability of cognitive change**

The predictive value of the study findings cannot yet be determined, however, teacher ratings from the Experimental group did allow some tentative inferences to be drawn. (See Chapter Seven, p.211.) Learning Support Teachers (LST) were more likely to regard the study effects as durable than

[9] Limitations of the CITM score have been discussed in the above section.

the Class Teachers. These contrasting findings suggest that while the LSTs perceived change in their learners as indicators of future change, Class Teachers regarded the changes in their learners as a more temporary and less durable phenomenon. LSTs might also have regarded the changes in the cognitive functioning of their learners as less resistant to external influences. (See above section.) The difference in the teacher evaluations of their learners might reflect the varying teacher perceptions of learners who experience barriers to learning. The literature indicates that teacher perceptions of learners within a mediational (dynamic assessment) context are strongly influenced by learner performances during these learning sessions (Benjamin & Lomofsky, 2003; Delcos, Vye, Burns, Bransford & Hasselbring, 1992; Vye, Burns, Delcos & Bransford, 1987). Therefore Class Teachers (who had not been exposed to the Basic Concept Sessions) might have been more inclined to maintain their earlier classifications of their learners as learners who were less capable of future learning, while LSTs who had observed learners during sessions might consider them more modifiable.

The cognitive and scholastic functioning of learners irrespective of their designation to the Experimental or Comparison group had improved during the study. The learners from both the Experimental and Comparison groups improved in the efficiency of their cognitive functioning, however, the degree and scope of the change was consistently greater for learners in the Experimental group.

The findings support the cognitive theoretical perspectives (troika of theorists) underpinning the study which contend that changes in cognitive functioning involve both the content of thought as well as the cognitive structures underlying it. Furthermore, Feuerstein (1980:xviii) maintains that changes in mental structures would effect change in the *'total cognitive structures rather than selective dimensions of behaviour'*. Such change would achieve a permanent, enduring and stable state of modifiability. It was not possible to evaluate the durability of cognitive change in the current study however, and therefore one would still need to regard the findings with some caution. The troika of theorists, however, do suggest that a metacognitive-orientated intervention is likely to be of greater benefit than conventional small group remedial instruction.

7.4 DOMAIN-GENERAL VERSUS DOMAIN-SPECIFIC EXPLANATIONS OF COGNITIVE DEVELOPMENT

A central cognitive processing unit is essential for those kinds of thinking which require successively more and more complex levels of processing (Adey & Shayer, 1994:124). The results of the study suggest that the improvement of the learners during the study was associated with corresponding improvements in their cognitive processing. Furthermore, learners in the Experimental group who indicated deeper and more generalized improvements in their cognitive functioning, also progressed more scholastically during the study (viz. learners in the Experimental group).

Adey & Shayer (1994:171) contend that: *'If learning tasks involve too complex a processing of information the limiting factor to achievement will not be prior knowledge, but will be inability of most students to process at that level*''. Therefore although learners in the Comparison group had made significant gains, for example in their knowledge of basic conceptual systems, these benefits did not translate into the same improved ability for information-processing as was found in the Experimental group. Adey & Shayer (1994:28) suggest that *'if children have not yet attained success on all parts of the psychological spectrum then the central processor will not be able to make the qualitative jump to the next phase of development*'. Thus, although cognitive gains for learners in the Comparison group were evident in most areas assessed, possible weaknesses or limitations in certain areas of information-processing indicated that these gains were not accompanied by the mental actions needed for more complex cognitive tasks. These areas of possible weakness or limitation might therefore also have been an indicator of the kind of processing difficulties (barriers to learning) which these learners experienced.

One might argue that the study results could be explained by other factors, for example improvements of the learners in the research groupings could be attributed to their linguistic and language development. This would be a domain-specific argument implying that the intervention programmes affected a specific capability resulting in improvements that were not linked to any central processing unit. The researcher cannot categorically refute such a claim. However, it seems unlikely that an intervention programme such as the BCMLP with a large proportion of time focussed on developing cognitive functions, would only have impacted on language. In addition, learners from both research groupings were exposed to language during the intervention programmes and it should also be considered that language is formally taught during the school day (the literacy learning area constitutes 40% of the Grade 2 school day). It is therefore unlikely that language on its own would have accounted for the differences found in scores between the two research groupings. Only after long-term studies of these learners have been conducted could it be determined whether the gains are attributable to changes in a central processing unit or in one specific domain.

7.5 'INFUSION' VERSUS 'CONTENT-FREE' APPROACH TO COGNITIVE EDUCATION

The content of the BCMLP is hierarchically structured and relevant to the goals of the school curriculum (RNCS). The BCMLP content was found to be moderately to highly connected to the Language and Mathematics Learning Outcomes of the Revised National Curriculum Statement. (See Chapter 5 and Appendix 4.) This would suggest that the BCMLP is located towards the infusion pole of the '*infusion---content-free'* continuum. Piaget did not believe that the organism structured information in terms of discrete stimuli and responses, but rather in terms of integrated and situated functional-structures. Schemas are situated in knowledge structures and acquired concretely in interaction with context and procedures of use (Cardellini & Pascual-Leone, 2004). This position complements Vygotsky's (1934/1986) notion that a dual and reciprocal relationship exists between conceptual learning at school and the child's cognitive development. Therefore, from a Piagetian and/or

Vygotskian perspective it would be a contradiction to teach thinking on its own or to regard content teaching as an activity unrelated to the mental development of the child.

The gains with respect to the cognitive and scholastic functioning of learners in the Experimental group might thus be attributed to the integration of the BCMLP content into existing knowledge structures. This assertion was not directly investigated in the current study, however. Arguments have also been proposed in favour of *'content-free'* cognitive education programmes such as Bright Start which has generated encouraging findings. Thus it would seem that both *'infusion'* and *'content-free'* approaches to cognitive education could be effective. The debate regarding 'infusion' or 'content-free' approaches to cognitive programmes has tended to dichotomise the description of such approaches. It would, however, be erroneous to speak of any programme as being completely 'content free' and especially programmes aimed at younger learners. In addition, metacognitive programmes, irrespective of whether they are 'infused' or 'content-free', require learning to be bridged into the school or home setting. Thus, it is proposed that all metacognitive programmes, even those which claim to be 'content-free', are located somewhere on the infusion continuum.

7.6 METACOGNITIVE PROGRAMMES VERSUS REMEDIAL PROGRAMMES

The troika of theorists which underpins this study is in agreement about the important role of metacognition in the education process. A metacognitive approach to education provides answers to the questions of how to teach as well as what to teach. The emphasis is thus not only on assisting learners to learn the content of the programme, but on learners becoming aware of their cognitive processes. This aspect of the BCMLP is well illustrated in an evaluative feedback comment from a [10]LST in the Experimental group: -

[10] LST 10, EMDC South.

‘I learnt a new way of teaching (i.e. mediational teaching). I could visibly see the learners thinking before they said something. …they were less impulsive (when they) answered questions.’

One would expect such learners to become more systematic, reflective, analytical and insightful in their approach to problem-solving. Haywood (1993) accordingly describes Mediated Learning Experience as the single most important dimension in any educational process. One might hypothesize that the metacognitive nature of this programme was the essential procedure which created shifts in both teaching and learning approaches during the study. The CITM (Gain Score 1) would provide some support for such a contention. However, it was not possible to investigate this hypothesis fully in the current study. It was also not possible to establish whether, and to what extent, a metacognitive approach was indeed adopted by all LSTs in the Experimental group. Furthermore, even untrained LSTs in the Comparison group might have introduced metacognitive elements of their own accord. In addition, a content analysis of the Comparison group sessions (Appendix 26) indicated that three LSTs made strong use of content of a conceptual and problem-solving nature.

A remedial education approach (as used in the Comparison group in the context of the study) is one in which a metacognitive approach to teaching is not necessarily adopted and the focus is mainly on the ‘what should be taught’ aspect of the session. It could also not be claimed that such an approach was not effective, as learners benefited from the study irrespective of the form of intervention. It cannot therefore be assumed that the results of the study were only attributable to a single factor such as the metacognitive nature of programme. Other programmatic adaptations made, for example small group size and short-term nature of the programmes and the consequent personal attention given to the learners, may also have played an important contributory role in generating the positive study results in the Experimental group.

7.7 EFFECTS OF THE TRAINING PROGRAMME FOR LSTs

An important incidental finding from this study was the positive evaluation of the teacher-training programme by the LSTs (Chapter Five, p.135) which suggested that the training programme had prepared them to implement the BCMLP at their schools. The emphasis placed on teacher-training during the study is supported by the literature (e.g. Haywood, 1995). Haywood (1995) argues that a major reorientation of the role of the teacher (to adopt a mediational teaching approach) and of the teacher's activities (to include a focus on higher cognitive functions) is required. (See Chapter Four, p.118.) The extensive teacher-training component (as well as the support of teachers after training) during the study might therefore also have contributed to the enhanced performance of learners in the Experimental group. (See Appendices 29 and 28 for examples of Mediational Teaching and the observation tool used to monitor the teachers.) Such a contention was not, however, evaluated in the current study and would need to be explored in a future study.

7.8 EFFECTIVENESS OF THE BCMLP

It is posited that learners who experienced barriers to learning and participated in this short-term and small group intervention programme benefited from their participation during this study. This answer is supported by the following findings: -

- The learners who participated in the BCMLP benefited significantly in a majority of the areas assessed (7 out of 12), and to a greater extent than learners in the Comparison group. The learners who participated in the BCMLP benefited and made significant progress in the following areas: - knowledge of basic conceptual systems, higher cognitive functioning, scholastic functioning and transfer of learning.
- The information-processing and cognitive functioning of learners from both research groupings improved during the study. However, the degree and scope of cognitive change appeared greater for learners in the Experimental group resulting in improved efficiency of thinking and ability

to generalize learning, when compared with learners in the Comparison group.

- The study findings suggest that learners in the Experimental group were more responsive to instruction and thus more modifiable than their peers in the Comparison group at the end of the study (CITM- Gain Score 1).
- The perceptions of teachers (LSTs and Class Teachers) of their learners indicated that their learners had not only benefited from the metacognitive programme, but that these changes were indicative of future learning. The LSTs claimed that their learners would also make future progress at school. Their perceptions of their learners were therefore not limited by previous assessments of their learners.

It could be inferred that the BCMLP intervention contributed markedly to the above study findings and that the programme effects were not attributable to chance. However, it was not possible to conclude with certainty that these findings were the result of the particular procedures (mediational teaching, concept teaching, vocabulary teaching and teaching to enhance information-processing) and processes (Basic Concept Teaching Model) associated with the BCMLP, as these were not directly evaluated during the current study. Notwithstanding, it would be difficult to separate the findings of this study from the procedures and processes of this specifically designed metacognitive intervention programme. The successful replication of the study results would provide evidence of the validity of the mechanisms underlying the programme.

A number of additional caveats should also be raised in relation to the effectiveness of the BCMLP. It should be noted that the long-term effects of the study are still outstanding. It would thus be premature to conclude that the BCMLP is successful without investigating the durability of its effects. In addition, various limitations of the study design and study implementation also demand that some caution be taken with respect to interpreting certain aspects of the study findings. (See Chapter Seven, p.225.) The question of the efficacy of the BCMLP is thus a complex one. The BCMLP (a short-term, small group programme) did significantly enhance the immediate post-test cognitive and scholastic scores of learners in the Experimental group who experienced barriers to learning, however one could not predict the long-term effects on the cognitive and scholastic functioning of these learners. In addition, the BCMLP procedures and processes would still need to be independently validated in future studies in order to assert that the programme is effective.

7.9 THE BCMLP AND OTHER METACOGNITIVE PROGRAMMES

The review of the three metacognitive programmes (Bright Start, Cognitive Acceleration Through Science, Concept Teaching) for younger children provided some encouraging findings. (See Chapter Three.) The three programmes, however, still require further validation and particularly in quantitatively constructed studies. The Bright Start curriculum is arguably the most extensively evaluated of the three programmes. However, its authors would agree that further validation is still required. Some of the findings of the current, quantitative, quasi-experimental study which provided certain tentative insights into the effectiveness of the BCMLP reflect findings of previous research into the above programmes. In other instances new information was obtained in areas not yet explored in previous research. For example, with respect to the Concept Teaching curriculum there have been no reported quantitative research studies (to the knowledge of the researcher).

The BCMLP findings resemble most closely the findings from the initial CASE@KS1 (Adey, 2002) and Bright Start (Tzuriel, Kaniel, Zeliger, Friedman & Haywood, 1998; Tzuriel, Kaniel, Kanner & Haywood, 1999) studies which found that learners made greater cognitive gains after receiving short-term interventions than learners who did not experience the metacognitive interventions. In addition, it has been found that the Bright Start curriculum has had positive ([11]and durable) effects on the scholastic achievement of learners (Paour, Cèbe & Haywood, 2000). The Concept Teaching curriculum

[11] Only post-test scholastic scores were gathered during this study, that is, no delayed testing has yet been performed.

was also found (in long-term case studies) to improve the school performance of learners with intellectual impairments.

An interesting difference between the evaluations of the BCMLP and the Bright Start curriculum has been observed. A Bright Start study found that control children who received mediational teaching on a dynamic assessment measure (CATM) made greater gains on this assessment measure than the Bright Start children (Tzuriel, Kaniel, Zeliger, Friedman & Haywood, 1998). Brooks & Haywood (2003:118) argue that a possible reason for this finding might be that the Bright Start children had *'already approached maximal performance and therefore had little room to improve further'*. This would be in contrast to the current study findings where BCMLP learners continued to gain from mediational teaching on a dynamic assessment measure (CITM) when compared with Comparison learners. It may, however, be contended that there was further room for cognitive improvement in BCMLP learners at the end of the study when compared to Bright Start learners and therefore also for improvement in their test scores.

7.10 LIMITATIONS OF THE STUDY

A number of limitations were associated with the study design and the implementation of the programme. These limitations should be taken into consideration when evaluating the findings of this study. Being an applied human sciences study there were aspects that could not be controlled and unintended actions occurred that could not be prevented, especially as the study involved real-time interventions with learners who experienced barriers to learning in schools within disadvantaged communities.

The main limitations related to the study design: -

- This pre-test---post-test study design was intended to measure the immediate effects of the intervention programmes on the cognitive and scholastic functioning of learners. The current study was therefore not able to determine the important long-term effects of the interventions. This was because of the amount of time that would have been required to do such a follow-up study (assessment would need to be done approximately two years after this study, that is, when the current learners enter the Senior Primary Phase of the education system).

- The study was limited in the extent to which it could explore pertinent hypotheses related to the development and evaluation of the BCMLP. (See Chapter Seven, p.231, for an outline of some of these hypotheses.)
- The learners selected to participate in this quasi-experimental, non-equivalent comparison group design were found to be non-equivalent at the start of the study. An advantage was found for learners in the Comparison group with respect to the number of years of early childhood education, while learners in the Experimental group were found to have two main areas of advantage during the pre-test phase of the study (viz. BTBC-R and UCT Spelling Test). These differences were most conspicuous for the BTBC-R and for this reason the results of the post-test on this battery could not only be attributed to the intervention programme. (See Chapter Seven, p.203.) An additional advantage was found on the UCT Spelling Test, however this did not have a marked impact on the study results. (See Chapter Seven, p.210.) A subgrouping of learners in the Comparison group from South were found to be significantly weaker than learners in both the Experimental and the Comparison group from Central.
- The LSTs selected to participate in this quasi-experimental, non-equivalent comparison group design study were found to have high levels of equivalence. (See Chapter Five, p.143.) However, some pre-test results were different for two teachers in the Comparison group. One LST accounted for consistently high mean rankings, whereas the other LST accounted for consistently low mean rankings.
- No evaluative feedback was gathered from teachers in the Comparison group during the study. This evaluative feedback could have provided additional and important information with respect to perceptions of the cognitive, scholastic and affective-motivational functioning of learners in the Comparison group. The researcher was not able to gather this information from these teachers for practical reasons. Such feedback

might have further clarified the reasons for the improvements of these learners during the study.

- The test batteries were administered by Learning Support Facilitators (LSFs) responsible for supporting the LSTs at schools in their own educational authority. Extensive work commitments of LSFs as well as the distance between the two local education authorities made it impossible to assign LSFs to schools in different local education authorities. In addition, on a few occasions the test batteries were administered by the researcher, when no other arrangement could be made. This might have contributed to assessor bias as data gathering procedures were not blinded.
- This quasi-experimental study was subject to the influence of a number of complex human variables such as the potential positive effect of the researcher on the LSTs in the Experimental group – or 'Halo Effect' (Thorndike, 1920).

The main limitations related to the implementation of the programme: -

- On average far fewer sessions than expected were implemented in both the Experimental and Comparison groups during the study, even though the study was extended by an additional school term. The Experimental group had an average of 34 sessions out of an expected 50 sessions and the Comparison group had an average of 23 sessions. It was recommended that the BCMLP be implemented intensively, that is, two to three times per week over a period of two terms. (See Chapter Four, p.105.) However, it was found that only an average of 5.7 sessions were implemented per month in the Experimental group, whereas an average of 3.8 sessions per month were implemented in the Comparison group. The programme was therefore implemented in a less intensive manner than was recommended.
- The number of sessions implemented in the research groupings was not equivalent and in fact appeared to markedly advantage learners in the Experimental group. (See above.) However, it should be noted that although learners in the Experimental group had received ±10 additional sessions, only ±14 of the Experimental group sessions focussed directly

on school related learning areas. In contrast, a large majority of sessions (±20 sessions) in the Comparison group focussed on scholastic related learning areas. (See Appendix 26.)

- The LSFs supported LSTs with the implementation of the programme after being exposed to the same training programme as the teachers. This was with the exception of two LSFs (from South) who had previously supported teachers during the developmental phase of the study. The LSFs received an additional briefing session before the implementation of the Main Study. (See Chapter Five, p.134.)The LSFs therefore were not afforded the opportunity to implement the programmes themselves before being required to provide support and assistance to teachers who were implementing the programme for the first time.

7.11 THE BCMLP IN THE SOUTH AFRICAN CONTEXT

7.11.1 Brief summary of the South African education context (See Chapter One, pp.3-10)

Three main contextual issues were taken into consideration when this new metacognitive programme was planned for the SA context. (See Chapter Four, p.101.) These issues were:- i) the large number of learners who experience educational and cognitive deficits at the start of their schooling careers, ii) the time-pressures in overburdened schools and iii) the need for structured teacher-training. The SA educational context might therefore be considered a challenging environment in which to introduce a novel, time-intensive, sophisticated programme to teachers. The researcher therefore needed to give careful thought to various factors such as the length and intensity of the programme, teacher-support and clarity of programme concepts in order to take cognisance of the above issues. (See Chapter Four, p.123 for the modifications taken into consideration when designing the BCMLP.)

7.11.2 Three main contextual issues considered during the study

i) The number of young learners who experience barriers to learning:

The BCMLP was specifically designed to address the varied and complex cognitive factors that could account for early learning failure in young learners and to do this while learners were still in the initial phase of schooling, that is, the Foundation Phase. Early learning failure has mainly been attributed to the immense backlogs in ECD provisioning compounded by the severity of socio-economic factors that impact on the formative development of young children. (See Chapter One, p.8.) The programme was therefore designed as an unique intensive but short-term intervention programme that could easily be implemented by mainstream [12]Class Teachers to address the complex cognitive needs of young learners in order to prevent future school failure. For such a programme to be of direct value to schools and teachers, it had to be efficacious in preventing school failure. The current study found that approximately 84% of the learners in the Experimental group who participated in the programme were promoted. A majority of these learners made consistent and significant scholastic gains during the study. It appeared that by the end of the study teachers (especially the LSTs) had developed a more optimistic belief in the ability of their learners to learn, that is, in their modifiability. Equally important to teachers and schools would be the knowledge that gains attained by learners would be maintained in the higher phases of the education system. This would need to be established in future studies.

ii) Time-pressures in overburdened schools:

The practical implementation of the programme was not directly evaluated during this study. However, a number of inferences may be made regarding this contextual issue. Notwithstanding the demands placed on teachers to adapt to a new (Outcomes Based Education) curriculum, recently revised, and to teach in large and heterogeneous classes (by virtue of the policy of Inclusive Education), it was possible for LSTs to implement a novel and time-

[12]The programme was implemented by LSTs during the current study and not by Class Teachers. See the next section for more discussion regarding the implementing of the BCMLP by Class Teachers.

intensive programme. Certain caveats, however, need to be mentioned. LSTs were probably not faced with the same challenges as Class Teachers in that they have more flexibility in how they structure their time-tables and teaching-learning environments. However, LSTs were also confronted with relatively large numbers of learners with high levels of learning needs. These teachers were in fact not able to administer more than six Basic Concept Sessions per month, when eight to twelve sessions were recommended. The implementation of the programme was therefore extended for an additional term. Two school terms were initially recommended equivalent to approximately four months. However, this was extended to three school terms equivalent to approximately six months. Despite limitations preventing the optimal implementation of the programme, LSTs were able to implement it to a satisfactory level. This was promising, especially considering the general educational context. It is therefore conceivable that the programme could be implemented by mainstream Class Teachers at the same schools. If this would not be possible, the value of the programme for LSTs has been shown.

iii) The need for structured teacher-training:

The fact that the teachers who participated in the training implemented the programme is impressive, especially within the SA context. Even within the international context teachers have a lack-lustre record of implementing programmes after training (Haywood, 1997). This suggests that teachers who were trained were confident enough to initiate the process of transferring learning from the training into practice. There may be several factors which accounted for the willingness and the seemingly motivated response to the programme, however, these were not directly explored in the current study. It is possible that the highly structured, experientially-based and theoretical nature of the teacher-training programme contributed to its success. Teachers rated the training programme highly and indicated that it had prepared them to implement the programme at their schools (See Chapter Seven, p.222.) Teachers were supported with the programme in their classes, which might also have contributed to their implementing the programme.

The BCMLP thus seemed reasonably well suited to meeting the needs of teaching-learning in the South African context. The LSTs were able to implement this metacognitive programme in mainstream public schools. This is revealing, especially when taking cognisance of the concerns raised regarding teachers in the South African context. (See Chapter One, p.7.) For example, many South African educational theorists have questioned the capacity of educators to implement 'sophisticated' ideas (e.g. Jansen, 1998, 1999; Taylor & Vinjevold, 1999). The successful implementation might be accounted for by the BCMLP design, which gave particular attention to preparing and supporting teachers, thus making it possible to implement the programme. One area of concern is that the programme could not be implemented with the intensity and number of sessions that were recommended because of existing demands on teachers. However, even a shortened version of the programme had significant effects.

7.12 RECOMMENDATIONS

The recommendations to be proposed will be made in three separate areas: - i) for future research, ii) for improvement of the programme and iii) for implementation of the programme.

i) Future research:

- A long-term follow-up study would be required in order to establish the durability and long-term effects of the study findings.
- Replication studies (of the current study) would assist to develop a deeper and more thorough knowledge base of the study effects as well as the procedures and processes of the programme. It would be preferable if these studies were to be conducted by independent researchers.
- The research design of future studies should aim to address the limitations of the current study design: e.g. non-random group design, limited evaluative feedback obtained from teachers and lack of 'blind' data gathering procedures.

- The BCMLP should be implemented as recommended in the original design of the programme (see Chapter Four) in order to determine the optimal effects that could be attained by the programme, for example the programme is intended to be implemented by Class Teachers in mainstream schools.
- Studies that are more process-based and qualitative in design would be particularly valuable to explore a number of related research questions. For example: - i) efficacy of the teacher-training programme, ii) teacher as mediator, iii) evaluation of the metacognitive processes in learners who participated in the programme, iv) benefits of the programme for learners (in large classes) who are not direct participants, but observe the programme, v) benefits of the teacher-support dimension of the programme, vi) implementing the programme with a large group of learners (in a classroom situation), vii) exploring the benefits of the programme for different groups of learners, viii) implementing the programme in schools where instruction is in languages other than English and ix) importance of the content of the programme.

ii) Improvement of the programme:

- The study found that significant results could be attained from 34 Basic Concept Sessions. However, the BCMLP was initially designed to be run over approximately 50 Basic Concept Sessions (BCS). Thus, it would still be recommended that for the optimal implementation of the programme 50 BCSs should be run.
- The study found that significant results could be attained from approximately 1.4 BCSs per week. However, the BCMLP was designed to be run intensively, that is, 2-3 BCSs per week. Thus, it would still be recommended that for the optimal implementation of the programme two to three BCSs should be run per week.
- Field workers (LSFs) who had been trained to support teachers at schools, had not themselves implemented the programme. There was no evidence, however, that this had an effect on the study outcomes. Notwithstanding, it

would be recommended that field workers first implement the BCMLP before being trained to provide support to teachers.

- Some LSTs who implemented the programme participated in informal support networks with other teachers. This aspect of the programme even though not strongly emphasized during the study is thought to be a valuable way for teachers to direct their own learning about the programme.

iii) Implementation of the programme:

- The programme could be introduced to LSTs (or to equivalently trained remedial teachers) in South Africa, during pre-service or in-service teacher-training contexts.
- The programme could be implemented by LSTs with relative ease and efficiency (in a small group format over two to three school terms) in schools where the medium of instruction is English.
- The programme could be administered by LSTs in a number of different contexts, for example the programme may be especially effective for with learners who come from different language backgrounds.
- The programme could be particularly appropriate for learners from disadvantaged communities.
- The programme could be implemented by LSTs to address deficits in knowledge base as well as to enhance and promote the cognitive and scholastic functioning of learners. The programme may therefore be effectively and harmoniously used alongside the Revised National Curriculum Statement (RNCS).
- The programme could be extended to all LSTs in the Western Cape, through the support of the Western Cape Education Department. LSTs would be well placed (especially after their experience with the programme during the study) to support the programme in regular classes if it is extended to Class Teachers in the Province.
- All LSFs in the Western Cape could be trained to support newly trained LSTs in the field. (See the above point.) This model would also free LSFs from intensive field-work (observation and support) with Class Teachers.

- The BCMLP was specially designed to meet the needs of learners in South Africa, particularly in the Western Cape. However, it might be relevant to learners in similar contexts in other countries, for example other African countries where children have similar early experiences of educational deprivation. The researcher posits that such a metacognitive, domain-general, programme might be efficacious beyond the language and cultural context of the current study. (See Chapter Seven, p.218 and p.219.) However, this contention should be considered tentatively until language and cultural influences on the BCMLP have been explored.

7.13 SUMMARY

The study found that learners benefited (cognitively and scholastically) from their participation in the programme irrespective of the form of intervention. Learners from both research groupings therefore benefited from the short-term, small group programmes at their schools. This highlights the potential importance of such intervention programmes implemented by Learning Support Teachers (LSTs) at mainstream public schools as well as the possible benefits of such programmes for learners who experience barriers to learning from disadvantaged communities. All the learners who participated in the study demonstrated improved efficiency in information-processing and increased the scope of their cognitive functioning. The fact that cognitive change was produced was important, however, that such change resulted in transfer and generalization (viz. structural change) of learning was regarded as being even more important. Significant differences in the information-processing capacities as well as modifiability of learners were found between the research groupings in favour of learners from the Experimental group.

The study posits that the BCMLP is an effective short-term and small group intervention programme for learners who experience barriers to learning in the Foundation Phase, even if their home language is not English. Learners who participated in the BCMLP benefited significantly with respect to their knowledge of basic concepts and cognitive and scholastic functioning, when compared with learners from the Comparison group. These study findings should be regarded with some caution until replication studies can be completed and the long-term effects of the programme can be evaluated. It may therefore be concluded that the study has provided some initial evidence of the efficacy of the BCMLP as an intervention programme for learners who experience barriers to learning.

The BCMLP, a specially designed programme, was appropriate and manageable for Learning Support Teachers to implement in mainstream public schools within disadvantaged communities in the South African context. This metacognitive programme therefore appeared suitable to the context and seemed to address many difficulties that have been traditionally associated with the implementation of such programmes. (See Chapter Three, p.98.) The adjustments made to the design of this programme (based on a review of three similar metacognitive programmes) were considered important as they allowed the apparent ease of fit into the South African school context. The BCMLP was found to be consonant with the main Learning Areas (Mathematics and Language) of the RNCS. It could be contended that the BCMLP is also consonant with the Critical Outcomes (Chapter One, p.5) of the RNCS which aim to develop the higher cognitive functioning of South African learners. Other important design features of the BCMLP are its short-term nature as well as the teacher-training and teacher support aspects of the programme.

The following quotation from LST 9 (Experimental group, EMDC Central) sums up many of the benefits of the programme: -

'The programme was very interesting and it allowed the children to reason, think and work independently. The children were also exposed to many practical activities ... (in different settings, like the) home and classroom. It also made them explore many dimensions and (they) never took things for granted. They loved the concrete activities and never felt the boredom of writing and not understanding… They could explain all their answers and solve their own problems.'

The results of this study are encouraging, supporting the use of short-term, small group programmes by Learning Support Teachers as a means of addressing the enormous cognitive delays in learning experienced by learners at the start of schooling in the South African context. It is contended that the BCMLP in particular appears to be an effective and efficient approach to prevent future educational failure and potential withdrawal from school learning at a critical and foundational phase of the child's cognitive and scholastic development.

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APPENDIX 1

COGNITIVE MAP

Components of the mental act:

1. The universe of content around which the mental act is centred (e.g. maths, science, reading, matrices).
2. The modality or language in which the mental act is expressed (e.g. verbal, pictorial, numerical, figural, symbolic).
3. The phase of the cognitive functions required by the mental act (input-elaboration-output).
4. The cognitive operations required by the mental act (seriation, categorization, comparison, identification, inferential reasoning).
5. The level of complexity of the task.
6. The level of abstraction of the task.
7. The level of efficiency with which the mental act is performed.

(Source: Lidz, 1991)

APPENDIX 2

Feuerstein's Mediated Learning Environment Characteristics:

1. Mediation of intentionality and reciprocity involves the deliberate guidance of an interaction by the mediator in a specific direction, purposefully focussing attention on the stimuli while simultaneously engaging and encouraging the responsivity of the mediatee in order to create optimal conditions for the process of mediation.

2. Mediation of meaning occurs when the mediator conveys the significance and purpose of an activity and elicits an understanding from the mediatee of why the activity should be conducted. It may refer to the cognitive, emotional or motivational systems and is a dynamic process that gives value to the activity and its performance. The mediation of meaning is deeply embedded in the cultural milieu of the learner. It is through the endowment of human meaning into the non-human environment that a child's cultural universe is established.

3. Mediation of transcendence is accomplished when an interaction goes beyond the 'here and now' of the interaction, thereby enlarging and diversifying the need system of the mediatee. Bridging into other areas becomes a way of ensuring the connectedness of knowledge. The most important transcendental need of children is the need to know and understand.

4. Mediation of a feeling of competence attempts to achieve the goal of making one feel competent of performing well in a new area of knowledge and therefore links strongly with the self-confidence of the learner. The feeling of competence will in turn assist the development of achievement motivation and the quality of cognitive functioning.

5. Mediation of sharing behaviour attempts to assist the mediatee to outgrow egocentric thinking and behaviour and to become aware of other people's feelings and beliefs. This is a highly emotionally charged quality which has an affective component linked to social values as well as a cognitive component linked to the development of empathy.

6. Mediation of individuation occurs when the mediator values and recognizes individual differences and thus encourages autonomy, independence and originality in the learner's thinking. On a psychological level, individuation will assist with the development of relationships that are differentiated and based upon the uniqueness of each person.

7. Mediation of self change involves an awareness of the human being as a changing entity and occurs when the mediator imparts to the child a belief that he/she is modifiable. Mediators are thus encouraged to tune into, and recognize, even the smallest changes within the learner. The learner's belief in and motivation to change is vital for the process of modification.

8. Mediation of novelty and challenge engages the learner's interest and relieves the boredom of conventional routine lessons. In this way interactional learning takes place with changes occurring in the stimulus, the mediator and the mediatee. Challenge can inspire a search for novelty and thus positively transform the attitude of the learner towards complexity. "A readiness to learn and a propensity to change states from the known to the unknown is a vital requirement in a world of change." (Feuerstein & Feuerstein, 1991:44)

9. Mediation of regulation and control of behaviour aims to assist the mediatee to control his/her own behaviour instead of being controlled externally. This occurs when the mediatee is able to organize his/her own behaviour so that it will become more efficient and systematic. This will encourage the development of a capacity for reflective thought.

10. Mediation of goal seeking, setting and achieving behaviour occurs when the mediator assists the mediatee to delay gratification and to plan, set and achieve goals. This will also assist children to develop an understanding of the importance of process in task accomplishment (Feuerstein & Feuerstein, 1991).

11. Mediation for a search for an optimistic alternative encourages people to look for solutions and for changes occurring as a result of these solutions in a positive manner. This alters the approach to problem solving from a passive acceptance of difficulties to an active exploration of possibilities so that a solution can be found.

12. Mediation of a feeling of belonging becomes important when the nuclear family is isolated from the larger network of the community. In South Africa this is particularly relevant where families have been torn apart by racial oppression and poverty.

(Source: Benjamin, 2000)

APPENDIX 3

SESSION PLANNER

DATE: .... **SESSION NO/S.:** ....

HIGHER ORDER CONCEPT: → Superordinate Concept

....

LOWER ORDER CONCEPTS: → Subordinate Concept

....
....
....
....
....
....
....

VOCABULARY:

....
....
....
....
....

INFORMATION PROCESSING:

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....
....

PURPOSE OF THE SESSION:

....
....
....
....

MATERIALS:

....
....

METHOD: (BASIC CONCEPTS TEACHING MODEL)

STEP 1: FOCUSSING & NAMING

STEP 2: IDENTIFYING

STEP 3: INTERNALIZING

STEP 4: BRIDGING

STEP 5: APPLICATION

STEP 6: TRANSFERRING

APPENDIX 4

Comparison of content: Revised National Curriculum Statement (RNCS) for Foundation Phase learners & the BCMLP

Information to Assist with Interpreting the Analyses:

- The numbering alongside the ratings represent the Assessment Standards associated with the specified Learning Outcome. The Assessment Standards are taken from RNCS and are recorded numerically in the same order that they appear in this document.
- The Assessment Standards for Grade 1 learners were used for these analyses.
- The key for the rating scale is presented on p.278.

Learning Area	Learning Outcome	Ratings (comparing Assessment Standards with BCMLP content)		Mean Rating
Mathematics	**1: Number, Operations & Relationships**	1:	4	**3.6**
		2:	3	
		3:	4	
		4:	4	
		5:	1	
		6:	4	
		7:	4	
		8:	4	
		9:	3	
		10:	5	
		11:	4	
	2: Patterns, Functions & Algebra	1:	5	**4.2**
		2:	3	
		3:	5	
		4:	5	
		5:	3	
	3: Space & Shape	1:	4	**3.7**
		2:	4	
		3:	2	
		4:	4	
		5:	3	
		6:	5	
	4: Measurement	1:	3	**3**
		2:	4	
		3:	3	
		4:	1	
		5:	4	
	5: Data Handling	1:	5	**4.2**
		2:	5	
		3:	5	
		4:	1	
		5:	4	
		6:	5	

Mean Numeracy Rating = 3.7

Learning Area	Learning Outcome	Ratings (comparing Assessment Standards with BCMLP content)	Mean Rating
Language	**1: Listening**	1: 5	**3.5**
		2: 5	
		3: 3	
		4: 2	
		5: 3	
		6: 3	
	2: Speaking	1: 5	**4**
		2: 4	
		3: 3	
		4: 3	
		5: 4	
		6: 5	
		7: 3	
		8: 5	
		9: 4	
	3: Reading & Viewing	1: 4	**4**
		2: 4	
		3: 4	
		4: 4	
		5: 4	
		6: 4	
	4:Writing	1: 5	**3.3**
		2: 2	
		3: 3	
		4: 2	
		5: 4	
		6: 4	
	5: Thinking & Reasoning	1: 5	**4.3**
		2: 5	
		3: 4	
		4: 3	
	6: Language Structure & Use	1: 5	**3.7**
		2: 4	
		3: 4	
		4: 3	
		5: 2	
		6: 4	

Mean Literacy Rating = 3.8

<u>RATING SCALE:</u> *similarity with BCMLP content*

1---------2---------3--------4---------5

No, not at all the same. | Moderately similar. | Yes, completely the same.

APPENDIX 5

SESSION EVALUATION SHEET (SES)

NUMBER OF SESSION/S: ....

Name of Learner: .... Grade: .... Date/s: ....

	Specify the Goals	Assess the Goals Recognize- Name- Identify- Apply- Infer Meaning	Comment on the Attainment of the Goals
1. CONCEPTS	***Higher Order:**		
	***Lower Order:**		
	Specify the Goals	**Assess the Goals** Attained: Yes/No/Partially	**Comment on the Attainment of the Goals**
2. VOCABULARY *(Specific vocabulary, related to the content of each conceptual domain, is determined during the sessions.)*			
	Specify the Goals	**Assess the Goals** Attained: Yes/No/Partially	**Comment on the Attainment of the Goals**
3. INFORMATION PROCESSING • *Multiple Ideas- can the learner process one or more idea at the same time* • *Complex Ideas- does the learner understand higher order concepts(complex ideas).* • *Connections Between Ideas- can the learner develop further connections between the concepts.*	Multiple Ideas:		
	Complex Ideas:		
	Connections Between Ideas:		

	Specify the Goals	Assess the Goals Low-Moderate-High	Comment on the Attainment of the Goals
4. SENSE OF COMPETENCE	• Self Motivated		
	• Participates		
	• Regulates own behaviour		

Key:
*Higher Order Concepts = Superordinate Concepts
*Lower Order Concepts = Subordinate Concepts
* Meaning = transfer of learning

APPENDIX 6

BASIC CONCEPTS ASSESSMENT INVENTORY

Name of learner: ……………………

Grade: ………………………………. **Date:** .... (start of programme)
Age: …………………………………. **Date:** ……………… (end of programme)
School: ……………………………… **Teacher:** ………………………………………

*HIGHER ORDER CONCEPT	*LOWER ORDER CONCEPTS	LEVEL I FOCUS & NAME	LEVEL II IDENTIFY	LEVEL III CATE-GORIZE	LEVEL IV *MEANING
1. Colour	Red				
	Blue				
	Yellow				
	Green				
	Brown				
	Black				

*HIGHER ORDER CONCEPT	*LOWER ORDER CONCEPTS	LEVEL I FOCUS & NAME	LEVEL II IDENTIFY	LEVEL III CATE-GORIZE	LEVEL IV *MEANING
2. Shape	Circle				
	Square				
	Triangle				
	Rectangle				
	Star				
	Diamond				

*HIGHER ORDER CONCEPT	*LOWER ORDER CONCEPTS	LEVEL I FOCUS & NAME	LEVEL II IDENTIFY	LEVEL III CATE-GORIZE	LEVEL IV *MEANING
3. Size	Big – Small				
	Bigger – Smaller				
	Biggest – Smallest				
	Same – Different				
	Tall – Short				
	Taller – Shorter				
	Tallest – Shortest				
	Thick – Thin				
	Medium/Average				

*HIGHER ORDER CONCEPT	*LOWER ORDER CONCEPTS	LEVEL I FOCUS & NAME	LEVEL II-III IDENTIFY & APPLY	LEVEL IV *MEANING
4. Position	Left			
	Right			
	Top			
	Bottom			
	Middle/Centre			

*HIGHER ORDER CONCEPT	*LOWER ORDER CONCEPTS	**LEVEL I** FOCUS & NAME	**LEVEL II-III** IDENTIFY & APPLY	**LEVEL IV** *MEANING
4. Position	Inside			
	Outside			
	Up			
	Down			
	Forward			
	Backward			
	First			
	Last			
	Here			
	There			
	Next to			
	Skip			
	Beginning – End			
***HIGHER ORDER CONCEPT**	***LOWER ORDER CONCEPTS**	**LEVEL I & II** FOCUS & NAME & IDENTIFY		**LEVEL III-IV** APPLY & *MEANING
5. Number & Quantity	More – Less	more / less Focus: ………… / ……………. Names: ………… / ……………. Identifies: ………… / …………….		
	Counting (1-100)	Focus: ………………………... Names: ……………………….. Identifies: …………………………		
	Ordinal number: *1st, 2nd, 3rd, etc.*	Focus: ………………………... Names: ……………………….. Identifies: …………………………		
	Cardinal number : *can the learner count how many blocks there are altogether?*	Focus: ……………………….. Names: ……………………….. Identifies: …………………………		
	Mathematical Operations/Symbols: + ; - ; =	plus / minus / equals Recognize: …… / ……… / ……… Names: …… / ……… / ……….. Identifies: …… / ……… / ………		
	1:1 Correspondence: *does the learner touch each block once when counting?*	**YES / NO**		
	Conservation of number: *has* the learner attained number permanence?	**YES / NO**		

*HIGHER ORDER CONCEPT	*LOWER ORDER CONCEPTS	LEVEL I & II FOCUS & NAME & IDENTIFY						LEVEL III-IV APPLY & *MEANING		
6. Letter	Group One:- A, M, N	**A**	**M**	**N**	**A**	**M**	**N**	**A**	**M**	**N**
	Group Two:- P, T, E	**P**	**T**	**E**	**P**	**T**	**E**	**P**	**T**	**E**
	Group Three:- F, I, C	**F**	**I**	**C**	**F**	**I**	**C**	**F**	**I**	**C**
	Group Four:- B, O, D	**B**	**O**	**D**	**B**	**O**	**D**	**B**	**O**	**D**
	Group Five:- H, U, G	**H**	**U**	**G**	**H**	**U**	**G**	**H**	**U**	**G**
	Group Six:- J, S , L	**J**	**S**	**L**	**J**	**S**	**L**	**J**	**S**	**L**
	Group Seven:- R, W, V	**R**	**W**	**V**	**R**	**W**	**V**	**R**	**W**	**V**
	Group Eight:- Q, K, Y, (Z, X)	**Q**	**K**	**Y**	**Q**	**K**	**Y**	**Q**	**K**	**Y**
	Capital and Small Letters	Capital: **YES/NO** Small: **YES/NO**								
	Sequence of the Alphabet	**YES/NO**								
	Phonetic Awareness (letter-sound pairings)	**YES/NO**								
	Reading Simple Words (fan, can, man, dot, etc.)	**YES/NO**								
	Writing Simple Words (fan, can, man, dot, etc.)	**YES/NO**								

LEVEL V

LEARNER'S SENSE OF COMPETENCE

Rate the learner on the scale below at end of each conceptual domain.

(low sense of competence) **1-------------5-------------10** (high sense of competence)

CONCEPTUAL DOMAINS:		CONCEPTUAL DOMAINS:		CONCEPTUAL DOMAINS:	
COLOUR:	Rating:	**SIZE:**	Rating:	**NUMBER:**	Rating: ....
SHAPE:	Rating:	**POSITION:**	Rating:	**LETTER:**	Rating: ....

Key:

*Higher Order Concepts = Superordinate Concepts
*Lower Order Concepts = Subordinate Concepts
* Meaning = Transfer of learning

APPENDIX 7

PILOT STUDIES

Pilot Study-part 1 (2001)

1. Aim

The aim of this initial, exploratory study was to provide some provisional information regarding the efficacy of the BCMLP as well as the research design for the study.

2. Method

This was a quasi-experimental study with a pre-test and post-test design with certain qualitative dimensions. A control group was not identified for this preliminary study, however, some control data were collected. The Boehm Test of Basic Concepts-Revised was used as a measure to compare learners in the Experimental group with other learners in their class. The researcher administered the study. Only 11 Basic Concept Sessions were administered during the study as a result of time limitations.

Pilot Study-part 1

Schedule of Basic Concept Sessions

	Basic Concept Session (Monday)	**Basic Concept Session** (Wednesday)	**Basic Concept Session** (Friday)
WEEK 1	**Colour 1**	**Colour 2**	**Shape 1**
WEEK 2	**Shape 2**	**Size 1**	**Size 2**
WEEK 3	**Position 1**	**Position 2**	**Letter 1**
WEEK 4	**Letter 2**	**Letter 3**	

3. Test Battery

The following measures were administered: (See Chapter Five for more information about the test battery.)

- Scholastic Battery: UCT Spelling Test, UCT Reading Test
- Knowledge of Basic Conceptual Systems: Boehm Test of Basic Concepts-Revised (BTBC-R)
- Cognitive Modifiability Battery: Children's Inferential Thinking Modifiability Test (CITM)

Note: The Cognitive Assessment System and the Ballard One-Minute Mathematics Tests (Addition and Subtraction) were the only tests measures not used from the full test battery.

4. Sample

The Pilot Study was implemented in a school in a disadvantaged community on the 'Cape Flats' in the South EMDC. Four [1]Grade 3 learners were referred to the study by their class teacher, based on their slow academic progress. The participants were all males. There were concerns that these learners would need to repeat a year in Grade 3. Control data were collected from learners in the same class (N=41). The ages of the learners in the Experimental group ranged from 8.6 to 9.4 years.

Pilot Study-part 1

Summary of Pre-test & Post-test scores (raw scores)

	Learner 1		Learner 2		Learner 3		Learner 4	
Measures	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**
BTBC	8 errors	3 errors	8 errors	2 errors	10 errors	5 errors	7 errors	3 errors
CITM Pre-Intervention	23	41	26	28	16	27	9	41

[1] The researcher had intended to administer the study with Grade 2 learners, but was not given permission by the school to use Grade 2 learners. However, Grade 3 learners are still in the Foundation Phase. The BCMLP was developed to promote the cognitive and scholastic functioning of such learners.

	Learner 1		Learner 2		Learner 3		Learner 4	
Measures	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**
CITM Post-Intervention	33	41	25	36	21	30	37	39
UCT SPELLING	21 6 month delay	21 6 month delay	11 24 month delay	12 24 month delay	21 12 month delay	20 12 month delay	9 30 month delay	14 18 month delay
UCT READING	**31** 6 month delay	**41** age level	**13** 24 month delay	**17** 18 month delay	**23** 18 month delay	**27** 15 month delay	**16** 18 month delay	**18** 16 month delay

5. Results

The results are described in statistical terms for ease of reporting, but the researcher is well aware that the findings from this small sample are no more than suggestive.

<u>*[2]BTBC-R:</u>

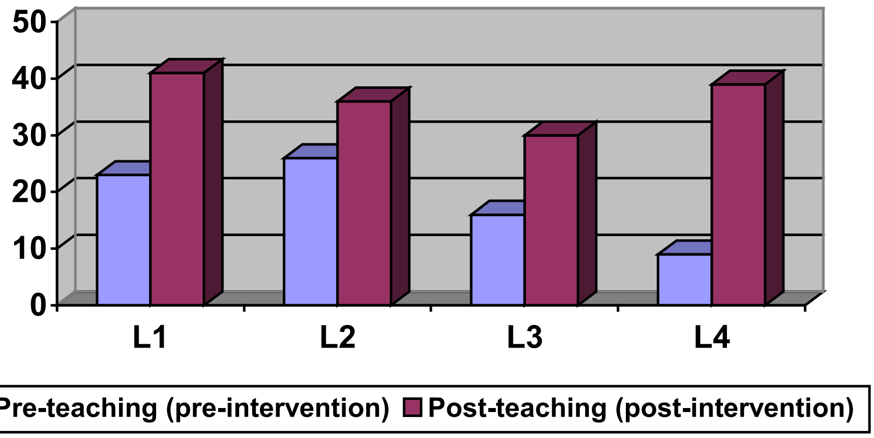
The mean error scores for learners in the Experimental group were **8.3** and **3.3** before and after the intervention programme respectively. Thus, the mean error score of learners in the Experimental group improved by 5 error points. The mean error scores for learners in the 'Control group' were **3.2** and **2.2** before and after the intervention programme respectively. The mean error score of learners in the 'Control group' improved by 1 error point. The learners in the Experimental group scored within the 10^{th} percentile before the intervention and within the 40^{th} percentile after the intervention programme (with the exception of one learner in the 20^{th} percentile). In contrast, a majority of learners in the 'Control group' scored within the 40^{th} percentile in the pre-testing stage and within the 55^{th} percentile during the post-testing stage of the study.

[2] Some difficulties were, however, discovered with several items in this test battery which will be explored further in the Recommendations below.

CITM:

There was a **36%** increase in the mean score from the pre-teaching stage (pre-intervention phase) to the post-teaching stage (post-intervention phase) of the test administration. The total pre-teaching score (pre-intervention phase) was **70/200** (35% correct), whereas the total post-teaching score (post-intervention phase) was **146/205** (71% correct). There were also increases in the mean scores from the pre-teaching stage (pre-intervention) to the pre-teaching stage (post-intervention) and from the post-teaching stage (pre-intervention) to the post-teaching stage (post-intervention) of the study by **32%** and **15%** respectively.

Pilot Study-part 1
CITM pre-teaching (pre-intevention) & post-teaching (post-intervention) scores



The CITM data therefore indicated a progressive increase in scores from the pre-intervention to the post-intervention phase of the study. It could be argued that learners were responsive to teaching/mediation and thus indicated an ability to modify their thinking in order to solve these complex inferential hypothetical problems.

UCT Reading:
There was an increase in the mean reading age score from 7.0---7.5 (raw score: 21) to 7.6---7.11 (raw score: 26). The largest increase in a score was by 10 points while the smallest increase in a score was by 2 points. Three learners made gains of 4 points and more in their reading level.

UCT Spelling:
There was a slight increase in the mean spelling age score from 16 points to 17 points (spelling age: 7.0---7.5years). The largest increase in a score was by 4 points. There was one learner whose score decreased by 1 point.

6. Discussion and Conclusion

Notwithstanding the limitations of this exploratory study, the test results suggested a general improvement in the performance of the learners. There were positive shifts in the conceptual knowledge base of the learners, compared to their peers. Marked improvements were also found on the CITM from the pre-intervention to the post-intervention phase of the study. The CITM data indicated that the learners were modifiable and were therefore able to learn. The scholastic performance of the learners could not be reliably interpreted as the learners were exposed to only three sessions in the Conceptual Domain of Letter. However, anecdotal evidence suggested that if the learners had received additional intervention, they would have responded positively in school related learning areas. The results were considered promising enough to justify further exploration.

7. Recommendations

- A major increase in the number of Basic Concept Sessions would need to be considered in a follow-up study. This would not only be limited to the Conceptual Domain of Letter. See Chapter Five for more information on the adjustments that were made to the number of sessions.
- The transfer component for the study would need to be enhanced. The transfer component of the programme had not been effective in this study. It was contended that this component would further enhance learner development.

- The study found that changes would need to be made to the Boehm Test of Basic Concepts-Revised, because of difficulties experienced with 4 (out of 50) items in this test battery. It was postulated that these difficulties were mainly related to the level of complexity of these concepts, possibly associated with the low usage of these concepts within the South African context. (See Appendix 8 for more information about the nature of the changes made to these four items.)
- The BCMLP would need to be implemented in an expanded pilot study with a larger sample of learners, by trained teachers and evaluated using all four test batteries selected for the study.

Pilot Study-part 2 (2002)

1. Aim

The aim of this Pilot Study was to administer an extended version of the BCMLP to be implemented by trained teachers in a number of sites and to evaluate the effects of the programme using the full test battery.

2. Method

A quasi-experimental, pre-test and post-test design, with an Experimental and Comparison group, was used. The data were analysed using non-parametric statistics as a result of the small sample size.

3. Test Battery

The following measures were administered: (See Chapter Five for more information about the test battery.)

- Scholastic Battery: UCT Spelling, UCT Reading, Ballard One-Minute Tests (Addition and Subtraction)
- Assessment of Knowledge Base: Boehm Test of Basic Concepts-Revised (BTBC-R)
- Cognitive Modifiability Battery: Children’s Inferential Thinking Modifiability Test (CITM)
- Cognitive Battery: Cognitive Assessment System (CAS)

The full test battery was administered during this study. All the test measures with the exception of the Scholastic Battery (which already exists in both languages) were translated into Afrikaans for Afrikaans speaking learners.

4. Sample

The sample for the Pilot Study was drawn from eight schools on the 'Cape Flats'. The study was implemented in the South EMDC. Eight Learning Support Teachers (LSTs) from the above-mentioned schools participated in the study. These teachers each selected five learners to participate in the study (N=40). The sample consisted of an equal number of English- and Afrikaans home-language learners as well as an equal number of male and female learners in the Experimental and Comparison groups, i.e. 20 learners in each research grouping. All the learners were in Grade 2. The BCMLP was designed for use by either Class Teachers or Learning Support Teachers (LSTs). The teachers in this study and the Main Study were LSTs, at the request of the education department concerned.

Pilot Study-part 2

Language, Gender, & Number of Learners in the Experimental & Comparison Groups

Experimental Group	Language	Gender	Number of learners
	1. English	Males	5
	2. English	Females	5
	3. Afrikaans	Males	5
	4. Afrikaans	Females	5
	TOTAL		**20**
Comparison Group	**Language**	**Gender**	**Number of learners**
	1. English	Males	5
	2. English	Females	5
	3. Afrikaans	Males	5
	4. Afrikaans	Females	5
	TOTAL		**20**

5. Results

The Wilcoxon Sign Ranked Test was used as it is appropriate for the analysis of non-parametric data. The data were analysed according two main groupings: language and gender. This resulted in four small learner groupings (N=5) in the Experimental and Comparison groups. The reader should therefore be cautioned, because of the small numbers of participants in each group used during data analysis. This made it extremely difficult to attribute power to the statistical analysis to be discussed. In addition, because of the small number of learners, it was not possible to analyze the data from certain test measures.

Pilot Study-part 2

Scholastic Battery (Wilcoxon Sign Test): - Analysis of gain scores for learners in the Experimental & Comparison groups.

Test	Language & Gender	N	Median	P-Value	N	Median	P-Value
		Experimental Group			**Comparison Group**		
UCT Reading	AFR – F	4	**5**	*	4	**5**	*
	AFR— M	4	**10**	*	4	**5**	*
	ENG—F	4	**10**	*	4	**5**	*
	ENG—M	5	**4**	*	4	**2**	*
UCT Spelling	AFR – F	3	**7**	**ns**	3	**2**	**ns**
	AFR— M	5	**5**	*	5	**4**	**ns**
	ENG—F	5	**5**	*	4	**5.5**	*
	ENG—M	4	**6.5**	*	5	**8**	**
Mathematics (Addition)	AFR – F	3	**1**	**ns**	2	**1**	**not pos.**
	AFR— M	5	**2**	**ns**	4	**1**	**ns**
	ENG—F	4	**2**	*	4	**4**	*
	ENG—M	4	**1**	*	3	**0**	**ns**
Mathematics (Subtraction)	AFR – F	4	**2.5**	**ns**	4	**1**	*
	AFR— M	4	**1**	**ns**	5	**1**	**ns**
	ENG—F	4	**6**	*	4	**1**	*
	ENG—M	4	**4**	*	4	**0**	**ns**

*p<0.05 **p<0.01

ns = not significant

not pos. = not possible to calculate

UCT Reading:

Significant improvements (p<0.05) were found for all learners in the Experimental and Comparison group. Of particular interest were the high median scores (M=10) in the Experimental group for the English male and Afrikaans female learners.

UCT Spelling:

Significant improvements (p<0.05) were found in the English- and Afrikaans female learners in the Experimental group. Significant improvements (p<0.05 and p<0.01) were also found in the English home-language male and female learners respectively in the Comparison group.

Mathematics (Addition):

Significant improvements (p<0.05) were found in the English home-language learners in the Experimental group. A significant improvement (p<0.05) was recorded in the English home-language female learners in the Comparison group.

Mathematics (Subtraction):

A significant improvement (p<0.05) was found in the English male and female learners in the Experimental group. Significant improvements (p<0.05) were recorded for Afrikaans and English home-language female learners in the Comparison group.

Pilot Study-part 2

BTBC-R (Wilcoxon Sign Test): - Analysis of gain scores for learners in the Experimental & Comparison groups.

Test	Language & Gender	N	Median	P-Value	N	Median	P-Value
		Experimental Group			**Comparison Group**		
	AFR – F	4	**-4**	**ns**	4	**-3.5**	**ns**
	AFR— M	5	**-1**	**ns**	4	**0**	**ns**
	ENG—F	5	**-4**	*	4	**-4.5**	*
	ENG—M	4	**-4**	*	5	**-5**	**ns**

*p<0.05 **p<0.01

ns = not significant

BTBC-R:

Significant improvements ($p<0.05$) were found in the English home-language learners in the Experimental group. A significant improvement ($p<0.05$) was recorded in the English home-language female learners in the Comparison group. (Note: the scores on this test are recorded as error scores and are therefore mostly represented as negative values.)

Pilot Study-part 2

CAS (Wilcoxon Sign Test): - Analysis of gain scores for learners in the Experimental & Comparison groups.

Test	Language & Gender	N	Median	P-Value	N	Median	P-Value
		Experimental Group			Comparison Group		
Matching Number	AFR – F	3	**0**	**ns**	2	**7.5**	**not pos.**
	AFR— M	5	**-2**	**ns**	2	**5**	**not pos.**
	ENG—F	4	**3**	*	4	**2**	**ns**
	ENG—M	5	**1**	**ns**	5	**5**	**
Planned Codes	AFR – F	5	**9**	**ns**	2	**-5**	**not pos.**
	AFR— M	5	**-1**	**ns**	2	**3.5**	**not pos.**
	ENG—F	5	**3**	*	4	**-0.5**	**ns**
	ENG—M	5	**15**	*	5	**9**	**
Number Detection	AFR – F	5	**-2**	**ns**	2	**13.5**	**not pos.**
	AFR— M	4	**13**	**ns**	2	**5**	**not pos.**
	ENG—F	5	**11**	**ns**	4	**17**	*
	ENG—M	5	**18**	*	5	**15**	**
Receptive Attention	AFR – F	4	**2**	**ns**	2	**15**	**not pos.**
	AFR— M	5	**7**	*	2	**9**	**not pos.**
	ENG—F	4	**13**	*	3	**6.5**	**ns**
	ENG—M	5	**13**	*	5	**4**	**
Nonverbal Matrices	AFR – F	3	**1**	**ns**	2	**0**	**not pos.**
	AFR— M	5	**2**	**ns**	2	**0.5**	**not pos.**
	ENG—F	5	**2**	*	2	**0**	**not pos.**
	ENG—M	4	**2.5**	*	5	**1**	**ns**

Test	Language & Gender	N	Median	P-Value	N	Median	P-Value
		Experimental Group			Comparison Group		
Verbal-spatial relations	AFR – F	3	**2**	*	2	**0**	**not pos.**
	AFR— M	5	**1**	*	2	**-0.5**	**not pos.**
	ENG—F	5	**-1**	**ns**	3	**-0.5**	**ns**
	ENG—M	4	**1**	**ns**	5	**-1**	**ns**

*p<0.05 **p<0.01

ns = not significant

not pos. = not possible to calculate

CAS:

The results from this test battery should be considered with additional caution, as it was not possible to analyze the data from the Afrikaans home-language learners in the Comparison group because of the small size of that sample. Similarly it was not possible to analyze the data from the English home-language female learners in the Comparison group in one subtest (Nonverbal Matrices).

Matching Number:

A significant improvement was found in the English home-language female learners in the Experimental group (p<0.05). A significant improvement was recorded in the English home-language male learners in the Comparison group (p<0.01).

Planned Codes:

Significant improvements were found in the English home-language learners in the Experimental group (p<0.05). A significant improvement was recorded in the English home-language male learners in the Comparison group (p<0.01).

Number Detection:

A significant improvement was found in the English home-language male learners in the Experimental group (p<0.05). Significant improvements were recorded in the English home-language male and female learners in the Comparison group respectively ($p<0.05$ and $p<0.01$).

Receptive Attention:

Significant improvements were found in the English and Afrikaans home-language male learners in the Experimental group ($p<0.05$). A significant improvement was recorded in the English home-language male learners in the Comparison group ($p<0.01$).

Nonverbal Matrices:

Significant improvements were found in the English home-language learners in the Experimental group ($p<0.05$). No significant improvements were recorded in the Comparison group.

Verbal-Spatial Relations:

A significant improvement was found in the Afrikaans home-language male learners in the Experimental group ($p<0.05$). No significant improvements were recorded in the Comparison group.

Pilot Study-part 2

CITM (Wilcoxon Sign Test): - Analysis of gain scores for learners in the Experimental & Comparison groups.

Test	Language & Gender	N	Median	P-Value	N	Median	P-Value
		Experimental Group			**Comparison Group**		
CITM (1): Pre-Intervention Gain Scores	AFR – F	3	**9**	**ns**	4	**10.5**	*
	AFR— M	4	**9.5**	*	5	**10**	**
	ENG—F	5	**17**	*	4	**12**	*
	ENG—M	5	**7**	*	5	**6**	**
CITM (2): Post-Intervention Gain Scores	AFR – F	4	**1**	**ns**	4	**9.5**	*
	AFR— M	5	**2**	**ns**	4	**3**	*
	ENG—F	5	**11**	*	3	**11**	**ns**
	ENG—M	5	**7**	*	4	**4.5**	**ns**

*p<0.05 **p<0.01

ns = not significant

CITM (1):

Significant improvements were found in the English and Afrikaans home-language male learners in the Experimental group ($p<0.05$). Significant improvements were recorded in the English and Afrikaans home-language learners in the Comparison group respectively ($p<0.05$ and $p<0.01$).

CITM (2):

Significant improvements were found in the English home-language learners in the Experimental group ($p<0.05$). Significant improvements were recorded in the Afrikaans home-language learners in the Comparison group ($p<0.05$).

6. Discussion and Conclusion

The general trend of the results for English home-language (male and female) learners in the Experimental group was encouraging when contrasted with their counterparts in the Comparison group. This finding was supported by the consistent improvements of these learners in a majority of the areas assessed, with the exception of the CAS (3 subtests were not significant) and mathematics (subtraction). Significant pre-test to-post test gains for the English home-language (male and female) learners in the Experimental group were found in **22 out of 26**[3] areas assessed, whereas significant pre-test to post- test gains for the Afrikaans home-language (male and female) learners in the Experimental group were found in only **7 out of 26** areas assessed. The study found that English home-language (male and female) learners in the Comparison group made significant gains in **14 out of the 26** areas assessed, whereas the Afrikaans home-language (male and female) learners made significant gains in **7 out of the 26** areas assessed. These findings were suggestive of an encouraging trend for English home-language learners in the Experimental group and thus initial evidence that they had benefited from their participation in the BCMLP. However, the reader should again be cautioned regarding the limitations of the study findings, especially with regard

[3] The assessment results were gathered from 4 test batteries in a total of 13 tests/subtests. The results in the above discussion are combined from two learner groupings, that is 13 tests/subtests from one grouping were added to 13 tests/subtests from another grouping (26 tests/subtests results in total).

to the findings for Afrikaans home-language learners in the Comparison group.

A further interesting finding from this study was that learners in the [4]Experimental Group had received only 34 sessions of intervention in the Conceptual Domain of Letter, whereas learners in the Comparison group had received 65 sessions of interventions, all of which focussed on reading and reading related activities. This finding seemed to support the claim that learners derived greater scholastic benefits from their participation in this metacognitive programme than learners in the Comparison group who participated in an 'ordinary' remedial-based programme. This was regarded as an especially important observation as it was the study's main contention that the acquisition of cognitive prerequisites together with a knowledge of basic conceptual systems would promote and enhance the development of school learning. The study found that English home-language (male and females) learners in the Experimental group had improved consistently across all the test batteries: - cognitive batteries, knowledge of conceptual systems and scholastics. These findings therefore appeared to anticipate the Main Study's contention that attention to the general and specific cognitive processing abilities of these learners had contributed to an overall improvement in their school learning.

The data revealed few differences in the performance of male and female learners in both the Experimental and Comparison groups. In the Experimental group female (English and Afrikaans) learners attained **13** significant results out of 26, whereas male learners attained **16** significant results out of 26. In the Comparison group female (English and Afrikaans) learners attained **11** significant results out of 26, whereas male learners attained **10** significant results out of 26. Thus it could be concluded that gender yielded very little additional explanatory information.

[4] The BCMLP was only implemented over 1,5 school terms (during the third and fourth school terms) and the number of sessions implemented in the conceptual domain of letter was therefore limited by time constraints.

The findings indicated a significant discrepancy in the performance of the English and Afrikaans home-language learners in the Experimental group. The discrepancy in the performance of these two language groupings could be related to a variety of factors, however, was largely attributed to the reliability of the instructions of the test batteries, which were translated from English into Afrikaans. For example, with respect to the BTBC-R it was not possible to find an exact Afrikaans equivalent for of all the English concepts used in this measure. These items would therefore have had an impact on the comparability of the two versions of the test measure. Furthermore, it was not possible to determine the level of reliability of these measures because of the sample size. It could also be postulated that teachers who had been trained (by the researcher) in English had difficulties translating aspects of the programme (e.g. the BCMLP Teaching Model) into Afrikaans. These aspects of the programme had initially been taught as well as modeled to teachers in English.

7. Recommendations

- It was recommended to use a single language (viz. English) to conduct the Main Study. This would include the testing phases, teacher-training and administration of the intervention programme. It was also recommended that only English home-language learners be selected for the study. These recommendations were made as a result of the emergence of Afrikaans as a confounding variable during this study.
- A larger sample of learners would need to be used for the Main Study. The small size of the sample in this study limited the power of the statistical analysis. A non-parametric method of analysis was used which limited the inferences derived from this study.
- It was recommended to start the implementation of the BCMLP in the second school term, allowing enough time should the programme need to continue into the fourth school term.

APPENDIX 8

Adaptations made to the Boehm Test of Basic Concepts-Revised (BTBC-R)

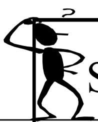
BTBC-R Item No.	BTBC-R Concept	Adaptation	Nature of Change
30	Several	Most	Repeated a concept used in the test
34	Alike	Same	Synonym
40	Middle	Centre	Synonym
44	Separated	Apart	Synonym

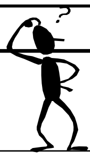
APPENDIX 9

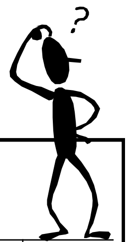
Example of a Transfer Activity Worksheet

Conceptual Domain of Size

MEASURE AND FIND THE SIZES OF:







	SHORTEST		MEDIUM		TALLEST	
FAMILY:						
CLASS:						
PETS:						
BOTTLE:						
FRIEND:						
OTHER:						

APPENDIX 10

Evaluation of the in-service training programme for LTSs: - Data gathered during the Pilot and Main Studies

QUESTIONS	Pilot Study (N=5)	Main Study (N=21)
	MEAN	**MEAN**
6. Did the workshop provide you with enough training to implement the programme at your school?	**8.8**	**7.9**
8.1 Information provided at the workshop	**9.2**	**8.7**
8.2 The teaching methods	**8.4**	**8.3**
8.3 The demonstrations with learners	**8.8**	**7.7**
8.4 The experiential sessions	**9**	**7.9**
8.5 The opportunity to work with learners	**8.8**	**7.5**
8.6 The session notes	**8.4**	**8.9**
8.7 The homework given at each session	**8.6**	**7.9**
8.8 The effectiveness of the trainer	**8.6**	**8.9**
TOTAL	**78.6**	**73.7**
MEAN SCORE	**8.7**	**8.2**

Note: Scores in the table were out of 10.

Note:

The above data is drawn from the evaluation forms completed after the training programme by all the workshop participants who attended the training sessions, that is, these findings do not only reflect the feedback from the LST-participants in the study.

APPENDIX 11

BCMLP OBSERVATION OF MEDIATION SHEET

Date: ....

Name of School: ....
Name of Teacher: ....
Length of Session: ....

Class Visitor: ....

Conceptual Domain: .... (attach a copy of the session planner)
Sub-Concepts: ....
Session No.: .... (e.g. 2 : 3 ; shape: third session)
No. of Learners Present and Absent: .... (e.g. 5 : 1 ; present: absent)

1. Brief Summary of Basic Concepts Session*:*

2. Teacher as Mediator: *(Rate each of the questions according to the scale below. Give a score from 1 to 10. Where possible, provide an example/evidence of the mediation used by the teacher in the appropriate block. This will assist with providing the teacher with feedback after the session.)*

MEDIATION CRITERIA	**1_____5_____10 never sometimes always**	
	RATING	**Example/s of Mediation**
1. Did the teacher *ask open-ended questions*?		....
2. Did the teacher *ask questions in a focussed, systematic* manner, i.e. in a conceptual domain and from the general to the specific?		....
3. Did the teacher make appropriate *use of prompts*? (e.g. Yes, this is a ... (pause))		....
4. Did the teacher provide the learners with *enough time to respond* to prompts and questions?		....
5. Did the teacher encourage the learners to *verbalize and to talk about their thinking* (e.g. I am first going to put this shape here and then ...)		....
6. Was the teacher able to provide the learners with *positive praise* when this was appropriate? (e.g. Very good work.)		....
7. If the teacher provided the learners with positive praise, did he/she provide *reasons for giving the praise*? *(e.g. I really like the way you are working: from left to right and top to bottom.)*		....
8. Did the teacher *challenge the learners to think* about their responses, i.e. both the correct and incorrect responses. (e.g. Yes, but why do you think this is a square?)		....
9. Did the teacher *provide information* to the learners when this was needed? (e.g. This is your left hand and this is your ...)		....
10. Did the teacher make on-going *use of conceptual labels* (lower order labels in association with higher order labels)		....
11. Did the teacher make *use of emotion* when mediating? (e.g. Wow, look at this block!!!)		....
12. Did the teacher assist the learners to *develop associations* in order to recall what they learnt? (e.g. It sounds like...)		....
13. Did the teacher mediate the concepts by *defining their salient characteristics*? (e.g. Yes, a square has four corners and 4 equal sides.)		....
14. Did the teacher *assist the learners to* think before they responded to questions? (e.g. First put the block down and then tell me what colour you are looking for.)		....
15. Did the teacher help the learners *to transfer their learning* (e.g. Where else could you find something that is big or small in size?)		....

3. Learners:

i) Describe the learners' response to the session? (*Please tick the response/s that best describe the learners during the session. Note: There could be more than one answer to the question, i.e. the learners could have responded differently at different times during the session.)*

motivated and eager to learn	*interested and participated*	*enjoyed the session*	*confused*	*disinterested*	*disruptive*

ii) Briefly explain the above response/s and especially if you have ticked more than one response:

___

___

___

iii) What concepts taught during the session still need to be reinforced*? (Tick the concept/s that require reinforcement alongside the appropriate learner.)*

Concepts taught during the session	**Learner 1**	**Learner 2**	**Learner 3**	**Learner 4**	**Learner 5** ....
•					
•					
•					
•					
GENERAL OBSERVATIONS ABOUT THE LEARNERS					

iv) Did the learners start to use the conceptual language mediated during the session or use conceptual language from previous sessions?

Frequently	**Occasionally**	**Never**

v) Briefly explain the above answer:

___

___

___

___

4. Evaluation of the Session:(strengths, weaknesses, concerns, general learning atmosphere)

___

___

___

___

___

___

5. Recommendations for Future Sessions: (be as specific as possible)

___

___

___

___

APPENDIX 12 (a)

THE BASIC CONCEPTS MEDIATED LEARNING PROGRAMME

22.01.2003

Dear Learning Support Teachers

It is my pleasure to invite you to attend a workshop designed to teach BASIC CONCEPTS to learners with barriers towards learning. The BASIC CONCEPTS PROGRAMME is a project of the South and Central Metropoles' EMDCs.

The BASIC CONCEPTS PROGRAMME is a doctoral project at the University of the Western Cape. Your participation at the training workshop will assist with the implementation of the BASIC CONCEPTS PROGRAMME.

The BASIC CONCEPTS PROGRAMME aims to develop the cognitive and scholastic functioning of Foundation Phase learners. The workshop will equip you with the knowledge and skills required to implement the programme in your class with a small group of learners. Teachers will be given support at their schools with the implementation of the programme. Biweekly support sessions will be offered.

The BASIC CONCEPTS PROGRAMME consists of about 50 sessions implemented over 2 school terms. It is recommended that these sessions be implemented over a concentrated time period. 2-3 Basic Concepts Sessions should be implemented per week.

The decision to participate in this project requires a commitment from you to implement the BASIC CONCPETS PROGRAMME at your school. Your Principal is required to approve your participation in this project.

Please complete the form below and ensure that it is handed to:

- *.......................... (South Metropole, EMDC): Tel: 37 44 107*
- *.......................... (Central Metropole, EMDC): Tel: 638 3151*

Note: The above names were deleted to protect the anonymity of these Learning Support Facilitators.

TIME FRAME FOR THE PROJECT:

1. Training Programme:- 5 Morning Sessions on Saturdays

Session 1: 22.02.2003

Session 2: 1.03.2003

Session 3: 8.03.2003

Session 4: 15.03.2003

Session 5: 22.03.2003

2. Implementation of the Programme:- 2nd & 3rd school term

I look forward to meeting and working with you.

Yours sincerely

Louis Benjamin

(Researcher, University of the Western Cape)

THE BASIC CONCEPTS MEDIATED LEARNING PROGRAMME

CONSENT FORM

I, ………………………………………… (teacher's full name) willingly agree to attend all the workshop sessions and to implement the BASIC CONCEPTS PROGRAMME with a small group of learners at my school.

Teacher's Signature	**Principal's Signature**
……………………………	………………………………
Date: ……………………	Date: ……………………..

APPENDIX 12 (b)

A STUDY TO MONITOR LEARNERS WITH BARRIERS TO LEARNING IN THE FOUNDATION PHASE

22.01.2003

Dear Class Teachers

I would like to thank you for agreeing to participate in this study. This study is done in partnership with the South and Central EMDCs. The purpose of this study is to monitor the scholastic and cognitive functioning of learners with barriers to learning.

A small group of Grade 2 learners who currently receive Learning Support will be selected to participate in the study. These learners will continue to receive regular learning support during the 2nd and 3rd school terms (2003). The learners will be assessed twice during the year.

Teachers will be requested to complete a questionnaire in order to provide some biographical data about their learners.

Teachers are required to complete and sign the attached sheet and to have this sheet signed by their Principals.

Yours sincerely

Louis Benjamin

(Researcher, University of the Western Cape)

A STUDY TO MONITOR LEARNERS WITH BARRIERS TO LEARNING IN THE FOUNDATION PHASE

CONSENT FORM

I, …………………………………… (class teacher's full name) willingly agree to participate in this research study (as discussed in the above letter) and to give my full cooperation to the project researcher and the research assistants.

Teacher's Signature	**Principal's Signature**
…………………………….	……………………………….
Date: …………………….	Date: ……………………..….

APPENDIX 13 (a)

The 'Basic Concepts' Mediated Learning Programme

6.02.2003

Sample Selection

(Experimental Group)

Dear Learning Support Teacher

Please note the following requirements regarding the selection of learners for the 'Basic Concepts' Programme: -

i) All the learners should be in Grade 2.
ii) Select 5 learners who are currently in a Learning Support Class.
iii) The learners should not be placed specially in a Learning Support Class in order to participate in the programme.
iv) The group should include both boys and girls (no fewer than two boys or girls in the group).
v) All the learners should be first language English speakers.
vi) The learners selected should be taught in English.
vii) All the learners selected to participate in the programme should obtain parental consent (see attached parental consent letter).

It is essential that the sample for this project is selected strictly according to the criteria outlined above, as the findings are being used for research purposes.

Please discuss any difficulties with the selection requirements directly with the researcher.

Yours sincerely

Louis Benjamin.

(Researcher, University of the Western Cape)

APPENDIX 13 (b)

A Study To Monitor Learners Who Experience Barriers To Learning In The Foundation Phase

6.02.2003

Sample Selection

(Comparison Group)

Dear Teacher

Please note the following requirements regarding the selection of learners for the study: -

i) All the learners should be in Grade 2.

ii) Select 5 learners who are currently in a Learning Support Class.

iii) The learners should not be placed specially in a Learning Support Class in order to participate in the programme.

iv) The group should include both boys and girls (no fewer than two boys or girls in the group).

v) All the learners should be first language English speakers.

vi) The learners selected should be taught in English.

vii) All the learners who will be selected to participate in this study will be assessed twice during the year. Parental consent should be obtained (see attached parental consent letter).

It is essential that the sample for this study is selected strictly according to the criteria outlined above, as the findings are being used for research purposes.

Please discuss any difficulties with the selection requirements directly with the researcher.

Yours sincerely

Louis Benjamin.

APPENDIX 14

Evaluation of the Teacher (LST) Training Programme

1. What I liked most about the BC Workshop:

…………………………………………………………………………………

…………………………………………………………………………………

…………………………………………………………………………………...

2. What I liked least about the BC Workshop:

…………………………………………………………………………………

…………………………………………………………………………………

…………………………………………………………………………………...

3. What did you learn about Basic Concepts (e.g. colour, shape, size)?

…………………………………………………………………………………

…………………………………………………………………………………

………………………………………………………………………………….

4. What did you learn about mediation/mediated teaching approach?

…………………………………………………………………………………

…………………………………………………………………………………

…………………………………………………………………………………

5. **<u>What did you learn about yourself as a teacher during the workshop?</u>**

……………………………………………………………………………………

……………………………………………………………………………………

……………………………………………………………………………………...

……………………………………………………………………………………..

<u>6. Did the workshop provide you with enough training to implement the programme in your school.</u> .... (rating)

1-----------------5--------------------10

strongly disagree strongly agree

7. **<u>Please explain the above rating:</u>**

……………………………………………………………………………………

……………………………………………………………………………………

……………………………………………………………………………………...

……………………………………………………………………………………..

8. **<u>Please rate the following aspects of the workshop:</u>**

- *The information provided at the workshop:* ***................(rating)***

1-----------------5--------------------10

very boring very stimulating

- *The methods used for teaching (e.g. activities, videos):* ***............. (rating)***

1-----------------5--------------------10

boring engaging

- *The demonstrations with the learners:* **......................(rating)**

1-----------------5---------------------10

very boring very interesting

- *The experiential sessions- when the teachers took on role of mediator and/or learner:* **.............. (rating)**

1-----------------5---------------------10

very unhelpful very helpful

- *The opportunity to work with learners:* **................... (rating)**

1-----------------5---------------------10

very unhelpful very helpful

- The session notes: **................... (rating)**

1-----------------5---------------------10

confused me even more helped to provide clarity

- *The homework given at the end of each session:* **................. (rating)**

1-----------------5---------------------10

Did not assist with my learning at the sessions. Assisted with my learning at the sessions.

- *The effectiveness of the trainer:* **...........................(rating)**

1-----------------5---------------------10

boring and frustrating very challenging and interesting

9. **<u>Please rate the BC Sessions according to the following scale.</u>**

1……………………5……………………10

very poor average very good

session 1: score: …/10

session 2: score: …/10

session 3: score:…/10

session 4: score:…/10

session 5: score:…/10

10.<u>Please state why you gave a session the highest score:</u>

…………………………………………………………………………………

…………………………………………………………………………………

…………………………………………………………………………………........................

11.<u>Please state why you gave a session the lowest score:</u>

…………………………………………………………………………………

…………………………………………………………………………………

…………………………………………………………………………………

<u>12.What would you change about the workshop and why?</u>

…………………………………………………………………………………

…………………………………………………………………………………

…………………………………………………………………………………

12.<u>What is your biggest concern about implementing the Basic Concepts Programme at your school?</u>

…………………………………………………………………………………………

…………………………………………………………………………………………

…………………………………………………………………………………………

<u>13. General comments & recommendations (include your feedback to the trainer)</u>

…………………………………………………………………………………………

…………………………………………………………………………………………

…………………………………………………………………………………………

…………………………………………………………………………………………

…………………………………………………………………………………………

…………………………………………………………………………………………

…………………………………………………………………………………………

>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>

APPENDIX 15

Programme for the Administration of the Test Batteries

Day One Testing:

8h30-9h30	BTBC-R
9h45-10h10	Ballard (addition & subtraction)
10h10-10h40	BREAK
10h40-11h10	UCT Spelling
11h20-12h45	UCT Reading

Day Two Testing:

8h30-10h10	CAS
10h10-10h40	BREAK
10h40-11h30	CITM Pre-Teaching (Set A)
11h30-12h45	Open Slot

Day Three Testing:

8h10-10h10	CITM Teaching/Mediation (Set A) (4 learners)
10h10-10h40	BREAK
10h40-11h10	CITM Teaching/Mediation (Set A) (1 learner)
11h30-12h45	CITM Post-Teaching (Set B)

APPENDIX 16

A Comparison of conceptual content: BTBC-R & BCMLP

Concepts in the BTBC-R	Concepts in the BCMLP	RELATIONSHIP BETWEEN THE CONCEPTS
1. TOP	1. TOP	**Same**
2. NEXT TO	2. NEXT TO	**Same**
3. FIRST	3. FIRST	**Same**
4. BOTTOM	4. BOTTOM	**Same**
5. END	5. END	**Same**
6. LAST	6. LAST	**Same**
7. DIFFERENT	7. DIFFERENT	**Same**
8. BEGINNING	8. BEGINNING	**Same**
9. SECOND	9. SECOND	**Same**
10. FORWARD	10. FORWARD	**Same**
11. MEDIUM SIZED	11. MEDIUM SIZED	**Same**
12. RIGHT	12. RIGHT	**Same**
13. LEFT	13. LEFT	**Same**
14. THIRD	14. THIRD	**Same**
15. SKIP	15. SKIP	**Same**
16. *CENTRE	16. MIDDLE	Similar
17. FRONT	17. FORWARDS	Similar
18. MOST	18. MORE --- LESS	Similar
19. SOME, NOT MANY	19. MORE --- LESS	Similar
20. BEHIND	20. BACKWARDS	Similar
21. FEW	21. MORE --- LESS	Similar
22. ABOVE	22. UP	Similar
23. BELOW	23. DOWN	Similar
24.* ALIKE	24. SAME	Similar
25. FEWEST	25. MORE---LESS	Similar
26. NARROWEST	26. THIN	Similar
27. WIDEST	27. THICK	Similar
28. AS MANY	28. SAME / MORE --- LESS	Similar
29. CORNER	29. VOCABULARY WORDS (E.G. HOW MANY CORNERS DOES A ... HAVE?)	**This word is inferred or may be used during a Basic Concept Session.**
30. ROW	30. VOCABULARY WORDS (E.G. LOOK AT THIS ROW OF BLOCKS.)	**This word is inferred or may be used during a Basic Concept Session.**
31. BETWEEN	31. VOCABULARY WORDS (E.G. WHAT IS THE SIZE OF THE BLOCK BETWEEN THE BIG AND THE SMALL BLOCK ?)	**This word is inferred or may be used during a Basic Concept Session.**
32. MATCH	32. VOCABULARY WORDS (E.G. FIND A BLOCK THAT MATCHES THIS ONE.)	**This word is inferred or may be used during a Basic Concept Session.**
33. HALF	33. VOCABULARY WORDS (E.G. HALF A CICRLE IS CALLED A ...)	**This word is inferred or may be used during a Basic Concept Session.**

Concepts in the BTBC-R	Concepts in the BCMLP	RELATIONSHIP BETWEEN THE CONCEPTS
34. SIDE	34. VOCABULARY WORDS (E.G. HOW MANY SIDES DOES A SQUARE HAVE?)	**This word is inferred or may be used during a Basic Concept Session.**
35. STARTING	35. VOCABULARY WORDS (E.G. WHAT LETTER DOES THIS WORD START WITH?)	**This word is inferred or may be used during a Basic Concept Session.**
36. PART	36. VOCABULARY WORDS (E.G. HOW MANY PARTS DOES THE LETTER **A** HAVE?)	**This word is inferred or may be used during a Basic Concept Session.**
37. OTHER	37. VOCABULARY WORDS (E.G. WHAT OTHER COLOUR DOES THE BLOCK HAVE?)	**This word is inferred or may be used during a Basic Concept Session.**
38. BEFORE	38. VOCABULARY WORDS (E.G. WHAT NUMBER COMES BEFORE FOUR?)	**This word is inferred or may be used during a Basic Concept Session.**
39. AFTER	39. VOCABULARY WORDS (E.G. WHAT NUMBER COMES AFTER FOUR?)	**This word is inferred or may be used during a Basic Concept Session.**
40. THROUGH	Not Used	Not Used
41. AWAY FROM	Not Used	Not Used
42. EVERY	Not Used	Not Used
43. OVER	Not Used	Not Used
44. WHOLE	Not Used	Not Used
45. FARTHEST	Not Used	Not Used
46. NEVER	Not Used	Not Used
47. *SEPARATED	Not Used	Not Used
48. PAIR	Not Used	Not Used
49. *SEVERAL	Not Used	Not Used
50. ALWAYS	Not Used	Not Used

*These four concepts were adapted in the final test battery. (See Appendix 8.)

Summary of findings:

1. 15 concepts (30%) are exactly the same in both ‘instruments’.
2. 13 concepts (26%) are similar in both ‘instruments’.
3. 11 concepts (22%) in the BTBC-R may be inferred or used in a Basic Concepts Session.
4. 11 concepts (22%) in the BTBC-R are not used in the BCMLP.
5. **39/50 concepts (78%) in the BTBC-R are similar to those in the BCMLP.**

APPENDIX 17(a)

THE BASIC CONCEPTS MEDIATED LEARNING PROGRAMME

28.02.2003

PERMISSION FOR YOUR CHILD TO PARTICIPATE

IN A SPECIALIZED EDUCATION PROGRAMME

Dear Parents

I am a doctoral student at the University of the Western Cape. I am currently doing my research at your child's school. The research programme is done with the permission of the Western Cape Education Department and in collaboration with the South and Central Metropoles' Education Management and Development Centres (EMDCs).

The programme aims to assist learners to *learn how to learn*. This short-term programme is intended to provide learners with the tools to learn how to read, write and perform basic mathematical operations.

The programme will be implemented at your child's school by his/her *Learning Support Teacher* during the 2nd and 3rd school terms. Your child will receive this specialized programme in a small group format with other learners in Grade 2. Learning Support Teachers have undergone an intensive training in order to prepare them to work with the learners. In addition, they (Learning Support Teachers) will receive regular support from Learning Support Facilitators (EMDC personnel) at their schools.

The learners will be evaluated at the beginning and again at the end of the programme in order to determine the gains made by the learners during the programme. The pre-programme evaluation will be implemented at the start of the 2nd school term while the post-programme evaluation will be implemented at the end of the 4th school term.

Your participation in the project will be warmly welcomed. Your child will be given tasks to take home during the programme, which you are encouraged to assist with. Please note that the information obtained during the research project will only be used for research and educational purposes. Some of the sessions with the learners may be video taped.

Yours sincerely

____

Louis Benjamin

(Researcher, University of the Western Cape)

****PLEASE NOTE:-** The consent form should be returned to your child's school before the 28.03.2003.

PARENT/LEGAL GUARDIAN

CONSENT AND INDEMNITY FORM

I ________________________ (print your name and surname in full), the parent/legal guardian of ________________________ (print the name and surname of your child in full) agree to allow the aforementioned to participate in the 'Basic Concepts' Programme.

Signature of Parent: (please print and then sign your name) **Date:**

....

APPENDIX 17(b)

A STUDY TO MONITOR LEARNERS WHO EXPERIENCE BARRIERS TO LEARNING IN THE FOUNDATION PHASE

PARENT/LEGAL GUARDIAN CONSENT AND INDEMNITY FORM

I _________________________ (print your name and surname in full), the parent/legal guardian of __________________________ (print the name and surname of your child in full) agree to allow the aforementioned to be assessed by Learning Support Facilitators from the Athlone and/or Mitchell's Plain Education Support Centres. The learner will be assessed during the 2nd and 4th school terms.

The information obtained about the learner will assist with a research study that is being conducted.

The assessments are done with the permission of the South and Central Metropoles' Education Management and Development Centres (EMDC).

Signature of Parent: (please print and then sign your name)

....

Date:

……………………………………

APPENDIX 18

UCT READING TEST

RAW SCORE:
....

(Pre ---- Post Programme Assessment)

KEY:
S = substitutions
Ref = refusals
R = reversals
WS = word synthesis
G = guessing
LS = letter-sound confusion

Name of learner:.................................. **Grade:** ....…………
School: .... **Date:** ....…………
Name of teacher: .... **Name of tester:** ....……

	CORRECT AT 1ST ATTEMPT (write the incorrect answer in this space)	CORRECT AT 2nd + ATTEMPT	ERROR TYPE (SEE KEY)
to			
is			
of			
at			
he			
my			
up			
or			
no			
an			
his			
for			
sun			
big			
day			
sad			
pot			
wet			
one			
now			
that			
girl			
went			
boys			
some			
just			
told			
love			
water			
things			
carry			

	CORRECT AT 1ST ATTEMPT (write the incorrect answer in this space)	CORRECT AT 2nd + ATTEMPT	ERROR TYPE (SEE KEY)
village			
nurse			
quickly			
return			
known			
journey			
terror			
obtain			
tongue			
shelves			
scramble			
twisted			
beware			
commenced			
scarcely			
belief			
steadiness			
labourers			
serious			
projecting			
fringe			

C0MMENTS ABOUT LEARNER: *(Did the learner give his/her best performance: was the learner very anxious, did the learner resist testing.)*

____

____

____

____

____

____

____

Test Instructions:

1. **Tick** the correct answer in the appropriate (shaded) column.
2. **Do not tick (or cross)** if the answer is incorrect, however, write the incorrect response (verbatim) in the space provided.
3. **Spontaneous improvements** of answers are accepted. This answer should then be ticked as correct in the second column (i.e. correct at 2nd + attempt).
4. If appropriate, complete the **error analysis** for each item.
5. **Discontinue test** after 5 -10 successive errors.

(Adapted by Benjamin, 2002)

APPENDIX 19

BCMLP BIODEMOGRAPHIC QUESTIONNAIRE FOR LEARNERS

Read These Instructions Carefully: -

- *Please fill in this questionnaire **with** the learner.*
- *Questions with the ** **are not** to be put (asked) to the learners.*
- *You may need to obtain certain information from school records or the child's parents/caregivers. This form **should not** be given to the learners' parents.*
- *The information contained within this questionnaire is confidential and will only be used by the researcher, to assist with the study.*

---

1. Full name and surname of child: ....

2. Date of birth of child: ....

3. Residential address: ....
....

4. | male | female | (tick the appropriate sex)

5. Religion: | Christian | Muslim | Other: .... | (tick the appropriate block)

6. Home language/s: ....

7. Is your father employed: | yes | no |

8. What is your father's occupation: ....

9. **What is the father's highest level of education: ....

10. Is your mother employed: | Yes | No |

11. What is your mother's occupation: ....

12. **What is the mother's highest level of education: ....

13. Do you live with both your parents: | yes | no |

14. If the answer to the above question is **No**, do you live with:

    - one parent: | father | mother | (tick the appropriate answer if applicable)

    - if you do not live with either your mother or your father, with whom do you live: ....

15.How many people live in your home: ....

16.How many brothers and sisters do you have: ....

17.**Does your school have a feeding programme:

YES	NO

(Complete this question if you answered YES to the above question)
18.**Does the learner receive food from the school feeding programme?

YES	NO

19. **Does the learner receive food from other learners, etc. at school?

YES	NO

(tick the appropriate block)

20.**Does the learner do his/her homework :

Always	Sometimes	Never

21.Who always helps you with your homework: (tick the appropriate option/s)

Mother	Father	Brother	Sister	Grandmother	Grandfather	No One	Other: (please specify) ....

22. Did the learner attend pre-school:

YES	NO

23. Did the learner attend Grade R:

YES	NO

24. **Level of involvement of the learner's parents with the school: *(Please rate the level of the parental involvement with the school on a 10 point scale. Refer to the rating scale below. Give a rating from 1 to 10.)*

RATING: .... (FILL IN YOUR RATING HERE)

1	5	10
not involved	***involved***	***very involved***
never visit the school	*sometimes visit the school*	*often visit the school*

25. **Please provide background information about the learner's home, family and physical environment that you consider important: (E.*g. deaths, financial difficulties, emotional problems, separations and/or divorces, community violence.) You may attach c*opies of other reports, if they are relevant. If you do not have any other information about the learner's background, indicate that information is **not known**.

____
____
____
____
____
____

APPENDIX 20

BCMLP BIODEMOGRAPHIC QUESTIONNAIRE FOR TEACHERS

1. **Date: …………………..**
2. **Full Name & Surname: Mrs./Mr./Miss ……………………………….**
3. **Home Tel. No.: ……………………………..CELL: ……………………..**
4. **Teacher's Home Language/s: …………………………………………..**
5. **Language/s of Instruction: ………………………………………………**
6. **School Address: …………………………………………………………..**
7. **School Tel. No.: …………………………………………………………..**
8. **School Fax No.: …………………………………………………………..**
9. **Number of years of teaching experience: …………………………..**
10. **What Grade/s have you taught and how many years of teaching experience do you have in each grade:**

GRADE/S	YEAR/S OF TEACHING EXPERIENCE

11. **Please complete the following question regarding your training. You may include training that you are currently doing. (Do not use abbreviations.)**

Teacher Qualification/s	Training Institution/s	Period of study (e.g. 1980-1984)

12. **Has anything had a *positive* or *negative* impact on your teaching during the year (2003). E.g. personal problems, family crises, health problems, large work load. Please discuss briefly in the space below: -**

…………………………………………………………………………………………
…………………………………………………………………………………………
…………………………………………………………………………………………
…………………………………………………………………………………………

APPENDIX 21

Biodemographic information (for learners) not used during the study.

Data from 8 categories was not reflected in the study analysis:

- Insufficient information was obtained from four data categories:

  Question 7: What is your father's occupation?

  Question 8: What is the father's highest level of education?

  Question 9: What is your mother's occupation?

  Question 10: What is the mother's highest level of education?

- Information from the remaining four data categories did not add *additional explanatory value* to the study:

Question 11: Does the learner receive food from other learners, etc. at school?

	Experimental	Comparison
Yes	20.37%	29.1%
No	75.93%	52.72%
No Answer	3.70%	18.18%
TOTAL	100%	100%

Question 20: Does the learner do his/her homework?

	Experimental	Comparison
Always	34,6%	30.23%
Sometimes	55,1%	55.81%
Never	10,2%	13.95%
TOTAL	99.9%	99.9%

Question 21: Who always helps you with your homework?

	Experimental	Comparison
mother	**54,41%**	**51.85%**
father	**14,71%**	**5.77%**
brother	**1,47%**	**1.92%**
sister	**5.89%**	**17.31%**
grandparents	**7.35%**	**7.69%**
after care	**2.94%**	**0**
no one	**2.94%**	**7.69%**
aunt	**5.89%**	**1.92%**
other	**4.40%**	**5.85%**
TOTAL	**100%**	**100%**

Question 24: Level of involvement of the learner's parents with the school.

	Experimental	Comparison
	MEAN	**MEAN**
South	**5**	**4.39**
Central	**5**	**7**
TOTAL	5	5.7

APPENDIX 22

BASIC CONCEPTS PROGRAMME
POST-PROGRAMME TEACHER EVALUATION OF LEARNERS

Date: ....

Name of Learning Support Teacher: ....
Name of School: ....

- ***Total Number Hours of Intervention:** .... (add up the hours on the attendance register)*
- ***Total Number of Sessions: ....***
- ***Have you implemented the entire programme: YES/NO (please circle)***
- ***If you answered NO to the above question, how many sessions do you still have to implement: .... (you may estimate if you do not know exactly)***

1. Has the Programme assisted to enhance the learners' *(consider the group as a whole)* **:-**	**RATING** (See the rating scale below. Give a score from 1-10)
1. General scholastic functioning	
2. Reading	
3. Spelling	
4. Writing	
5. Maths	
6. Confidence (proud of his/her work, takes learning risks)	
7. Motivation to learn (participates, works independently)	
8. General behaviour	
9. Expressive/spoken language	
10. Understanding of basic concepts (colour, shape, size, position, number, letter)	
11. Thinking abilities (gives a reason for an answer, asks questions, works things out before answering a question)	

1-------------------3---------------------5------------------8-----------------------10

1	5	10
no	some	yes
not at all	improvement	definitely
(no evidence of gains)	(some evidence of gains)	(lots of evidence of gains)

2. What (if any) were the <u>most important gains</u> made by your learners during the Programme? Please explain your answer.

....
....
....
....
....
....
....
....
....

3. Has the programme assisted to enhance the learner's *(consider each individual learner)* **:-**	**RATE EACH LEARNER** **(See the rating scale below. Give a score from 1-10)**				
	Learner 1 Name:	**Learner 2 Name:**	**Learner 3 Name:**	**Learner 4 Name:**	**Learner 5 Name:** ....
1. General scholastic functioning					
2. Reading					
risks, etc.)					
independently, etc.)					
size, position, number, letter)					
questions, works things out before answering a question, etc.)					
(*please add up the ratings for each learner)*					
Average Rating (*divide the total rating for each learner by 11 to obtain the average rating)*					

1--------------------3-------------------------5--------------------8------------------------10

no / not at all / (no evidence of gains)

some / improvement / (some evidence of gains)

yes / definitely / (lots of evidence of gains)

APPENDIX 22

4. **Please *__comment on the above ratings__* for each learner/participant. Explain the reasons for these ratings. The high and low ratings are of particular interest.** (For example, the reason for the learner's low average rating was that he did not attend all the sessions and thus did not benefit as much as he could have from the programme.)

	Average Rating (please fill-in the average rating for each learner)	**COMMENT ON THE PROGRESS OF EACH LEARNER DURING THE PROGRAMME**
Learner 1 Name:		....
Learner 2 Name:		....
Learner 3 Name:		....
Learner 4 Name:		....
Learner 5 Name:		....

5. See questions below-	**Learner 1 Name:**	**Learner 2 Name:**	**Learner 3 Name:**	**Learner 4 Name:**	**Learner 5 Name:** ....
1. Will the learner be promoted at the end of the year?	**Yes/No** (circle the answer)	**Yes/No** (circle the answer)	**Yes/No** (circle the answer)	**Yes/No** (circle the answer)	**Yes/No** (circle the answer)
2. Have you changed your decision about the promotion of the learner **since** his/her participation in the programme?	**Yes/No** (circle the answer)	**Yes/No** (circle the answer)	**Yes/No** (circle the answer)	**Yes/No** (circle the answer)	**Yes/No** (circle the answer)
3. Please explain the **above answer**, i.e. *why have you or why have you not* **changed your decision** about the promotion of the learner since the **start** of the programme.	I have decided *to promote / not to promote the learner* (circle) because	I have decided *to promote / not to promote the learner* (circle) because	I have decided *to promote / not to promote the learner* (circle) because	I have decided *to promote / not to promote the learner* (circle) because	I have decided *to promote / not to promote the learner* (circle) because ....
4. Do you think that the gains (if any) made by the learner will be maintained?	**Yes/Maybe/No** (circle the answer)	**Yes/Maybe/No** (circle the answer)	**Yes/Maybe/No** (circle the answer)	**Yes/Maybe/No** (circle the answer)	**Yes/Maybe/No** (circle the answer)
5. Please explain the above answer.	....	....	....	....	....

APPENDIX 23

CITM mean gain score calculations

Children's Inferential Thinking Modifiability Test: Pre-intervention (pre-teaching & post-teaching) & Post-intervention (pre-teaching & post-teaching) means in the Experimental and Comparison Groups

Test Measure	Group	Pre-Intervention means		Post-Intervention means	
Children's Inferential Thinking Modifiability Test		Pre-Teaching	Post-Teaching	Pre-Teaching	Post-Teaching
	Experimental N=54	15.63	25.54	19.96	32.00
	Comparison N=55	15.55	27.45	20.65	29.45

Gain Scores:

1. **Post-test (Post-Intervention) - Post-test (Pre-Intervention)**

Experimental Group: 32.00-25.54 = **6.46**

Comparison Group: 29.45-27.45 = **2.00**

2. **Post-test (Post-Intervention) - Pre-test (Pre-Intervention)**

Experimental Group: 32.00-15.63 = **16.37**

Comparison Group: 29.45-15.55 = **13.9**

APPENDIX 24

Non-Parametric analysis not reflected in Chapter Six

Group x Location: Kruskal-Wallis Test

Pre-test outcomes of the analysis of variance (Kruskal-Wallis):
Group (Experimental & Comparison) x Location (N =109).

	Scholastics	BTBC-R	CAS	CITM
Chi-Square	22.866	13.816	31.411	.721
df	3	3	3	3
p	.000*	.003*	.000*	.868

* Difference in means statistically significant (p<0.05)

The location of the learners in the Experimental and Comparison groups from the South and Central EMDCs were found to have a significant effect (p<0.05) on the pre-test study scores in three test batteries (Scholastics, BTBC-R, and CAS), but not in one of the test batteries (CITM). In order to interpret the significant findings one needs to consider the mean rankings generated by the Kruskal-Wallis. Only the highest and lowest mean rankings were reported. (See Appendix 25 for a full review of the Kruskal-Wallis mean rankings.)

Kruskal-Wallis: Highest & lowest mean scholastic rankings-
Group (Experimental & Comparison) x Location.

	CATEGORY	GROUPING	N	*MEAN RANKING
UCT Reading	Highest Ranking	Experimental: South	29	68.78
	Lowest Ranking	Comparison: South	30	35.98
UCT Spelling	Highest Ranking	Experimental: South	29	70.07
	Lowest Ranking	Comparison: South	30	35.33

	CATEGORY	GROUPING	N	*MEAN RANKING
Maths (+)	Highest Ranking	Comparison: Central	25	69.00
	Lowest Ranking	Comparison: South	30	38.25
Maths (-)	Highest Ranking	Comparison: Central	25	65.50
	Lowest Ranking	Experimental: Central	25	43.88
Scholastics Total	Highest Ranking	Experimental: South	29	69.45
	Lowest Ranking	Comparison: South	30	32.95

Scholastics

The highest mean ranking was attributed to learners in the Experimental group from South (69.45) and the lowest mean ranking to learners in the Comparison group from South (32.95).

Kruskal-Wallis (BTBC-R): Highest & lowest mean rankings-
Group (Experimental & Comparison) x Location.

	CATEGORY	GROUPING	N	*MEAN RANKING
	Highest Ranking	Experimental: Central	25	64.80
	Lowest Ranking	Comparison: South	30	37.27

BTBC-R

The highest mean ranking was attributed to learners in the Comparison group from Central (64.80) and the lowest mean ranking to learners in the Comparison group from South (37.27).

Kruskal-Wallis (CAS): Highest & lowest mean rankings-

Group (Experimental & Comparison) x Location.

	CATEGORY	GROUPING	N	*MEAN RANKING
Matching Number	Highest Ranking	Comparison: Central	25	74.18
	Lowest Ranking	Comparison: South	30	42.15
Planned Codes	Highest Ranking	Comparison: Central	25	71.10
	Lowest Ranking	Comparison: South	30	39.27
Receptive Attention	Highest Ranking	Comparison: Central	25	73.18
	Lowest Ranking	Comparison: South	30	43.50
Nonverbal Matrices	Highest Ranking	Comparison: Central	25	66.46
	Lowest Ranking	Comparison: South	30	35.20
Verbal-Spatial Relations	Highest Ranking	Comparison: Central	25	67.84
	Lowest Ranking	Comparison: South	30	41.33
CAS Total	Highest Ranking	Comparison: Central	25	77.82
	Lowest Ranking	Comparison: South	30	32.13

CAS

The highest mean ranking was attributed to learners in the Experimental group from Central (77.82) and the lowest mean ranking to learners in the Comparison group from South (32.13).

Conclusion:

The above non-parametric results are consistent with the parametric results in Chapter Six (p.169-173) and were therefore not reported in that section of the study.

APPENDIX 25

Kruskal-Wallis Test: Mean rankings not reflected in the body of the text.

1. Group x Gender:

Test Battery	Grouping	N (109)	Mean Rank
Scholastics	Experimental: Female	24	72.40
	Experimental: Male	30	55.35
	Comparison: Female	22	48.30
	Comparison: Male	33	46.50

2. Group x Location:

Test Battery	Grouping	N (109)	Mean Rank
Scholastics	Experimental: Central	25	55.36
	Experimental: South	29	69.45
	Comparison: Central	25	64.34
	Comparison: South	30	32.95
Test Battery	Grouping	N (109)	Mean Rank
BTBC-R	Experimental: Central	25	64.8
	Experimental: South	29	57.86
	Comparison: Central	25	63.16
	Comparison: South	30	37.27

Test Battery	Grouping	N (109)	Mean Rank
CAS	Experimental: Central	25	49.92
	Experimental: South	29	63.36
	Comparison: Central	25	77.82
	Comparison: South	30	32.13

3. Group x Teacher:

Test Battery	Research Grouping	N (54)	Mean Rank	Research Grouping	N (55)	Mean Rank
Scholastics	Experimental: Teacher 1	5	43.4	Comparison: Teacher 1	5	62.1
	Experimental: Teacher 2	5	64.3	Comparison: Teacher 2	5	10.4
	Experimental: Teacher 3	5	77.3	Comparison: Teacher 3	5	29.7
	Experimental: Teacher 4	5	62.6	Comparison: Teacher 4	5	40.6
	Experimental: Teacher 5	5	56.2	Comparison: Teacher 5	5	47.6
	Experimental: Teacher 6	5	77.9	Comparison: Teacher 6	5	27.9
	Experimental: Teacher 7	5	50.6	Comparison: Teacher 7	5	33.8
	Experimental: Teacher 8	5	83.6	Comparison: Teacher 8	5	41.5
	Experimental: Teacher 9	5	48.7	Comparison: Teacher 9	5	66.0
	Experimental: Teacher 10	4	64.63	Comparison: Teacher 10	5	100.6
	Experimental: Teacher 11	5	63.3	Comparison: Teacher 11	5	59.2
Test Battery	Research Grouping	N (54)	Mean Rank	Research Grouping	N (55)	Mean Rank
BTBC-R	Experimental: Teacher 1	5	42.4	Comparison: Teacher 1	5	30.3
	Experimental: Teacher 2	5	57.2	Comparison: Teacher 2	5	16.1
	Experimental: Teacher 3	5	47.9	Comparison: Teacher 3	5	28.1
	Experimental: Teacher 4	5	56.5	Comparison: Teacher 4	5	37.6
	Experimental: Teacher 5	5	48.5	Comparison: Teacher 5	5	35.9
	Experimental: Teacher 6	5	94.0	Comparison: Teacher 6	5	36.4

Test Battery	Research Grouping	N (54)	Mean Rank	Research Grouping	N (55)	Mean Rank
BTBC-R	Experimental: Teacher 7	5	73.2	Comparison: Teacher 7	5	52.1
	Experimental: Teacher 8	5	69.8	Comparison: Teacher 8	5	69.5
	Experimental: Teacher 9	5	65.9	Comparison: Teacher 9	5	88.8
	Experimental: Teacher 10	4	45.5	Comparison: Teacher 10	5	68.4
	Experimental: Teacher 11	5	67.8	Comparison: Teacher 11	5	76.2
Test Battery	**Research Grouping**	**N (54)**	**Mean Rank**	**Research Grouping**	**N (55)**	**Mean Rank**
CAS	Experimental: Teacher 1	5	52.9	Comparison: Teacher 1	5	45.2
	Experimental: Teacher 2	5	80.5	Comparison: Teacher 2	5	15.1
	Experimental: Teacher 3	5	53.3	Comparison: Teacher 3	5	55.4
	Experimental: Teacher 4	5	55.8	Comparison: Teacher 4	5	34.2
	Experimental: Teacher 5	5	35.9	Comparison: Teacher 5	5	35.3
	Experimental: Teacher 6	5	61.1	Comparison: Teacher 6	5	32.0
	Experimental: Teacher 7	5	36.4	Comparison: Teacher 7	5	85.7
	Experimental: Teacher 8	5	85.8	Comparison: Teacher 8	5	20.8
	Experimental: Teacher 9	5	63.3	Comparison: Teacher 9	5	89.2
	Experimental: Teacher 10	4	37.63	Comparison: Teacher 10	5	92.9
	Experimental: Teacher 11	5	62.0	Comparison: Teacher 11	5	76.1

APPENDIX 26

Content analysis of the Comparison Group sessions.

Teacher	Literacy	Numeracy	*Other
Teacher 1: South	**100%**	**0**	**0**
Teacher 2: South	**100%**	**0**	**0**
Teacher 3: South	**100%**	**0**	**0**
Teacher 4: South	**50%**	**0**	**50%**
Teacher 5: South	**100%**	**0**	**0**
Teacher 1: Central	**100%**	**0**	**0**
Teacher 2: Central	**40%**	**20%**	**40%**
Teacher 3: Central	**100%**	**0**	**0**
Teacher 4: Central	**100%**	**0**	**0**
Teacher 5: Central	**47%**	**47%**	**6%**
Teacher 6: Central	**33,3%**	**22,2%**	**44,4%**
Mean Percentage	**79,1%**	**8.1%**	**12.8%**

*Examples of ‘Other’:
- Problem solving activities
- Memory activities
- Motor co-ordination activities
- Teaching about shape concepts
- Teaching about position concepts
- Teaching about size concepts

APPENDIX 27

CONCEPTUAL DOMAIN OF COLOUR

SUBORDINATE CONCEPTS:

- Red
- Blue
- Yellow
- Green
- Brown
- Black

VOCABULARY: (the words may vary depending on the content of the session)

- Dark --- Light
- Shade
- Hot --- Cold

PURPOSE OF THE SESSIONS: (3 sessions are recommended to mediate the concept of colour)

To assess and to develop the conceptual domain of colour. The learner should be able to match, identify, name and apply the above mentioned sub-concepts. The learner should have a working understanding of the concept colour and be able to make frequent use of colour descriptions in everyday situations (e.g. there is a **BLUE** bag on the table and also a **BLACK** bag …).

SESSION 1 --- 3

1. MATERIALS:

- Transfer Activity Worksheet : Colour
- Colour Magazines
- Block Set A
- Glue
- Scissors
- Crayons/Colouring-in Pencils

2. BASIC CONCEPTS TEACHING MODEL:

- **Focusing & Naming**

What do you see? What **colour** is this block? How do you know that the **colour** of this block is....? Are you sure that the **colour** is ....? Now (turn the block over) what **colour** do you see? I thought you said the **colour** of the block is ... etc? Yes, the block has two **colours.**

- **Identifying**

Find a block that has the *same* **colour** as your block. What is the **colour** of your block? When you find a block that has the same **colour**- put them together so that I can see that they are exactly the same/match. What have you done? Yes, you have put the blocks with the same ***colours*** together. How did you know that those blocks were all the same **colour**?

- **Internalizing**

Look at the sky. The **colour** of the sky is blue. Now try to imagine that you are in the blue sky. Keep looking at the blue sky. Now close your eyes and make a picture of the blue sky in your heads. Keep looking at the blue sky, but with your eyes closed. Try to remember the **colour** of the sky in your heads. (Allow the learners to open their eyes if they need to look up at the sky.) Now you can all open your eyes. Can you tell me about the **colour/s** you saw when you had your eyes closed.

- **Applying**

Can you sort all these blocks into groups according to their **colours**? What is a group? In a group we put things that are the same together. How are your blocks all the same? Yes, they are all the same in **colour.**

- **Bridging**

Where else would you see this **colour**? What does this **colour** remind you of? Do you think of something cold or hot when you think about this **colour**? Do you like this **colour**? Why? What else has the same **colour**? Let's go and find these **colours** ... What **colours** did you find …? Are you sure that the **colour** of the ... is red?

- **Transfer Activity Worksheet: Colour**

For the next session find the **colours** that we learnt about at school and at home. Please draw and/or find pictures for each of the **colours**. You can even try to find new **colours** that we did not learn about today. Tell me the names of these **colours** and how you found out about them. Try to use the names of the **colours** as often as you can after the session at school and also at home. Also use the word **'colour'** as often as you can.

*(Give each learner a blank book for the transfer activities. The learner can use the book to rehearse transfer activities, develop his/her own activities, **share what he/she has learnt with his/her parents**, and as a portfolio of the Basic Concepts he/she has attained. Transfer worksheets can also be included in the book.)*

<u>Note:</u>

- The number of concepts taught in the sessions depends on the level of the learners.
- However, three sessions are recommended to mediate this conceptual domain, i.e. two concepts per session for learners who require intensive mediation.
- The basic concept teaching model should be followed in the order that it is presented. This is not prescribed, but has been found to be an effective format.
- The Transfer Activity Worksheet may be introduced during the session.

3. CLASSROOM ACTIVITIES:

(These activities can be used **in conjunction** with the Basic Concepts Teaching Model. These activities have been developed by teachers to assist with the internalization and transfer of learning. The activities could be introduced after a Basic Concepts Session.)

MATERIALS:

- Crayons / coloured pencils
- Bean Bags
- Balls / Skittles (painted plastic bottles: 6 blue, 6 red and 6 yellow bottles, etc.)
- Worksheet 1– give each learner a copy of this worksheet

ACTIVITIES:

<u>Ball and Skittles</u>

Play with the balls and the skittles. Group the red, blue, and yellow skittles together. Ask the learners to knock the skittles over with the ball (only use one colour at a time). Every time they knock the skittles over ask the learners to name the colour. Increase the level of complexity of the activity by placing different coloured skittles together, however, only once the learners have learnt the colour labels.

Bean Bags 1

Ask the learners to sit in a circle and ask one learner to pick-up a bean bag (from the middle of the circle). Ask the learner to pass the bean bag to his/her friend next to him/her. The learner names the colour of the bean bag before passing the bean bag on to his/her friend. Repeat this activity with each colour. Prompt the learner if he/she requires assistance.

Bean Bags 2

Repeat the above activity, however, after passing around one bean bag (one colour), introduce a second bean bag (two colours). Two bean bags are now passed around the circle at the same time. Ask two learners (at opposite points in the circle) to each pick up a different colour bean bag. A third colour can be introduced once the learners begin to label the colours more efficiently. The teacher-facilitator can vary the speed of the game (e.g. pass the bean bags: slowly, fast, faster and even faster).

Learning About Colour

Present the group members with a colour and ask them to think where they have seen the colour before. Brainstorm all the possible places where this colour can be found. Record on a large sheet of paper, using illustrations, the responses of the group members. Discuss various associations the learners have with the colours. For example: Is red a hot or cold colour? Do you like red clothes? What is your favourite colour and why?

Colour in the picture: Worksheet 1

Refer to the drawing of the flowers in the vase. Ask the group members to tell you what they see in the picture. Thereafter, ask the learners what is missing in the picture (colour). Follow-up this discussion with an experiential exercise: ask the learners to go outside or show them pictures of flowers with stems, leaves, pollen. Request the learners to colour in their pictures with the colours red, blue and yellow, etc. Ask the learners why they decided to use the colours they used to colour in different parts of the picture.

EXAMPLES OF MEDIATIONAL QUESTIONS:

- What do you see?
- What colour do you think this is?
- How do you know that?
- Where have you seen this colour before?
- How can you remember the name of this colour?
- What colour do you want to colour this in with? Why do you want to colour it in with that colour?
- Yes, you could colour this flower red, but why would you colour it in red?
- Why do you think that blue is a cold colour?

(Source: Benjamin, 2002)

APPENDIX 27