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UNCOVERING POTENTIAL : DYNAMIC ASSESSMENT OF NON-VERBAL REASONING ABILITY IN EDUCATIONALLY DISADVANTAGED CHILDREN

ANTHONY GEWER

A RESEARCH REPORT SUBMITTED TO THE FACULTY OF EDUCATION, UNIVERSITY OF THE WITWATERSRAND, IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF EDUCATION (EDUCATIONAL PSYCHOLOGY)

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ABSTRACT

South African research into dynamic assessment has contributed to the growing body of international research which supports the efficacy of dynamic assessment in uncovering learning capacity in a variety of populations of learners with special needs. This study investigated the application of dynamic assessment to a sample of black children within a South African township clinic setting. Aged 9-15 years (mean age = 10.96) they had been referred to the clinic with learning difficulties. The experimental group (n=48) was exposed to a group dynamic assessment process, using certain tasks of the Learning Propensity Assessment Device (LPAD). Their performance was assessed prior to and following the mediated learning intervention. Using Analysis of Covariance, comparisons of pre and post-test scores combined with an innovative qualitative scoring method designed by Lurie and Kozulin (1996) yielded positive findings for the experimental group as compared with a control (n=24) not exposed to mediation. Results of the Raven's Coloured Progressive Matrices (RCPM) and the Rey-Osterreith Complex Figure Test (ROCFT), suggest that the intervention yielded changes, not only in the scores attained, but also in the *quality* of the responses on the post-tests.

KEYWORDS

Dynamic Assessment, Learning Propensity Assessment Device, Psychoeducational Assessment, Special Needs

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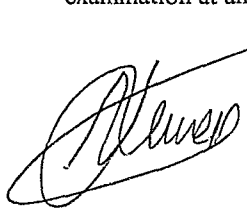
My colleague, Ann Hofmeyr, for her constant encouragement and sharing of ideas.

Shelley O'Carroll, for assisting me with the statistical analysis.

My wife, Glenda, who is my greatest inspiration.

DECLARATION

I declare that this research report is my own original, unaided work. It is being submitted for the degree of Master of Education (Educational Psychology) at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at any other university.



A. Gewer

September, 1998

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CHAPTER ONE : BACKGROUND TO THE STUDY

1.1. Introduction

The practice of intellectual assessment has come under much criticism in South Africa for being both culturally biased and highly dependent on school experience. Thus many children from culturally different communities, who have been subjected to apartheid education, have been placed at a severe disadvantage when having to experience such an assessment. This has lead to many children being given a poor prognosis for educational achievement, which has become a self-fulfilling prophecy and negatively affected their ability to succeed at school and beyond. Static psychometric assessment has been ineffective in specifying the functions that are needed for learning and scholastic success, and which can be enhanced through appropriate intervention. Within this context, it is necessary to explore alternative forms of assessment.

Dynamic assessment has arisen in reaction to the inability of static assessment to counteract the negative impact of inadequate exposure to effective learning environments. While static assessment takes insufficient cognisance of, and does not explicitly measure the child's ability to learn, the dynamic assessment process is centrally a measure of learning ability. As Feuerstein (1979: 49) states, "[t]he potential for being modified by learning should be the object of focus in psychometric assessment."

Until 1996, the primary means of assessing children who were referred with learning problems to the Child and Adolescent Unit at Chris Hani Baragwanath Hospital, Soweto, was through the use of individual screening mechanisms. Such mechanisms were utilised because they are quick to administer, are non-verbal and are supposedly "culture-fair". Despite the intentions, many of these children were found to be intellectually impaired, and the common outcome was a recommendation for placement in special schooling. This is a similar circumstance to that in which Feuerstein and his colleagues found themselves in Israel, with immigrants from African and Asian countries (Feuerstein, Rand, and Hoffman, 1979; Kaniel, Tzuriel, Feuerstein, Ben-Shachar, and Eitan, 1991; Tzuriel and Kaufman, in press). In order to contribute to a new paradigm for cognitive assessment in South Africa, this research investigates the use of dynamic assessment in this context.

1.2. Literature Review

1.2.1. The South African Context

1.2.1.1. Understanding assessment in the South African context

Kriegler and Skuy (1996) state that there a crisis in post-apartheid assessment practice. The authors argue that the basis for this crisis is the assumptions which still underlie the practice of assessment and which have largely ignored the impact of apartheid on the majority of learners, including high rates of school failure and scholastic impairment. Within this context the authors critique the assumptions which locate learning problems primarily within the child, and use a medical model to assign labels which are not necessarily accurate, thus ignoring the socio-cultural context, and the role of mediators in the child's development.

According to Kriegler and Farman (1996), African children who are assessed for learning problems are largely placed in the category of mental retardation. They believe that the provision of equitable educational services will not be effective in the South African context, if the conceptualisation of special educational needs continues to focus on intrinsic deficits.

1.2.1.2. The implications of this context for useful assessment practice

Kriegler and Skuy (1996:114) see assessment in South Africa as predominantly a "political activity" which perpetuates deficient institutions, rather than helping children to learn. The authors state that assessment practice must be able to directly respond to, and feed into, the context in which it is being performed, in order provide for change. Assessment practice should reflect the skills necessary for effective learning and functioning in South African society, taking into account the inequality in opportunities for acquiring skills. As such, the "assessment can only be justified if it can be demonstrated that the information gathered will be useful to the child from whom it is obtained." (ibid: 116)

According to Skuy (1995: 10), the fundamental goal of cognitive education is to identify and develop learning potential in order to enhance adaptive capacities and develop autonomous thinking. The new education policy direction in South Africa focuses on the need for assessment to be integrally linked to the development of learners to become both flexible in their thinking and independent in their learning. In addition, Kriegler and Skuy maintain that there needs to be a fundamental shift in philosophical thinking around the nature of human functioning and the intention of assessment practice within philosophical guidelines. To this end, "[t]he dynamic approach to assessment is recommended because it takes an optimistic view of human functioning, emphasising modifiability and change with reference to individuals and society." (Kriegler and Skuy, 1996: 118)

1.2.2. General dissatisfaction with assessment practices

Haywood, Brown and Wingenfield (1990, cited in Haywood, Tzuriel and Vaught, 1992) state that assessment is often performed with the sole purpose of classification, for the purpose of finding appropriate placements. This has resulted in three broad diagnostic outcomes: a)giftedness, requiring specialised instruction, b)average functioning, requiring regular instruction, and c)low aptitudes for learning, such as mental retardation, or specific learning disabilities and physical impairments, all requiring specialised instruction.

Archer and Green (1996: 126) emphasise that "[a] classification system for learning difficulties is useful if an assigned label can point to specific intervention which will facilitate learning." Labels should provide a means for understanding to effectively facilitate decision-making. However, labels can often serve as markers which may determine future interactions and lead to self-fulfilling prophecies. The problem highlighted by Haywood *et al* (1992), is that the predictive value of static instruments is questionable for individuals from minority groups, especially as they are placed in a normative sample with majority groups. An over-reliance on this test data has the potential for misclassification. Also, using standard tests in static mode, restricts their ability to provide much predictive information especially regarding the kind of learning environment from which the child will most benefit.

1.2.3. Dynamic Assessment

1.2.3.1. The philosophy of Dynamic Assessment

Lidz (1991: 4) emphasises that Dynamic Assessment (DA) must be viewed as being distinct from static assessment, by virtue of the fact that "..dynamic assessment focuses on learning *processes*, in contrast to the traditional assessment on already learned *products*." This is important to recognise because a focus on product will not provide a clue as to why the learner is failing, nor on his or her capacity for achievement. For Jensen and Feuerstein (1987: 380), the underlying philosophy of DA is that the "individual is an open system susceptible to influences that can produce structural changes in cognitive functioning." Through DA, Jensen and Feuerstein state, we seek to overcome traditional notions of structural limitations, such as age, etiology and severity of condition. In producing such changes, the relationship between the human mediator and the individual assumes significance.

These changes are reflected in the structure of cognitive processing. Structure relates to "...selection, recording, organization and response. How this is all done is a matter of process, style and strategy." (Lidz, 1987: 449) Structure is not a static entity, as it is susceptible to modification. Lidz (1997) further comments that the information provided by dynamic asessment regarding modifiability is information which is not derived from other approaches to assessment. By exploring learning processes more clear information can therefore be gained regarding the link between assessment and instruction. Lidz states that the dynamic assessment approach provides a logical argument for the incorporation of instruction into the assessment process, to ensure it more adequately predicts the learner's capacity for learning.

1.2.3.2. The roots of mediation

Kozulin and Presseisen (1995: 67) emphasise that recent years have seen a "cognitive revolution", which began with the work of Piaget and expanded upon by Vygotsky and Feuerstein. Piaget's theory lacked exploration of the socio-cultural aspects of cognitive development, as well as of the role of human mediators in providing the individual with the

necessary tools for higher mental processes. For Vygotsky, in contrast, cognitive development is integrally linked to socio-cultural experience. It was his belief that children learn, not through independent exposure to unfamiliar tasks, but through collaborative interaction. As such, the child internalises what she experiences when it is made meaningful by significant mediators. This internalisation then forms the basis for the child's reasoning ability (Kozulin, 1994: 274).

Herein lies the understanding of the way in which children learn, which involves an interaction between already existent spontaneous concepts and the scientific concepts they acquire through mediation. The interaction represents the zone of proximal development (ZPD), and this is the fundamental guide to the child's ability to learn. Through mediation, we seek to explore the child's ZPD in order to directly inform the educational intervention needed to enhance that child's learning ability.

1.2.3.3. Models of Dynamic Assessment

Models for DA have been suggested inter alia by Feuerstein *et al* (1979), Budoff (1987), Campione and Brown (1987), Guthke and Wingenfield (1992), and Carlson and Wiedl (1992). Lidz (1995) states that there are two main categories of DA. The first aims to "improve the predictive validity of the task....to provide a better estimate of the ability construct." (145-146) This category covers the procedures outlined by Budoff, Campione and Brown, Guthke and Wingenfield, and Carlson and Wiedl. The second category focuses on revealing the "..meta-cognitive processing of the learner to allow conclusions about learner functioning that may be either domain-specific, or permit generalizations across domains." (ibid) The work of Feuerstein fits into this category, by providing a more qualitative and holistic picture of the child's ability to learn with a variety of tasks. Table 1.1. represents a breakdown of current approaches to dynamic assessment of cognitive functioning.

Table 1.1. Prevailing models of dynamic assessment

Dynamic Assessment Approach	Originator	Nature of Assessment
Test-Train Test	Budoff (1987)	Traditional standardised testing instruments used to obtain a residual gain score between pre-test and post-test after training.
Testing-the-Limits	Carlson & Wiedl (1992)	A standardised intervention is integrated into the testing process, using verbalization and feedback, in a process which lead to higher levels of performance.
Learning Test	Guthke and Wingenfield (1992)	Intervention is integrated into the testing process using feedback and assistance and results are based on post-test.
Graduated Prompting Assessment	Campione and Brown (1987)	Use of a standardized test-train-transfer-test method which involves progressive prompts to produce quantifiable information which is linked to academic skills.
Mediated Learning	Feuerstein *et al* (1979)	Uses a test-train-test procedure, seeking to assist the child to acquire cognitive operations across a variety of domains, and involves non-standardized clinical interventions.

Further approaches are associated with content-based dynamic assessment. These include dynamic assessment of reading (Bednar and Kletzien, 1990 and Spector, 1992, cited in Lidz, 1997), mathematics (Jitendra and Kameenui, 1993), and language impairments (Olswang, Bain and Johnson, 1992, cited in Lidz, 1997). In addition Lidz (1991) developed a curriculum-based dynamic assessment model which addresses instruction issues arising out of the subject's classroom. Lidz, Jepsen and Miller (1997) have investigated the dynamic use of process-based assessment to remediate specific learning difficulties.

1.2.4. Feuerstein's model of Dynamic Assessment

1.2.4.1. The Learning Propensity Assessment Device (LPAD)

As Lidz (1991) points out, the LPAD comprises a battery of verbal and non-verbal tasks, which seek to tap a variety of operations, including analogical reasoning, numerical reasoning, categorization and memory. Each test comprises of an original task, and a variation of the task for the purposes of mediation. The tasks are novel in nature, so that the learner has not had previous experience of them. The rationale for this, as stated by

Ashman and Conway (1997: 112), is that Feuerstein and his colleagues argue that "...test instruments should be clearly distinguishable from academic tasks, but should reflect similar cognitive demands."

Lidz (1991: 17) emphasises that the LPAD is "...a clinical procedure, not a standardised or normative one, and considerable clinical judgment and inference are involved." Feuerstein's model for designing LPAD tasks requires the exploration of cognitive structure, cognitive functions, operations and non-intellective factors, the use of MLE, exploration of the extent of change through transfer measures, and the provision of an environment conducive to the development of competence and independent thinking (Feuerstein and Jensen, 1992).

Through his work, Feuerstein found a "..wide array of cognitive deficiencies characteristic of the culturally disadvantaged." (ibid: 57) The LPAD model of DA seeks to assist the individual in achieving mastery over tasks by mediating the necessary cognitive skills. The model then allows for variations in the degree of complexity, the language or modality of the task, and the operations involved. The results of the assessment must focus primarily on process, i.e. the method used by the individual to reach the task solution, which will provide insight into the process of remediation. If the individual uses an inappropriate method, one must explore whether or not the individual has an alternative method. This will help to determine whether or not the individual has the skills required.

In order to achieve these aims, Feuerstein and Jensen state that the relationship between the examiner and examinee is crucial. The motivational and arousal components of the individual's functioning may be reliant on this relationship and this will affect the individual's performance. The LPAD seeks to enhance this relationship, by changing it from one of distance and neutrality, as found in static testing situations, to active collaboration which will increase the individual's interest and provide a more positive approach to the tasks. The examiner also provides feedback to the examinee and helps him/her improve his/her ability to monitor his/her own behaviour.

1.2.4.2. The rationale behind Feuerstein's approach

Feuerstein *et al* (1979) state that the traditional goals of assessment involve an emphasis on labeling children and classifying them into subgroups. This is especially true for minority groups who tend to perform worse on traditional assessments, and this adds to their marginalisation. For Feuerstein, traditional tests fail to adequately consider situational and background factors, such as the role of the examiner, familiarity with the tasks, the modality of presentation, the pressure of time, and the stress and anxiety associated with the testing situation. Such factors can undermine the efficiency of the individual's cognitive functioning.

1.2.4.3. Mediated Learning Experience (MLE)

Feuerstein emphasises the importance of mediated learning for the assessment process. "...[T]he more an individual has benefited from mediated learning, the greater will his capacity be to become modified through direct exposure learning." (ibid: 71) The culturally deprived child is one who has been exposed to insufficient MLE, which results primarily from deficient family interaction. MLE is the vehicle for intergenerational transmission of culture. Jensen and Feuerstein (1992) state that the development of higher cognitive functioning is highly dependent on the individual's exposure to MLE. If MLE is successful, a high degree of modifiability is achieved, while unsuccessful MLE could result in deficient cognitive functioning in all three phases of the mental act – Input, Elaboration and Output. These deficiencies interact with emotional issues such as negative self-perception and demotivation and create low manifest functioning.

Feuerstein conceptualized mediated learning as the "proximal determinant" of cognitive development (Kozulin and Presseisen, 1995: 69). Other factors, such as organic factors within the individual, as well as environmental factors, serve as distal elements, becoming negatively intrusive if MLE is ineffective or not provided. Feuerstein *et al* argue that failure to take these distal factors into account, by recognising them as possible intrusive elements in the assessment and, by extension, denying children access to non-restrictive education, serves to perpetuate inequality. Therefore, dynamic assessment seeks to provide the

opportunity to overcome the negative effects of these distal factors on performance by providing MLE within the assessment process.

1.2.4.4. The LPAD as a research instrument

The use of the LPAD in research necessitates a shift in the understanding of traditional research concepts, such as validity and reliability.

Haywood and Wingenfield (1992) outline the limitations of using traditional standardized instruments which are static by nature. Their belief is that one can only develop a true understanding of learning by exposing individuals to situations where change is necessary and then examining how the individuals cope with this change. The authors argue that the LPAD provides a rich source of verbal interaction. The purpose of DA in research is to provide information on the "zone of actual development". The intervention then allows for post-test analysis of not only near-transfer (the ability to apply what has been learned to similar tasks), but also the amount of change and the conditions necessary to provide that change.

The main concern highlighted by Haywood and Wingenfield, is the need for reliable and valid psychometric properties in DA. They state that DA instruments have been shown to be reliable when administered in static mode. The problem found is the reliability of inferences made from mediation, especially with regard to inter-rater reliability. This concern is also raised by Frisby and Braden (1992), who state that a review of studies demonstrates inter-rater reliability to be far below minimal standards. In addition, criticisms regarding the validity of DA have been raised by Haywood and Wingenfield (1992), Frisby and Baden (1992) and Jitendra and Kameenui (1993). Frisby and Braden state that the construct "potential" cannot be measured within the sphere of scientific demands. They question the feasibility of 'structural' changes, as conceived by Piaget, through mediation. They claim that the changes observed in DA represent superficial behavioural changes, rather than the enduring changes described by Piaget.

Tzuriel (1992) replies to the critique of Frisby and Braden by stating that their approach draws largely on a biological paradigm, whereas Feuerstein draws on a sociological

paradigm. Tzuriel emphasises that the structural changes referred to in DA are related to the quality of problem-solving techniques when the individual is in an environment conducive to enhancing such techniques. Lidz (1997) states that traditional notions of reliability are not necessarily applicable to DA, because the premise of DA is to encourage change rather than seek stability. Furthermore, according to Lidz, predictive validity can be found in the comparison of post-test scores, after intervention, with achievement tests, but emphasises further that true validity can only be achieved by ensuring that the classroom instruction that follows the assessment, flows directly from the findings of the dynamic assessment process.

1.2.4.5. Group administration of the LPAD

Group DA has been described as efficient and economical. Tzuriel (1992) states that group DA can provide a screening mechanism to assess the amount of intervention the child will need at school. Rand and Kaniel (1987) state that the purpose of group DA is to activate learning and provide favourable conditions for intervention. However, they stress that the group administration should provide only a precursor to further investigation, and should not form the basis for decisions. According to Lidz (1991), group DA can provide valuable information to teachers regarding learners in need of individual attention. Rand and Kaniel also state that group testing can provide information on how children should be grouped in classes in order to provide specific educational programmes to meet individual needs. Tzuriel and Feuerstein (1992) and Feuerstein *et al* (1979) found group DA useful for identifying favourable conditions for effective mediated learning with disadvantaged children.

1.2.4.6. Further relevant research on the LPAD

Research has shown the usefulness of the LPAD with a wide range of populations with special needs. Tzuriel and Kaufman (in press) performed a study to examine the effect of DA on low-performing Ethiopian immigrant children, and found that the Ethiopian immigrant children demonstrated greater improvement in performance than the Israeli-born group, and were able to close the gap in their scores. Similar results were found by Kaniel *et al* (1991). Skuy, Kaniel and Tzuriel (1988) found that the LPAD was a more useful

indicator of giftedness in low socio-economic status children than standard testing. Keane and Kretschmer (1987) performed a study of DA with severely to profoundly deaf children. The authors concluded that the cognitive deficiencies prevalent in the population of deaf students can be overcome through mediation.

1.2.4.7. Research on the LPAD in South Africa

Local studies have provided evidence for the specific usefulness of the LPAD in the South African context amongst population groups with differing educational needs.

Skuy and Shmukler (1987) compared the performance of "Coloured" and Indian adolescents from low socio-economic status areas, and found that the group who were found to be most lacking in MLE, due to family and social variables, made important gains on many of the independent measures. Skuy, Archer and Roth (1987) used a case study to demonstrate how the LPAD as an assessment model can also provide the tools for remediation of a learning problem. The authors conclude that the study provided evidence that the LPAD not only demonstrated cognitive modifiability, but also provides the basis for remediation of scholastic impairment.

In a study on temperament and cognitive modifiability, Skuy *et al* (1990), sought to examine the relationship between temperament, as a stable personality construct, and modifiability. The study provided evidence of how LPAD findings, in cognition and personality variables, can be utilised to inform approaches in teaching. Furthermore, in a study of adolescents from a gifted child programme, Skuy *et al* (1990) concluded that certain tasks from the LPAD may be useful in identifying potential candidates for a gifted programme.

While these studies provide positive implications for the use of the LPAD in the South African context, they are limited by their application to particular populations. This study expanded on this research, within a township clinic setting, with black children who are perceived to have learning problems.

CHAPTER TWO : THE STUDY

2.1. Rationale and Aims

2.1.1. Rationale for the study

Assessment practices have been criticised, both in the South African context and internationally, because they have failed to adequately address socio-cultural differences. In line with international trends, research in South Africa has demonstrated the ineffectiveness of traditional instruments to predict learning ability in children who have been educationally disadvantaged. An alternative approach is suggested by the philosophy of dynamic assessment. This philosophy challenges the view that the locus of learning problems is primarily within the child, which provides a poor prognosis for educational achievement. The optimistic approach of DA serves to negate this perception by recognising the impact of external socio-cultural factors on the development of cognitive dysfunctions, and by recognising that, through mediation, these cognitive dysfunctions can be modified to improve the child's learning ability.

Learning difficulties are therefore seen as being rooted in ineffective learning environments and inadequate exposure to mediation. As a result, while traditional assessment instruments will uncover deficits in cognitive reasoning ability, dynamic assessment seeks to explore the child's ability to learn, if given adequate mediation. This study seeks to contribute further to the exploration of dynamic assessment in the South African context. Owing to the challenges of the environment in providing adequate mediation, however, a sole focus on quantitative improvements would provide only limited insight into the modifiability of the children. The study therefore provides added insight into cognitive processes by exploring the improvement in the quality of responses to further support the mediation process.

The new education policy calls for a curriculum which is centred around outcomes-based learning. This relies on an approach which is inherently process-based rather than content-based. It is necessary, therefore, for assessment practices to provide information which will assist in determining the necessary outcomes for each child, based on his or her strengths and weaknesses. Dynamic assessment provides a mechanism for facilitating the realisation

of such outcomes, by invoking the mediation process as a basis for discovering learning potential. Previous studies have provided insight into the usefulness of the LPAD with certain South African populations, but have not specifically addressed the needs of the general black school-going population. This research takes the South African research a step further by investigating modifiability within a township context, thus providing further evidence of the usefulness of dynamic assessment as an alternative means of acquiring information which will better direct the child's educational intervention.

2.1.2. Aims of the study

Based on the rationale provided above the specific aims of the research are therefore as follows:

1. To examine the adaptability and usefulness of DA in a South African township context.
2. To evaluate the extent to which the mediation process used will be useful in providing a measure of the educationally disadvantaged child's modifiability.
3. To test the usefulness of the Lurie and Kozulin Qualitative Scoring Method as an outcome measure for dynamic assessment.

2.1.3. Hypotheses

The following hypotheses were formulated:

1. Children who perform below average on the Raven's Coloured Progressive Matrices (RCPM), a test of non-verbal intellectual reasoning, will improve their performance significantly once they have undergone a brief process of mediation, utilising the teaching tasks provided in the LPAD, when compared with a group who receives no such intervention.
2. Children who perform below average on the Rey-Osterrieth Complex Figure Test (ROCFT), a test of perceptual organisation and visual memory, will improve their performance significantly, once they have undergone a brief process of mediation as outlined in the LPAD, when compared with a group which receives no such intervention.
3. The quality of responses provided by the children who received mediation will improve significantly on both tasks, in comparison with the children who received no meditation.

This is measured by the child's ability to provide a more accurate and appropriate response following mediation, as measured by the Lurie and Kozulin Scoring Method (1996).

4. The children who receive mediation on the ROCFT will be able to transfer the skills acquired to a similar figure. This transfer will be reflected in the quality of their performance on the similar figure, when c ɔmpared to that of the group that receives no mediation.

2.2. Method

2.2.1. Sample

The sample for the research comprised 72 subjects who were referred to the Child and Adolescent Psychiatric Unit, Baragwanath Hospital for psychoeducational assessment. The subjects were all from the broader Soweto area and were assigned as follows:

- An Experimental Group, consisting of 48 children between the ages of 9 and 15 years (mean age = 10.96).
- A Control Group, consisting of 24 children between the ages of 9 and 15 years (mean age = 10.96).

Due to the fact that the mediation process involved considerable time, the Experimental Group was completed first, and the Control Group was selected afterwards to match the Experimental Group. All subjects were assigned to the research programme once a full intake questionnaire had been administered. In general, these children had all been referred to the unit because they are experiencing problems relating to scholastic progress. The reason for referral i.e. primarily a scholastic difficulty, and the child's age, were the primary criterion for inclusion in the programme. The only reason why a child was not included, was where it was felt that the child's difficulty was not related to a learning problem, or it was agreed that the child was explicitly intellectually disabled, based on clinical screening, they were not included.

2.2.1.1. Breakdown of presenting problems of the sample

The referrals came from teachers, community health centres, social workers and paediatricians. The primary presenting problem was that the child is a "slow learner". Overall, therefore, teachers seemed to have a predominant perception that the children being referred were poor in all subjects. Stemming from this belief was a further widespread belief that these children should be referred to special schools. Table 2.1. represents a breakdown of problems reported by the teachers concerning the child's performance at school.

Table 2.1. Breakdown of presenting school problems

Reported School Problem	Experimental Group (n=48)	Control Group (n=24)	Total (n=72)
Generally Poor in all subjects	41 (85%)	20 (83%)	61 (85%)
Behavioural Problem	9 (19%)	6 (25%)	15 (21%)
Social Problems*	17 (35%)	8 (33%)	25 (35%)
No Behav/Social Problems**	22 (46%)	10 (42%)	32 (44%)

*These children were reported as having social problems, either isolating themselves and withdrawing from social interaction, or only playing with children younger than themselves. Many of these children are described as being emotionally immature and not accepting responsibility for tasks.

**These children are described as being responsible children, and being able to mix easily with groups of children of their own age. Their only presenting problem, as far as the teachers are concerned, is their inability to make scholastic progress.

A breakdown of the children's scholastic progress, as found on Table 2.2., gives further impetus to the crisis.

Table 2.2. Breakdown of scholastic progress according to years repeated

Number of Repeats	Experimental Group (n=48)	Control Group (n=24)	Total (n=72)
At Least One Repeat	44 (92%)	22 (92%)	66 (92%)
More than one repeat	33 (69%)	13 (54%)	46 (64%)
Repeat of Every year	14 (29%)	6 (25%)	20 (28%)

While some of these children (n=16) have migrated to English-medium schools in central Johannesburg and its surrounding suburbs, all the children had begun their formative schooling in Soweto. In addition, it is clear that those children who have left townships schools are experiencing learning problems in their new schools. This is evidenced by the fact that they were referred to the Unit at Baragwanath Hospital for assessment. Overall, a basic factor underlying these statistics is that there is a clear lack of early identification practices for learning difficulties in township schools. It is believed that this is due to a number of factors, including:

1) a lack of specialised support services in township schools under apartheid,
2) a lack of adequate training of teachers in the identification of learning problems,
3) a general apathy among teachers to confront these children's learning problem which has resulted in many children being promoted to higher standards despite not passing the year, and
4) inadequate understanding on the part of parents of their children's learning difficulties, probably resulting from the general feelings of disempowerment that apartheid has created.

2.2.1.2. Family background of the sample

This disempowerment of parents is evident in the home circumstances of the sample. One of the most glaring statistics is that 63% of the children come from single parent households. In addition, 53% of the children have little or no contact with at least one of their parents. In almost all the cases, the absent parent is the child's father. Table 2.3. demonstrates the subjects' family status.

Table 2.3. Status of family

	Experimental Group (n=48)	Control Group (n=24)	Total (n=72)
Single Parent Household	30 (63%)	15 (63%)	45 (63%)
Dual Parent Household	18 (37%)	9 (37%)	27 (37%)
One Absent Parent/ Little or No Contact *	26 (54%)	12 (50%)	38 (53%)

*excludes deceased parents

A prominent difficulty is that many of these parents are unable to provide adequate support to their children, with regard to schoolwork. This is largely due to the fact that many of the parents have very limited exposure to education themselves. Only two parents reported having any post-matric qualification. The following table represents a breakdown of educational status of the parents.

Table 2.4. Educational status of households

Level of Education of Parents	Experimental Group (n=48)	Control Group (n=24)	Total (n=72)
One parentt with at least Matric	12 (25%)	7 (29%)	19 (26%)
One parent with at least Std 9	11 (23%)	6 (26%)	17 (24%)
One parent with less than Std 8	25 (52%)	11 (45%)	36 (50%)

According to the Human Development Index for South Africa, 1991, the mean years of schooling for the black population as a whole is 5.53 years. The mean number of years of schooling for parents in this study who have some active participation in the subjects lives (n=106), is 7.33 years. Considering that statistics for the Gauteng province are usually higher than the average for South Africa as a whole, this seems to be a reasonable correlation of the Gauteng black population. Table 2.5. represents the unemployment rate amongst these parents, in comparison to the general Gauteng black population (Source : Central Statistical Services, October Household Survey - 1995).

Table 2.5. Unemployment rate amongst parents

	Experimental Group (n=73)	Control Group (n=33)	Total	Gauteng Black Population
Total	30.1%	27.3%	29.24%	20.9%

Overall, 61% of the children come from a family circumstance where there is at least one supportive parent who is in a stable job or profession. The rest have to rely on extended family for support. For single parents this places an extra burden. Table 2.6. demonstrates the extent to which single parents are able to provide an income to support their children. In many cases, those working in the informal sector did not have stable work and made

very little money. These unemployment figures are significantly high considering the total number of unemployed black women in the Gauteng area is around 26.8% (Source : Central Statistical Services, October Household Survey -1995).

Table 2.6. Employment status of single parent households

Employment Status of Parent	Experimental Group (n=30)	Control Group (n=15)	Total (n=45)
Formal Sector	8 (27%)	5 (33%)	13 (29%)
Informal Sector	5 (17%)	3 (20%)	8 (18%)
Unemployed	17 (56%)	7 (47%)	24 (53%)

Of the seventy two children, only twenty seven parents (38%) indicated that there are family problems at home. Thirty of the children (42%) were reported by parents to have behavioural problems at home, mostly relating to taking responsibility for tasks, including the completion of homework and household chores. Only six of these children were reported to have more serious behavioural problems, such as stealing, playing truancy and substance use.

2.2.1.3. Implications of sample characteristics

The factors highlighted above provide an indication of many school and home-related difficulties, which may impede the effectiveness of mediation of the tools necessary for successful development. It is also important to emphasise that the system of apartheid has had devastating effects on family and community structures. Furthermore, many family members themselves never received adequate educational instruction, being victims of the 'bantu' education system. This data provides a microcosmic outline of some of the after-effects of this system. This data also masks the extent to which family values still play a vital role in the child's development. Many of these parents are deeply concerned for their children's well-being and have made, and are willing to make, many sacrifices for them. In addition, the support of the extended family is essential where the mother has been unable to provide such support to the child, either because she works long hours, or because she has not been lucky enough to receive sufficient formal education to provide her child with

the support he or she requires. Therefore, the conditions for MLE do possibily exist within this context and this is important for the success of the dynamic assessment.

2.2.2. Measures

2.2.2.1. The Raven's Coloured Progressive Matrices (RCPM) (Raven, 1965)

The Raven's Standard Progressive Matrices (RSPM) (Raven, 1958) and the Raven's Coloured Progressive Matrices (RCPM) have popularly been used as "culture-free" non-verbal measures of intelligence. The RCPM consist of 36 items, divided into three sets, which measure pattern completion, gestalt closure and analogical reasoning. The subject is required to complete the part of the matrix that is missing by recognizing the relationships involved. In being progressive, the items progress from fairly simple to more complex operations.

Raven, Court and Raven (1990) provides norms for the RCPM based on a 1986 study of school-going children in the United States of America. These norms are based on separate samples from various parts of the USA, and Sattler (1988 : 310) states that they "..are probably representative of the school-age population." Sattler also quotes adequate test-retest reliability for the RCPM and RSPM, ranging from .71 to .93. Furthermore, according to Sattler, adequate concurrent validity, involving white, black, Mexican-American, American Indian, deaf and mentally retarded children, has been found on the RCPM and RSPM when compared to intelligence tests (.50s to .80s) and achievement tests (.30s to .60s). According to Raven *et al* (1990), the RCPM is an appropriate test to measure cognitive development up until the stage where the subject is able to reason by analogy across a range of tasks. Wright, Taylor and Ruggiero (1996: 739) also state that, owing to the inappropriate nature of standardised intelligence tests in a population who are not first language English-speaking, the RCPM "...is especially conducive to research in a multilingual and multi-cultural setting." This is based on the fact that the format of the test minimizes the impact of situational variables.

Studies have demonstrated that the Raven's Matrices is not an accurate measure of intellectual ability within a cross-cultural context (Feuerstein *et al*, 1979; Kaniel and

Fisherman, 1991; Wright, Taylor and Ruggiero, 1996). In addition, various studies utilising the Raven's Matrices and mediation tools, have demonstrated that the performance of subjects on this instrument, who have not received sufficient mediation in their development due to socio-cultural variables, can become comparable with subjects from populations who have been exposed to sufficient mediation (Feuerstein *et al*, 1979; Tzuriel and Feuerstein, 1992; Tzuriel and Kaufman, in press). Further studies have demonstrated that the Raven's Matrices, as a static measure, does not provide an adequate measure of intellectual ability amongst "special" populations (Feuerstein, 1979; Budoff, 1987; Campione and Brown, 1987; Carlson and Wiedl, 1992; Keane and Kretschmer, 1987; Skuy, Kaniel and Tzuriel, 1988). These studies demonstrated that, through a process of mediation using tasks adapted from the Raven's Matrices, the functioning on the Raven's Matrices can be improved and the learning potential of these "special" children can thus be uncovered. Therefore, while the Raven's Matrices have proven useful in measuring intellectual ability amongst certain populations, its applicability across cultures is limited. However, its format lends itself as a useful instrument for identifying modifiability in different cultures, if used as a DA tool.

2.2.2.2. The Rey-Osterrieth Complex Figure Test (ROCFT) (Rey, 1959)

The ROCFT involves a complex geometric figure, consisting of a large rectangle equally divided into eight parts by two intersecting lines and diagonals with various details. The subject is asked reproduce the figure, firstly by copying, and then from memory. The purpose of this test is to measure perceptual organisation, visual memory, visual-motor co-ordination, and planning. The ROCFT is scored on a 36-point scoring system (Lezak, 1995), based on the 18 different units which make up the figure. Two points are awarded for each unit which is present and correctly placed. One point is awarded if the unit is correct, but is placed incorrectly within the figure. No points are awarded if the unit is not present or does not sufficiently resemble the unit. A maximum of 36 points can be achieved. The unit scoring system was normed by Osterrieth in 1944, through data obtained from 230 "normal" children aged four to fifteen. The copy and memory scores are measured according to an accuracy score and an organisation score.

An alternative Developmental Scoring System (DSS) has been developed by Bernstein and Waber (1996) according to the following components: Organization, Style, Accuracy and Error. Inter-rater reliability studies using the DSS have reported inter-rater agreement at 95% (Waber and Holmes, 1985 as cited in Chen and Cermak, 1998). High inter-rater reliability has also been established for Organization and Style components. According to Chen and Cermak (1998), a systematic study of the construct validity of the ROCFT has not been undertaken. However, the authors quote research with children which have demonstrated valid developmental scores for visual construction and visual memory, as well as validity for the measurement of planning and organisation in children. These studies provide evidence for the validity and reliability of the various components being measured on the ROCFT.

2.2.2.3. The LPAD

The LPAD consists of a battery of instruments aimed at both individual and group administration. The assessment tools have all been designed or adapted according to the LPAD model which comprises the interaction of operations, cognitive functions and modality. A consistent feature of the LPAD instrument is that they all contain an initial task for the purpose of assisting the subject in gaining the underlying principle. The subsequent tasks then increase in complexity and novelty in order to assist the subject in achieving mastery over the task.

The Set Variations I consists of a series of five items. These items consist of tasks involving analogical reasoning, similar to those found on the Raven's Matrices. Each item contains a model task, for the purpose of initial mediation, and six variations. The mediator can provide mediation with each task, but should allow the subject to attempt the task on his or her own. The ROCFT also forms part of the LPAD battery. In the dynamic mode of the LPAD, this test is used to mediate skills which will assist the child to memorise, organise and plan. In addition, Feuerstein developed a set of nine Equivalent Figures for the purpose of measuring transfer. An Equivalent Figure was selected from this set and is utilised here for this purpose.

Tzuriel (1992) cites a number of studies involving a variety of population groups which validate the dynamic approach. Using a test-teach-test approach, these studies demonstrate the effectiveness of the LPAD in identifying cognitive modifiability. These include studies amongst disadvantaged children (Tzuriel and Feuerstein, 1992, Skuy and Shmukler, 1987), Ethiopian immigrants (Kaniel *et al*, 1991) and amongst "special" populations, including deaf children (Keane and Kretschmer, 1987) and gifted children (Skuy, Kaniel and Tzuriel, 1988; Skuy, Gaydon, Hoffenberg and Fridjhon, 1990).

These studies all demonstrate the impact of intervention in improving scores, unlike groups who do not receive such intervention. Haywood and Wingenfield (1992) describe this as providing short-term validity for dynamic assessment, but not necessarily providing long term information. However, these findings provide support the cognitive modifiability hypothesis. In addition, Tzuriel (1992) refers to Jensen's (1990) findings of validity for the "cognitive map" at each phase of the mental act (input, elaboration, output and metacognition), using Feuerstein's list of cognitive functions. Tzuriel also cites Shapiro (1991) and Shochet (1992) to provide evidence of how DA is a better predictor of learning ability than static instruments. This is also support by Samuels, Killip, MacKenze and Fagan (1992, cited in Haywood and Wingenfield, 1992)

Haywood and Wingenfield (1992) state that the LPAD and related testing instruments have demonstrated adequate internal consistency and test-retest reliability when administered in static mode. Lidz (1997) emphasises that traditional notions of reliability are not appropriate for DA. While intra-test reliability for pre-test and post-tests is important, high test-retest reliability would invalidate the DA process as DA seeks to bring about change rather than stability. Haywood and Wingenfield highlights the difficulties in obtaining inter-rater reliability and feel that this should be a primary area of focus for research on DA. Tzuriel (1992) refers to a study by Samuels (1989), where inter-rater percentage of agreement was 87.6% for deficient cognitive functions and 91.6% for type of mediation.

In order to achieve cognitive modifiability on the LPAD the role of mediation is crucial. Mediation on the LPAD is outlined by Feuerstein *et al* (1979) and involves the development of relationship between the examiner and the child which is conducive to learning. The mediator seeks to explore with the subject the skills necessary to succeed on

the task, to encourage reflection by the child, and to provide feedback on the child's learning process. Mediation is achieved by not only focusing on the techniques of the task itself, but by making the task more meaningful for the child by applying its purpose to other tasks and situations. Various studies supporting the validity of MLE are cited by Tzuriel (1992), including mother-child interactions (Tzuriel and Eran, 1990; Tzuriel and Ernst, 1990) and teacher-pupil interactions (Tzuriel and Gross, 1992)

2.2.2.4. Lurie and Kozulin's qualitative analysis of matrices

Lurie and Kozulin (1996) developed a set of matrices and system of analysis which provides more precise insight into deficient cognitive functions. This system operates according to the phases involved in problem solving, being, 1) Definition of the problem; 2) Identification of the basic principle of the problem; 3) Implementation of the principles using multiple sources of information; and 4) Precision in the response.

Lurie and Kozulin designed the V-LL matrices with these four phases in mind, by allowing the rater to assign a score according to which phase of problem-solving is being utilised to solve the problem . The items provide for responses, which correlate with these phases in such a way, that the responses provided can each be analysed and the level at which problem solving is failing can be clearly identified. The responses are therefore divided into four groups:

1. "Absurd" responses, which are not possible given the particular task.
2. "Trial-and-error" responses, where the child makes an attempt to solve the problem by recognising certain elements, but the principle of the task has not been understood.
3. "One dimensional" responses, where the child has taken chosen some parameters correctly, but certain sources of information have been neglected.
4. "Near Hit" responses, where the child has recognise all the elements but one minor part of the task was missing due to impaired self-evaluation and fine perceptual discrimination .

This scoring method was used in this study to provide a qualitative analysis of the subjects' performance on the RCPM and the ROCFT, in order to investigate the impact of mediation in improving problem-solving skills. The scoring system is useful for analysing the extent to

which mediation will improve the level of problem-solving utilised to solve the task, so that more insight can be gained into the modifiability of the subjects' cognitive functioning.

2.2.3. Procedure

2.2.3.1. The process of dynamic testing with the RCPM

The following procedure was applied:

- The children were asked individually to complete the RCPM (Set A, Ab and B) according to the normal instructions for the test.
- Groups of children were then put through the process of mediation with items from the LPAD Set Variations I. The groups consisted of a maximum of five children. The amount of time spent on mediation depended on the level of the children as some children acquired the skills quicker than others.
- The children were then asked to again complete the RCPM (Set A, Ab and B) without assistance. This serves as a post-test score to measure immediate transfer of the cognitive skills learned.

The Control Group was asked to complete the RCPM twice, but received no group intervention.

Originally, the procedure decided upon for the dynamic testing on the RCPM, was to pre-test the children at least four to five days before the group intervention. Owing to the conditions in which the testing was taking place, it became necessary to include children in the group intervention who could only be pre-tested on the same day. As such, it was decided to control for this variable, and the final sample was divided into two groups, the first being the group which had been pre-tested on a previous occasion, and the second group being those children who had been pre-tested on the same day as the intervention. This same procedure was utilised for the Control Group.

2.2.3.2. Mediation with the Set Variations I

Initial mediation with the Variations I is guided by the subject's level of functioning, both generally and on the test. In the preparatory stages the primary goals are to define the problem, focus on the task, set rules, regulate behaviour and identifying the sequence required to perform on the task. Once the subject has completed the task, post-performance mediation can be undertaken. The goal of this stage of mediation is to assist the subject tc become more aware of his/her cognitive processes in order to become more clear on the nature of the tasks and how to use this knowledge to complete further tasks. The development of insight is crucial to ensure the subject is able to integrate and apply what they learned. With regard to this sample, a fairly intensive level of mediation was required, involving repeated reference to the rules of the task and to self-regulation of behaviour, mostly because the subjects struggled to understand the concepts involved and to work independently after initial mediation. Nursing staff translated the mediation for those subjects whose English was poor.

2.2.3.3. The process of dynamic testing with the ROCFT

Dynamic testing on the ROCFT also took place in a group setting. The ROCFT in dynamic testing mode involves seven stages. At each stage the children are asked to use four different coloured pens, which they must alternate at thirty second intervals to demonstrate the chosen strategy used, and how this strategy changes. The order of use of the coloured pens remains standard for all the children.

- The children were asked to copy the figure directly from sight.
- The children were then asked to reproduce the figure from memory.
- The examiner mediated a proposed approach to completing the figure. The level of mediation depended on the extent to which the children required more or less teaching to perform the task.
- The children were asked to produce a second copy from sight.
- The children were asked to reproduce a second copy from memory.
- The children were then asked to copy a second, Equivalent Figure from the LPAD, from sight.

- Finally, the children were asked to reproduce the selected Equivalent Figure from memory.

The purpose of the final two stages is to examine the extent to which the child is able to transfer the skill acquired to a similar, but novel, task. The Control Group was asked to reproduce the complex figures in a similar manner, without the group mediation stage. All the children were pre-tested and post-tested on the same day.

2.2.3.4. Mediation with the ROCFT

Mediation on the ROCFT involves the learning of spatial relationships, organization and sequencing. There are four possible levels of mediation, and the level chosen depends on the performance of the subject.

1. Minimal mediation, which focuses on awareness of organization.
2. This level involves focusing on the major components of the figure, and showing how they apply to overall organization.
3. The mediator introduces the first components and the subjects are then expected to complete the figure.
4. This level involves working through the figure piece by piece.

For the purposes of this sample, it was necessary to use the third and fourth level of mediation. Again, the nurses assisted in translating the process for those subjects who had poor English.

2.2.3.5. The implications of the mediation process

The purpose of the mediation process is two-fold. Firstly, it allows for improvement on the tasks first introduced in the pre-test. Secondly, it allows for the transference of skills which may be useful to the child in learning tasks. While it is difficult to measure the long-term utility of the mediation, it does provide a guideline for the ability of the child to gain such knowledge if given the necessary interaction. Ultimately, this assists in predicting the child's success, and making decisions around the provision of his or her programme for learning.

2.3. Experimental Design

The research involved an Experimental Group, who received mediation, and a Control Group, who received no mediation. Quantitative data analysis was achieved through comparison of pre-test and post-test scores for both instruments used, with and without mediation.

2.3.1. Statistical methods used to analyse the RCPM results

The RCPM results are divided according to the day in which pre-test occurred, as follows:

- Experimental Group (Different Day),
- Experimental Group (Same Day),
- Control Group (Different Day),
- Control Group (Same Day).

In order to successfully examine the modifiability hypothesis on these four groups, a two-way analysis of co-variance (ANCOVA) was undertaken on the scores achieved, with the pre-test as co-variate. The ANCOVA is used because of the variability in pre-test scores. These pre-test scores are partialled out, and the means are adjusted. The significance of the difference between these adjusted means can then be analysed.

This statistical analysis served to examine the mediation effects on the Experimental Groups, and to examine whether having performed the pre-tests on the same or different day as the post-test negatively affected the group results. The ANCOVA was then also applied to the RCPM B8-B12 scores, which are items closely related to the mediation process. In addition, a qualitative analysis was undertaken on the results of the pre-test and post-tests to measure the level to which the children were able to make use the knowledge learned, to improve the quality of their response. In order to achieve this, the Lurie and Kozulin Scoring Method (1996) was applied to items B8-B12.

A check of inter-rater reliability among three independent raters was undertaken to assess the application of these levels to the tasks, and analysed utilising the Kappa (κ) measure of

inter-rater agreement. The Kappa (κ) statistic is a measure of agreement between independent raters according to certain categories. These raters would be able to assign the subjects to a particular category or across categories. The level of agreement can be high or can appear random. The Kappa co-efficient measures the proportion of times the raters agree, to the maximum times they could agree. The Kappa (κ) statistic was further used to compare the degree of pre-post test change amongst the qualitative responses of the Experimental and Control Groups. The κ statistic provides a measure of agreement. The lower the agreement for each group, the more change is evident for that group. This change would represent a shift in the representation of responses within the four levels.

2.3.2. Statistical methods used to analyse the ROCFT results

The ROCFT results were analysed using a one-way ANCOVA, with the pre-test as co-variate. Again, the pre-test effects were explored, by adjusting the means once the pre-test results were excluded. This statistical method was then utilised to explore the mediation effects on the groups, on the copying and memory tasks of the ROCFT, respectively. There was no day variable present in this analysis as all subjects were pre-tested on the same day. The concern was to analyse both the results of the copying and memory tasks according to the overall scores, as measured using the 36-point unit scoring scale.

A qualitative analysis was further undertaken utilising a similar approach to that of the RCPM. The four levels of analysis were again applied in a slightly modified format, and an inter-rater reliability test amongst three raters was again performed, using the Kappa (κ) statistic. The κ statistic was again used to assess the degree of change amongst the qualitative responses to gain a more in-depth insight into the shift in responses.

CHAPTER THREE : RESULTS

3.1. Results on the RCPM

3.1.1. Quantitative Analysis

The Means and Standard Deviations for the four groups (n=72), according to the overall Pre-Test and Post-Test scores on the RCPM are presented below.

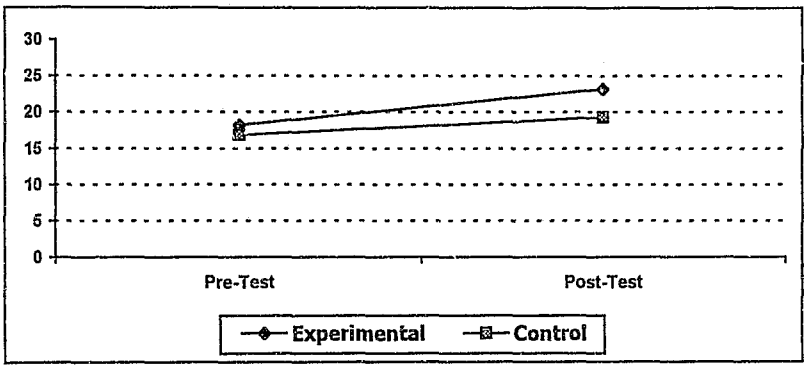
Table 3.1. Means and Standard Deviations for overall RCPM results

	Experimental Group Same Day		Control Group Same Day		Experimental Group Different Day		Control Group Different Day	
	Pre-Test	Post-Test	Pre-Test	Post-Test	Pre-Test	Post-Test	Pre-Test	Post-Test
X	16.71	22.21	15.75	20.00	19.71	24.25	17.92	18.58
SD	4.23	8.85	5.15	5.82	5.37	8.48	4.58	5.26

These results represent the total scores on the RCPM, when the totals of all correct answers (A1-B12) are calculated. The general trend of these scores suggests noticeable shifts for all groups except the Control Group – Different Day. However the standard deviations suggest greater variability in the post-test scores of the Experimental Group, which might suggest a more implicit shift in this group's approach to the task.

The two-way ANCOVA analysis included the post-test scores, the pre-test scores, the Experimental/Control groups, and the pre-test days, as variables. The ANCOVA did not yield a significant result for the mediation ($F(1,67) = 2.92$, $p=0.919$). Graph 3.1. demonstrates the mean changes in the Control and Experimental Groups. Owing to the fact that the pre-test day did not produce a significant effect, the scores are combined. Despite the non-significant results obtained when comparing the overall scores of the two groups, the graph depicts a noticeable difference in the gradients, in favour of the Experimental Group.

Graph 3.1. RCPM pre-test vs post-test results for combined groups



While the impact of the intervention was not significant for the overall scores, based on the mean age of the subjects (10.96), the effect of the intervention process was to raise the scores of the Experimental Groups on the RCPM from just below the 10th percentile to just below the 25th percentile (1986 U.S. Norms). This would place the group at close to the average range For the Control Group, on the other hand, the scores remained below the 10th Percentile, placing them significantly below average. Furthermore, a more in-depth examination of the scores, reveals that while the intervention did not assist all the subjects, the post-test reflected a considerable increase in the number of subjects were able to score within the average range on the RCPM. This is defined as a score that falls within the range above the 25th percentile, and below the 75th percentile. This increase was not shown for the Control Group. Table 1.2. provides a breakdown of this change.

Table 3.2. Breakdown of number of scores within average range on pre-tests and post-tests

	No. of Ave Pre-test Scores	No. of Ave Post-test Scores
Experimental (n=48)	3 (6.25%)	22 (45.83%)
Control (n=24)	2 (8.33%)	2 (8.33%)

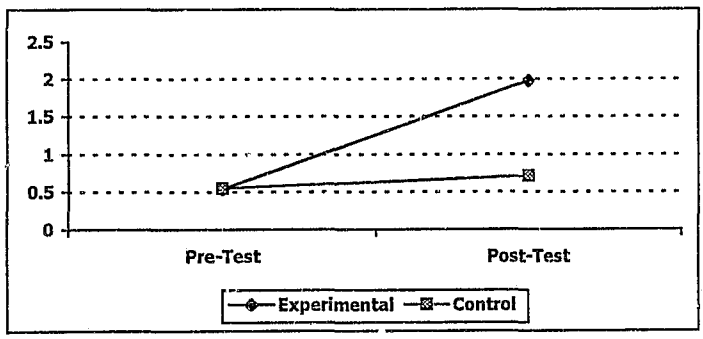
In order to examine the impact of the intervention further, an analysis was conducted on the correct responses on items B8-B12. The Set Variations I of the LPAD are most directly applicable to these items, which test analogical reasoning. Table 3.3. represents the means and standard deviations for the four groups on the B8-B12 items (n=72).

Table 3.3. Means and Standard Deviations for B8-B12 responses on the RCPM

	Expermental Group Same Day		Control Group Same Day		Expermintal Group Different Day		Control Group Different Day	
	Pre-Test	Post-Test	Pre-Test	Post-Test	Pre-Test	Post-Test	Pre-Test	Post-Test
X	0.08	1.75	0.42	1.00	1.00	2.21	0.67	0.42
SD	0.28	1.96	0.67	1.48	1.47	1.98	0.98	1.16

Here there was a shift in favour of the Experimental Group both with respect to the means and the standard deviations. Taking into consideration the psychometric difficulties of the small number of items, the ANCOVA of the B8-B12 post-test responses, using the same variables as on the previous analysis, revealed a significant result for the intervention ($F(1,67) = 8.56$, $p<0.01$), in favour of the Experimental Group. Graph 3.2 illustrates the significant impact of the intervention on B8-B12 items. Taking into account the small number of items, the results suggest a positive result for the mediation in achieving an improvement in performance on these items.

Graph 3.2. RCPM pre-test vs post-test results for items B8-B12



3.1.2. Qualitative Analysis using the Lurie and Kozulin Scoring Method

In order to assess the qualitative changes in the subjects' responses, it was necessary to adapt the scoring method suggested by Kozulin and Lurie to responses on the Raven's Coloured Matrices. This is due to the fact that these levels were designed for the V-LL matrices. A preliminary investigation of the reliability of such an exercise was undertaken. Three postgraduate psychology students were asked to rate the response items on the Matrices according to the levels as follows, 1)Absurd; 2)Trial-and-Error; 3)One-dimensional; 4)Near-hit; and 5)Hit.

An inter-rater reliability analysis was then initiated. Table 1.3. demonstrates the results achieved from the Kappa (κ) analysis of agreement. Unfortunately, the inter-rater reliability was found to be non-significant. This was found to be due to the following factors:

- The students were unfamiliar with the matrices
- The students lacked an understanding of the underlying principles behind the test.
- The students had different understandings of how the different levels should be applied.

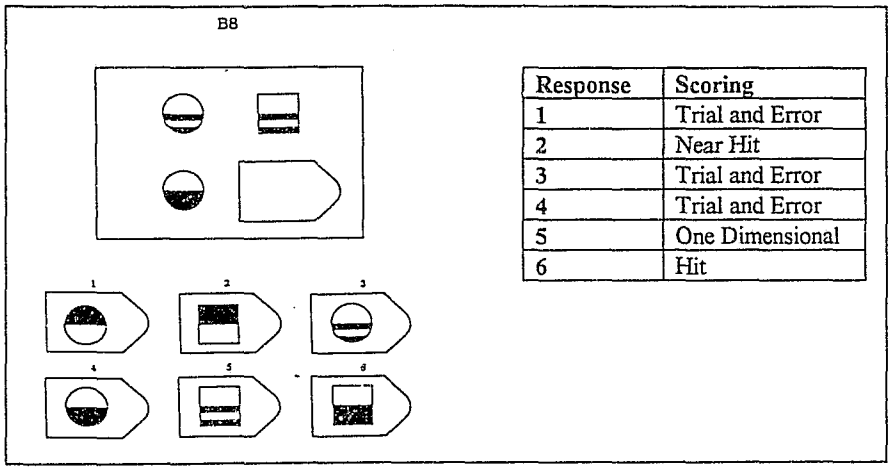
Table 3.4. Results of Kappa (κ) measure of inter-rater agreement for the RCPM

	Rater One	**Rater Two**	**Rater Three**
Rater One			0.335
Rater Two	0.377		
Rater Three		0.375	

While the attempt to establish reliability was hampered, it was nonetheless decided to apply the analysis method and provide a clear foundation for future reliability studies. As such, levels were applied to the item responses, in consultation with other mental health professionals who have a working knowledge of the test. As the Variations I is closely related to items B8-B12, the analysis is focused on these items. The qualitative levels were applied to the six potential responses for each of these five items. These outcomes were then applied uniformly to each subject.

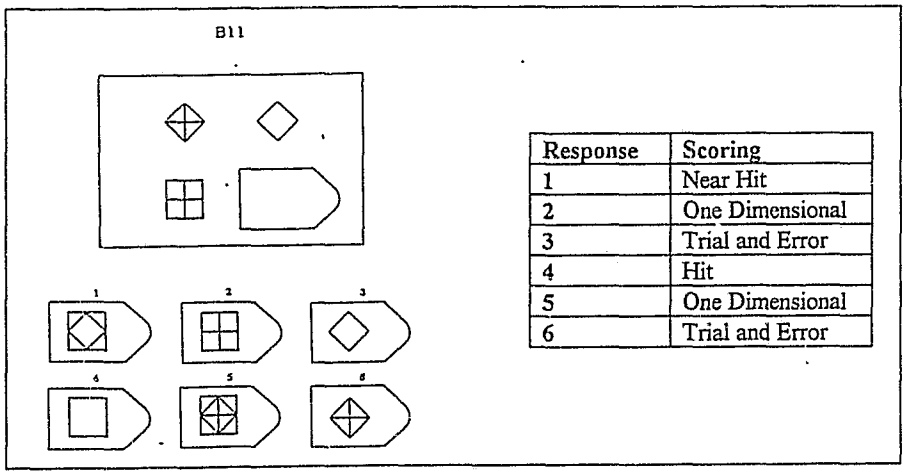
Figures One and Two provide examples of how the qualitative levels of analysis were applied to the items. As there are four levels of analysis and five potential responses, excluding the correct response, particular levels will have been assigned to more than one response for each item. The nature of tasks made it difficult to apply the levels, so the following approach was used. Trial and error responses were those where the subject did not recognise the need to change the shape of the pattern accordingly. One dimensional responses reflected those where the shape of the pattern was changed correctly, but the inner patterns were not adjusted correctly. Near hit responses were applied to responses which were close to the answer but had one incorrectly placed element.

Figure One: Application of Lurie and Kozulin's qualitative scoring method to item B8 of the RCPM



Response	Scoring
1	Trial and Error
2	Near Hit
3	Trial and Error
4	Trial and Error
5	One Dimensional
6	Hit

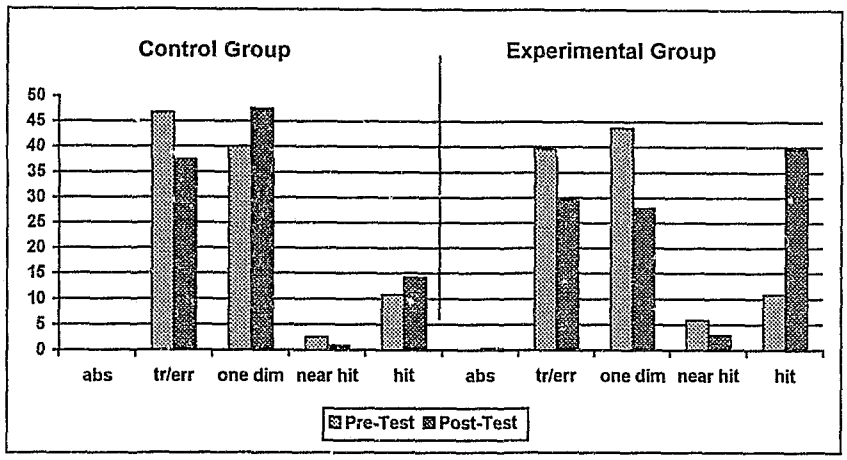
Figure Two: Application of Lurie and Kozulin's qualitative scoring method to item B11 of the RCPM



Response	Scoring
1	Near Hit
2	One Dimensional
3	Trial and Error
4	Hit
5	One Dimensional
6	Trial and Error

When the Experimental Group and the Control Group are seen together, as on Graph 1.3., there is a suggestion of a greater shift in the quality of responses for the Experimental Group over the Control Group.

Graph 3.3. RCPM B8-B12 responses according to qualitative scoring levels



A Kappa (κ) analysis of the level of agreement was then conducted on the B8-B12 qualitative scores, with the following results.

Table 3.5. RCPM Kappa (κ) results for pre-test and post-test qualitative levels

Item	Experimental		Control	
	Kappa (κ)	% Agreement	Kappa (κ)	% Agreement
B8	0.1035	35.42	0.189	58.33
B9	0.0988	37.5	0.5778	75
B10	0.0974	39.58	0.2237	54.17
B11	0.2749	50	0.5225	70.83
B12	0.1954	50	0.3778	70.83

As is evident from the results, the level of agreement of the pre-test and post-test scores was substantially different between the two groups. The lower level of agreement for the Experimental Group suggests a greater degree of change in responses after the intervention. The Control Group, on the other hand, demonstrated high levels of agreement, as high as 58%. This suggests low levels of change in responses for the Control Group.

According to Landis and Koch (1977, cited in Rudenberg, 1995), when a level of agreement is sought between two sources, the values of kappa should be understood as follows:

- 0.75 and above – excellent agreement beyond chance
- between 0.40 and 0.75 – fair to good agreement beyond chance
- below 0.40 – poor agreement beyond chance

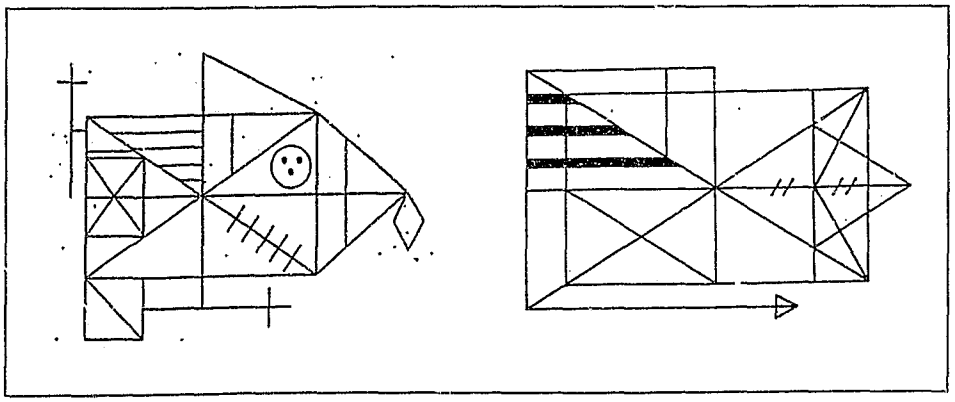
The application of these levels of analysis to the results obtained above provides a result in which all the Experimental Group comparisons fall into the level of poor agreement, while the B9 and B11 comparisons of the Control Group fall into the fair to good level of agreement. Overall agreement for the Experimental Group was 15.4%, while the overall agreement for the Control Group was 37.82%.

3.2. Results on the ROCFT

3.2.1. Quantitative Analysis

With respect to the ROCFT all the subjects were pre-tested on the same day. The Experimental Group received a group intervention after the Pre-Test Copying and Memory tests. As there is no scoring system for the equivalent figure, the analysis of this task focused only on the quality of the responses.

Figure Three: The Rey-Osterrieth Complex Figure and the Equivalent Figure Drawing from the LPAD



The table below represent the means and standard deviations for the Pre-Test and Post Test Copy and Memory tasks on the ROCFT for the Experimental Group and Control Group.

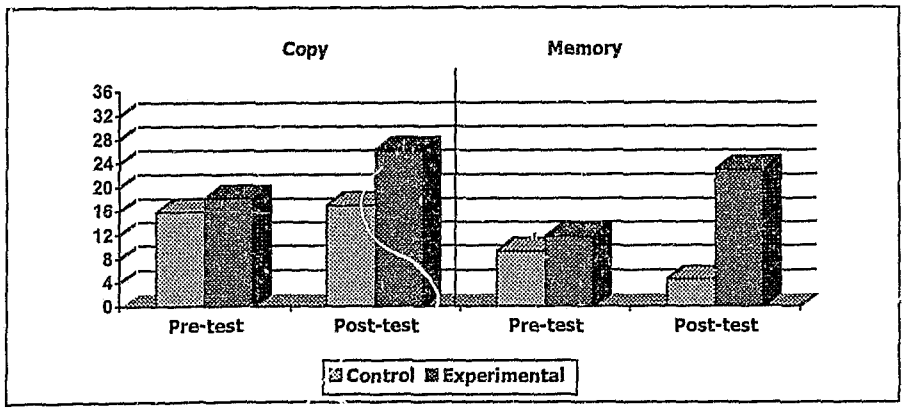
Table 3.6. Means and Standard Deviations for ROCFT responses

	Experimental Group - Copy		Experimental Group - Memory		Control Group - Copy		Control Group – Memory	
	Pre-Test	Post-Test	Pre-Test	Post-Test	Pre-Test	Post-Test	Pre-Test	Post-Test
X	18.17	26.25	11.76	23.00	15.85	17.00	9.25	4.59
SD	9.45	8.36	6.80	9.00	7.83	8.09	12.50	6.69

The mean scores suggest marked improvements in the scores for the Experimental Group on both the Copying and Memory tasks. The Control Group produced very little improvement on the Copying task and a decrease in scores on the Memory task.

The hypothesis that required testing related to the suggestion of improved performance of the Experimental Group, over the Control Group, on the ROCFT Copying and Memory tasks. In order to examine the significance of this improvement, one-way ANCOVA's were performed on the post-test results of both the Copying and Memory tasks, with the pre-test as a co-variate. The adjusted means yielded a significant result for both the Copying task ($F(1,69) = 30.46$, $p<0.0001$) and the Memory task ($F(1,69) = 31,96$, $p<0.0001$) in favour of the Experimental Group, thus providing a positive result for the intervention. Graph 2.1. demonstrates the trends found in the Copy and Memory tasks for the two groups.

Graph 3.4. ROCFT pre-test vs post-test results for Copy and Memory tasks



3.2.2. Qualitative Analysis using the Lurie and Kozulin's Scoring Method

As for the RCPM, to further investigate the significance of this result, a qualitative using the Lurie and Kozulin Scoring Method, was undertaken on the ROCFT. The raters were asked to rate a random sample of 12 Experimental Group responses and 6 Control Group responses. The results received from a measure of inter-rater agreement using the Cohen's Kappa once again produced a non-significant result. The reasons for the negative results were similar to those applicable to the RCPM (see p32). However, one additional problem was that the raters found it difficult to apply the levels of analysis to the ROCFT in the way that they had been defined for the matrices.

Table 3.7. ROCFT Kappa (κ) results for inter-rater agreement

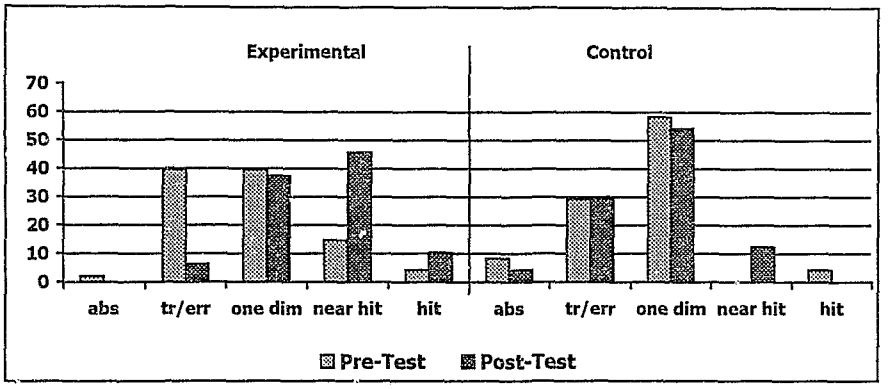
	Rater One	Rater Two	Rater Three
Rater One			0.248
Rater Two	0.424		
Rater Three		0.416	

It was therefore decided to re-define the levels of analysis to make them more applicable to the nature of the ROCFT tasks. The levels of analysis, as applied to the ROCFT results, were interpreted as follows:

1. Absurd - no form, fragmented
2. Trial and error - form and certain elements but principle not understood
3. One-dimensional – Attempt at systematic solution, some parameters chosen, but impaired planning
4. Near-hit, Minor Parameters overlooked, impaired self-evaluations and impaired fine perceptual discrimination
5. Hit

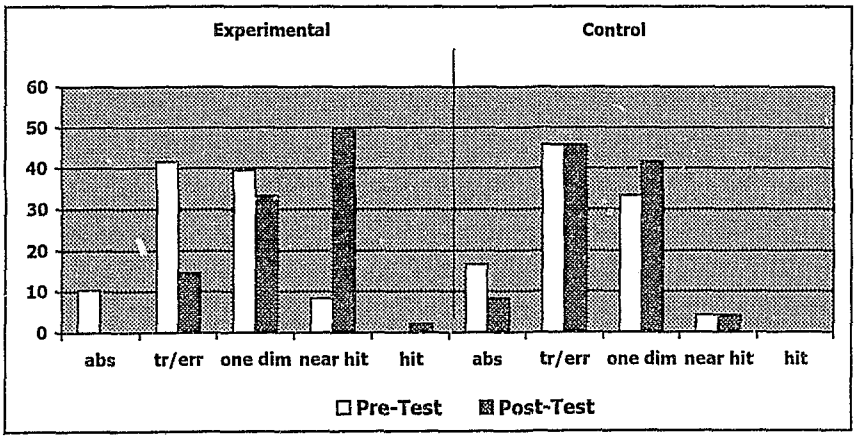
A blind analysis was then undertaken according to these definitions. Graph 3.5. displays the extent of improvement for the Experimental Group on the Copying tasks, when compared to the Control Group.

Graph 3.5. ROCFT results on Copying task using qualitative scoring method



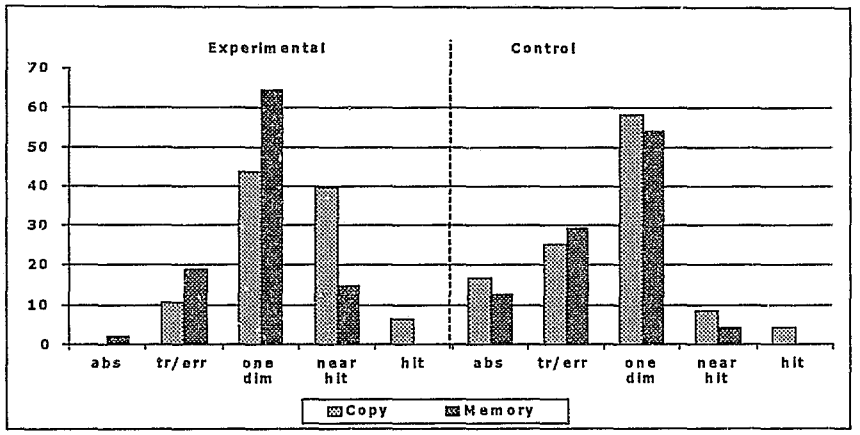
Graph 3.6. below indicates is the large deviations in pre and post-test responses for the Experimental Group. This is demonstrated most effectively in the decrease in trial-and-error responses and the large increase in near-hits.

Graph 3.6. ROCFT results on Memory task using qualitative scoring method



This pre-post difference is consistent with the higher standard deviation on the post-test (memory) for the Experimental Group. Combined with the improved copying scores, this improvement in scores suggests an improvement in strategies which assisted in the enhancement of memory. Graph 3.7. demonstrates the extent to which the skills acquired through the intervention were transferred to the equivalent figure.

Graph 3.7. Equivalent Figure Drawing results using qualitative scoring method



A Kappa analysis was conducted to assess the level of agreement between the qualitative levels of the pre-test and post-test responses, in order to confirm the changes in the levels of responses.

Table 3.8. ROCFT Kappa (κ) measure of agreement for qualitative scores

	Experimental Group		Control Group	
	Kappa (κ)	% Agreement	Kappa (κ)	% Agreement
Copying	0.100	33.33	0.5103	70.83
Memory	-0.0612	18.75	0.7809	83.33
Equivalent (Copy/Memory)	0.2841	54.17	0.4467	66.67

The results provide evidence of variability in the Experimental Group responses on the copying and memory tasks, while the Control Group did not demonstrate much variability. The changes on the equivalent figure are less noticeable, but are still evident. In particular, the memory results provide a highly noticeable change. According to the levels of Landis and Koch, the level of agreement for the Experimental Group is in the poor range of agreement, while the Control Group is in the excellent level of agreement. This suggests substantial change for the Experimental Group, while the responses for the Control Group remained very similar. Furthermore, agreement between the copy scores for the Experimental Group also fall into the poor range, while the agreement between the copying scores for the Control Group are just below the excellent range.

CHAPTER FOUR : DISCUSSION

4.1. Introduction

It was hypothesised that, through the use of mediation within a DA procedure, the subjects of this study would significantly improve their performance on the Raven's Coloured Progressive Matrices (RCPM) and the Rey-Osterrieth Complex Figure Test (ROCFT)., both with regard to their overall scores and with regard to the quality of their responses. It was further hypothesised that the subjects would be able to transfer skills acquired to complete the ROCFT would transfer such skills to a similar figure. The analysis of the pre-tests and post-tests of the Experimental and Control Groups suggests evidence of positive implications for DA, to produce improvement in the children's' performance in all these areas.

4.2. Interpretation of findings

4.2.1. Quantitative changes on the RCPM and the ROCFT

The results suggest some important gains by the Experimental Group on the RCPM and ROCFT. While the impact of the intervention was not significant for the overall scores on the RCPM, a closer analysis of the results revealed noteworthy improvements. Almost half of this group was able to achieve improvements in their performance. This is in contrast to the subjects in Control Group, who were unable to demonstrate much individual improvement. In addition, the mean changes for the Experimental Group brought them close to the average range, while the Control Group scores remained well below average. Finally, an analysis of changes on the B8-B12 items revealed significant improvements. Considering that these items require abstract reasoning, the results are positive when taking into account the level of educational deprivation.

The practice effect of pre-testing and post-testing on the same day did not prove to be a significant factor. The administration of the pre-test and post-test on the same day proved problematic only for the Control Group. The time period between administration of the pre-test and post-test was very short for this group. While this criticism of the research

design remains valid, the importance of the research is in the adaptability of LPAD measures to various settings. This provides important insight into the usefulness of such measures in the South African context, where resources and time is often short, and where mental health workers are often faced with heavy workloads. More importantly though, the results suggest that the RCPM, as a static measure, is not reliable or valid in a context where there is a lack of MLE due to socio-economic and educational deprivation. The impact of the mediation was to provide evidence of possible potential that was not identified in the Control Group.

The purpose of the intervention with the ROCFT is to enhance the subject's ability to reason effectively with an abstract gestalt, in order to develop a strategy to produce the best replica. It also seeks to enhance the subject's ability to hold the strategy used to produce the replica, and reproduce it from memory. The results from the task suggest that the intervention was highly effective in improving the subjects' reproduction of the complex figure. The intervention also proved significantly effective in improving the reproductions from memory for the Experimental Group. As the intervention focuses on mediating planning strategies to enable the child to approach the task, it is believed that the improvement in planning also enhanced the subjects' memory strategies. Therefore, the intervention provides a good tool for improving not only the child's ability to copy a stimulus, but also for producing a memorized version of that stimulus. This is evidenced in the improved manner in which the subjects used a system to bring all the components together to form the whole.

The quantitative results on the RCPM and the ROCFT are important, considering the mediation process lasted three to four hours. Considering the novelty of the tasks and the extent to which the patients who enter the unit are struggling to make scholastic progress, it would unrealistic to expect the subjects to show great improvement immediately. Taking this into account, the results achieved are noteworthy.

4.3.2. Interpretation of qualitative results

The value of the intervention process is also suggested by the qualitative analysis of change, using the Lurie and Kozulin Scoring Method. The levels of analysis are useful in providing

added information, which is not necessarily reflected in the total scores. The DA was aimed at providing insight into the process of learning, by working with small groups of subjects so their strategies could be closely observed. The information obtained in this respect can provide teachers and parents with some insight into the subjects' learning difficulties, which was not available when the instrument was administered in a static form. A more intensive analysis of the item responses, utilising the qualitative levels, suggested that the intervention process assisted in enhancing the subjects' ability to reason and apply newly learned cognitive skills.

The difficulty in obtaining an acceptable level of inter-rater reliability for the qualitative scoring method on both measures is consistent with the concerns raised by Frisby and Braden (1992). These authors use this problem as a point of criticism for attaining reliable inferences from mediation. They further state that this low reliability affects the validity of the DA as a whole. Tzuriel (1992) counters this argument from the perspective that DA arises from a sociological paradigm and seeks to examine the conditions needed to produce meaningful change. This is consistent with a process-based assessment perspective. An over-reliance on statistical conceptualisation detracts from the necessary focus on, not only the quantitative change, but also the quality of change. By investigating this added feature to the DA paradigm, this research seeks to contribute to the dynamic nature of assessment by focusing more on process rather than content.

4.3.2.1. Qualitative changes on the RCPM

Following the low levels of overall reliability through independent raters, the focus of this analysis turned again to the B8-B12 items, which are easier to rate according to the levels devised by Kozulin and Lurie. When comparing the results, it is interesting to note the patterns of change in responses, which provide some insight into the manner in which the responses were chosen.

The positive changes evident in the Experimental Group pre and post-test responses on the RCPM suggest that the Experimental Group subjects gained a better understanding of the task, and were able to develop their ability to inhibit their impulsivity in responding to the tasks. While the Control Group did produce some improvements, the responses suggest

that the subjects had gained no real insight into the nature of tasks, and did not improve much in their ability to inhibit their impulsivity.

Examination of the qualitative levels further suggests another interesting phenomenon. The trend of the changes in the quality of the non-hits, suggests that the Control Group - "different day" were able to improve the quality of their responses to a greater degree than the Control Group – "same day". This may have resulted from a tedium effect, suffered by the latter due to the short time between the pre-test and post-test. This is particularly evident in the lower number of trial and error responses in favour of one-dimensional responses. This suggests that, while the practice effect was evident in the number of hits achieved for the Control Group - same day Group, this group did not seem to improve the quality of its responses. The same day Group tended to respond in much the same way, only differing in the number of hits. This is in contrast to the noticeable changes for both Experimental Groups. Therefore, this would suggest that the intervention benefited both Experimental Groups.

The results from the Kappa analysis confirm the extent of change in the levels of response. The lower level of agreement, between pre-test and post-test responses for the Experimental Group, provides evidence that this group's responses were influenced as a result of the intervention. The scores for the Control Group, on the other hand, remained more consistent and predictable.

One important consideration, however, is the lack of improvement for the near hit category of responses. The results would suggest that the use of the near hit category did not serve much purpose here, as any improvement in the quality of the response was in favour of a hit. Therefore, a decrease in the trial-and-error and one dimensional responses did not lead to an improvement in near hit responses. This may mean that the RCPM items do not lend themselves to such fine detail analysis. This would suggest, rather, that based on the nature of the items, if the subject understands the concept, they will most likely get the right answer, rather than missing one detail from the answer. This could contrast with items on other matrices, which have more complex detail to recognise to find the right answer.

Despite this limitation, the results achieved from the qualitative scoring provided a deeper understanding of the extent of change as a result of the intervention, by providing a more useful comparison of the nature of responses for the Control Group and the Experimental Group on the pre and post-tests.

4.3.2.2. Qualitative changes on the ROCFT

The qualitative analysis on the ROCFT, proved to be more successful than on the RCPM scores. The complex nature of the figure made it easier to assign the five levels of analysis to the responses. These levels provide a useful analysis for monitoring the child's approach to the task. This is due to the nature of the task, whereby the demand on the subject to complete a gestalt which has many facets to it, will allow for more detailed analysis. As such, the use of the qualitative levels, such as using more than one source of information, or a near hit, is more possible with the variety of facets involved.

While the RCPM results demonstrated that a decrease in the number of lower quality responses did not lead to an increase in near hit responses, the ROCFT results demonstrated much finer discrimination amongst the qualitative levels. This can be explained by the fact that while the RCPM has fewer choices of response, and ultimately has right and wrong answers, analysis of the ROCFT requires less focus on the achievement of a completely correct response, but rather focuses on accuracy and planning. Therefore, the ROCFT lends itself more to being a process-based assessment instrument by the very nature of its application.

There was a substantial drop in the number of trial-and-error responses on both the copying and memory task of the ROCFT for the Experimental Group. Furthermore, there was a substantial increase in the number of near hit responses. This represents a shift in the subjects' approach, as they moved from not having an understanding of the principle of the task, to a systematic approach which only had a few missing elements. The Control Group did not display much noticeable variability. There was a slight increase in the number of near hits on the copying tasks, but ironically this also resulted in less hits. There was also a small drop in the number of absurd responses on the memory task, and a slight increase in the number of one dimensional responses.

The Kappa analysis of the qualitative responses for the groups, confirms the variability of the Experimental Group responses and the low level of variation for the Control group, especially on the memory tasks. The evidence of improved planning and memory is also found on the performance of the groups on the equivalent figure drawing. While not as substantial as the ROCFT, the results for the equivalent figure demonstrate a clear discrepancy between the skills of the Experimental and Control Groups to complete the copying and memory task. The less noticeable difference may be due to the fact that the equivalent figure used is less complex than the ROCFT. However, the Experimental Group demonstrated better skills in copying the figure and reproducing it from memory, as demonstrated on the Kappa analysis. This demonstrates adequate transfer of the strategies learned on the ROCFT to the equivalent figure. This suggests that the mediation process provided a learning experience which extended beyond mere practice effects on the ROCFT, and which could be applied to similar tasks.

Further analysis of the ROCFT responses revealed the following:

- Most of the subjects rotated their initial copies of the figure. In the static administration of this task, this would suggest visual-spatial difficulties, which is a common element of many learning problems. The intervention demonstrated that these difficulties could be easily remedied. The post-test responses for the Experimental Group, showed that many subjects had improved the orientation of their drawing, while the Control Group continued to rotate their drawings. This has positive implications for the remediation of learning difficulties amongst educationally disadvantaged children.
- Furthermore, all the subjects initially displayed poor planning strategies, as evidenced by the order in which they completed the figure. Such strategies included starting with arbitrary pieces of the figure, as well as not providing enough space to complete the figure effectively. The intervention assisted in improving planning strategies, which was evidenced by a more systematic approach to the post-test by the Experimental Group. The Control Group continued to produce a lack of planning ability.
- Finally, a further important observation was that many subjects seemed to produce very small figures on the initial copying task, suggesting high levels of anxiety and constriction. It was found that many of the subjects on the Experimental Group tended

to produce more elaborate reproductions, while the Control Group's drawings continued to be small.

4.4. Implications of the results

Tzuriel (1992), and Rand and Kaniel (1987), emphasise the usefulness of group administration of the LPAD as a screening tool to establish a baseline of abilities. Once this has been performed, however, they emphasise the necessity for further investigation before any decisions regarding the child's educational needs. Due to the large number of children and adolescents who attended the Child and Adolescent Psychiatry Unit, group DA proved to be a useful and efficient way of providing a service to the community. Once the group DA of cognitive functioning had been completed, the staff of the Unit were able to undertake further investigation on more domain-related skills. Such investigation involved the use of achievement screening tests, to glean further information regarding the subjects knowledge base.

Therefore the psychologists in the Unit were able to provide teachers with practical information which contained insight into the relationship between the child's cognitive processing and their performance on domain-related tasks. The further investigation was implemented in such a way that the results provided information on similar aspects of the child's reasoning, especially in relation to their approach to the tasks, and their response to mediation. Therefore, even with the domain-related tasks, processes were being examined.

Due to the novelty of the tasks presented to the subjects, initial scores revealed high levels of difficulty in understanding the nature and demands of the tasks. The subjects were largely found to be impulsive, inattentive, and had a tendency to give up easily. This is consistent with the reports of the teachers and parents. It is also consistent with the experience of continuous inability to make scholastic progress at school. Low levels of motivation and interest become evident as the students increasingly become less able to complete the work expected of them in the classroom. However, this does not provide evidence for low levels of cognitive reasoning. Rather it provides a suggestion of an ineffective educational environment that does not cater to these students' needs.

The DA procedure provides a mechanism to duplicate the classroom environment to some degree. Thus it provides a useful context for investigating the factors highlighted above more effectively and for gaining insight into how easy or difficult they are to remediate. Traditional, static assessment procedures would not have allowed such an investigation. The results of such an assessment would have provided a poor prognosis for the subject's ability to cope in a classroom environment. Through DA, an element of realism is introduced so the assessment can provide useful information as to the conditions necessary to enhance the subject's learning.

As such, the DA approach used in this research sought to illuminate some of the underlying potential, which is not being realised in the school system. The use of both quantitative and qualitative measures provides analysis of the intricate complexity of unfolding cognitive potential. On examination, the results provide possible insight into the following factors.

- There was an improvement in the Experimental Group's ability to pay attention as the subjects were required to work independently without the tester overseeing them.
- The Experimental Group became less impulsive in their responses, tending to think them through more carefully. This is suggested in the variations in post-test results for the Experimental Group.
- For the same reason, it could be suggested that the Experimental Group was more motivated to complete the post-test. This is especially noticeable in the Control Group – same day results.
- The Experimental Group demonstrated improvement in visual-spatial orientation on the ROCFT. This could provide assistance in various scholastic tasks.
- The Experimental Group improved in their ability to recognise part-whole relationships, as evidenced on both the RCPM and the ROCFT results.
- The Experimental Group was able to effectively use a plan for completing the ROCFT and then transferring this plan, in order to successfully complete the equivalent figure.

These are some of the conclusions that can be drawn, but they would need to be compared to the subject's performance on other tasks. However, they provide useful tips for the teacher and parent with respect to areas of intervention, such as how to develop the subject's capacity to work independently, how to improve the subject's processing of

information, planning and memory strategies, and how to apply these process-based skills to their schoolwork and daily life.

4.5. Shortcomings/Limitations of the study

The conclusions drawn from this research are limited by the following:

- There are many questions regarding the nature of the design, which limit the effectiveness of the findings. This relates particularly to the administration of the pre-tests for the RCPM on the same day as the intervention. This particularly problematic for the Control Group who did not receive any intervention, resulting in a relatively short period of time between the pre-test and post-test. It is believed that this group may have negatively influenced the overall impact of the mediation process.
- The failure to achieve inter-rater reliability for the qualitative measures places a limitation on the reliability of the results. t also calls into question the relevance the types of responses that have been defined by this scoring method, when applied to the RCPM. Lurie and Kozulin conceptualised these levels of analysis with a particular set of matrices – the V-LL matrices. These matrices provide for responses particularly suited for each level of analysis. The RCPM does not necessarily have the depth of responses to allow for the same analysis.
- Although time constraints disallowed the use of more LPAD instruments, it would have been desirable to do so, in order to acquire more collateral information. The RCPM and the ROCFT test certain aspects of cognitive functioning. However, they do not give an indication of the numerical and verbal modalities. In addition, such operations as categorization and logical multiplication are not readily tapped.

4.6. Further research and applications

This research provides some interesting questions regarding the further use of DA in providing information regarding the cognitive functioning in educationally disadvantaged children. While limited in its scope it provides a basis for future exploration. Important features that warrant further investigation include:

- An investigation of whether or not the qualitative scoring system can be adequately adapted to another form of matrices, such as the Raven's Standard Progressive Matrices (RSPM). This may prove useful, because the RSPM has a greater amount of depth to its responses. In addition the RSPM, like the RCPM, forms part of the LPAD battery, and the LPAD contains a mediation tool, the Set Variations II, which is specifically designed for items on the RSPM. This would allow for a further investigation of transfer.
- An investigation of how the qualitative scoring system can be applied to other measures, which form part of the LPAD battery. This follows the successful use of the scoring system on the ROCFT.
- A further analysis of the use of the ROCFT, by establishing inter-rater reliability on the qualitative scoring system. This could prove useful for developing a more process-oriented scoring system for the ROCFT.
- The development and exploration of a mediation tool for Lurie and Kozulin's matrices. This would assist in linking the mediation directly to the responses, allowing for a clear analysis of the subject's cognitive abilities.
- An extension of the research into the school setting where variables can be better controlled. A further benefit of this is that the teachers can be directly included in the research and the findings can be more usefully applied. This will potentially allow for more long term benefits from the process.

4.7. Conclusion

The fundamental question arising out of this research, is the efficacy of DA as a tool for recognising cognitive potential in educationally disadvantaged children in South Africa. The research highlights the difficulties facing educational psychologists in producing relevant assessment information, which will assist in overcoming the effects of apartheid education. These difficulties are prominent in issues surrounding the assessment situation, language, resources, time constraints, interaction with parents and teachers, and the assessment material itself. It is believed that this research goes some way to illuminating the complexity of effective assessment in the context of new and innovative pedagogical frameworks.

One of the primary tasks that plagued this research was how to make it relevant to the context in which it was being undertaken. This presented problems for the control of variables which may have confounded the effect of the intervention. In keeping the research as contextually valid as possible, it provided the opportunity to explore different aspects of the DA approach. Firstly, it explored the use of group assessment, which was of considerable value to the Unit, as it cut down substantially on the load of assessments. Secondly, it explored alternative mechanisms of analysis, which could yield useful information to inform intervention.

The ineffectiveness of standard cognitive instruments has been a point of debate in the social sciences in South Africa for many years. It is only now that this had lead to meaningful change in the use of such instruments, and the over-reliance on results thereof. The results achieved produce further proof of the need to be aware of socio-cultural variables which may impact on the subject's ability to perform on such tests. This is in line with current progressive thinking around such testing all over the world.

The results indicate positive implications for cognitive change in a DA situation. The Experimental Group was able to benefit from the intervention process, and even transfer what they had learned to a similar task. The DA produced extra information regarding the subjects' strengths and weaknesses, which would not have been picked up in a static assessment. This information was then correlated with results from the further testing, and provided valuable guidance for the parents and teachers on how to intervene.

The research provided necessary challenges that provide the basis for future work. It adds to the volume of work, which has provided a sound basis for the use of DA in a variety of contexts. Many of the issues that needed to be addressed were not necessarily dealt with due to the difficulties highlighted above. It is hoped, therefore, that this research contributes to the new paradigms in educational theory and practice in South Africa, and provides a vehicle for future exploration.

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APPENDIX

Raven's Coloured Progressive Matrices

1. Two-way ANCOVA Overall Scores (A1-B12)

Dependent Variable : POST_TST

Source	DF	Type III SS	Mean Square	F Value	Pr > F
Model	4	2485.164526	621.291132	21.26	0.0001
Error	67	1958.335474	29.2288888		
Corrected Total	71	4443.500000			

Source	DF	Type III SS	Mean Square	F Value	Pr > F
GROUP	1	85.458536	85.458536	2.92	0.0919
DAY	1	109.512082	109.512082	3.75	0.0571
GROUP*DAY	1	24.674601	24.674601	0.84	0.3515
PRE_TEST	1	2175.039526	2175.039526	74.41	0.0001

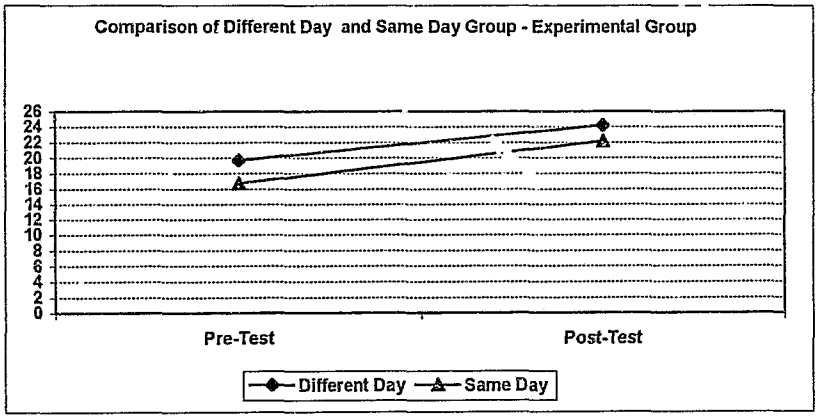
2. Two-way ANCOVA B8-B12 items

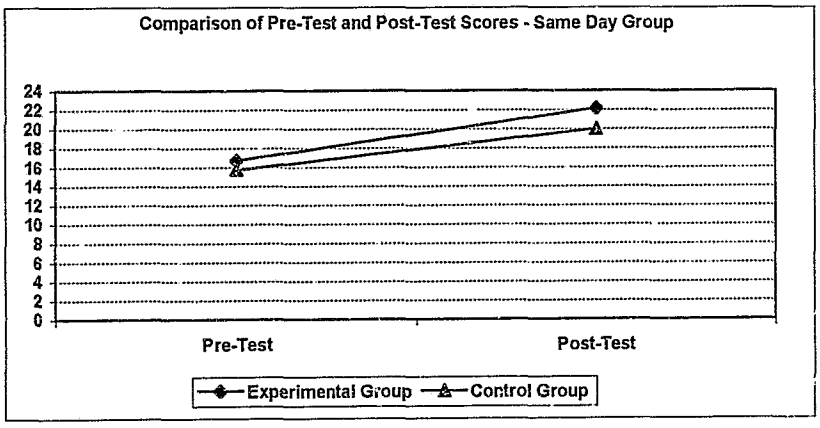
Dependent Variable : POST_TST

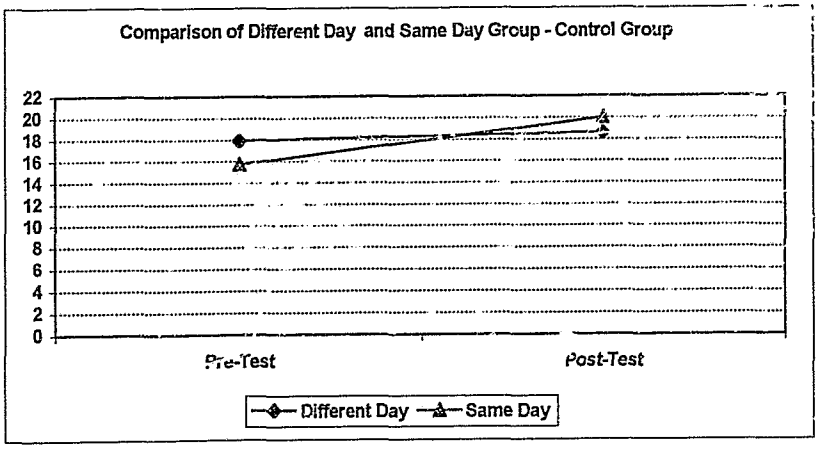
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	57.23139791	14.30784948	5.03	0.0001
Error	67	190.75471320	2.84708527		
Corrected Total	71	247.98611111			

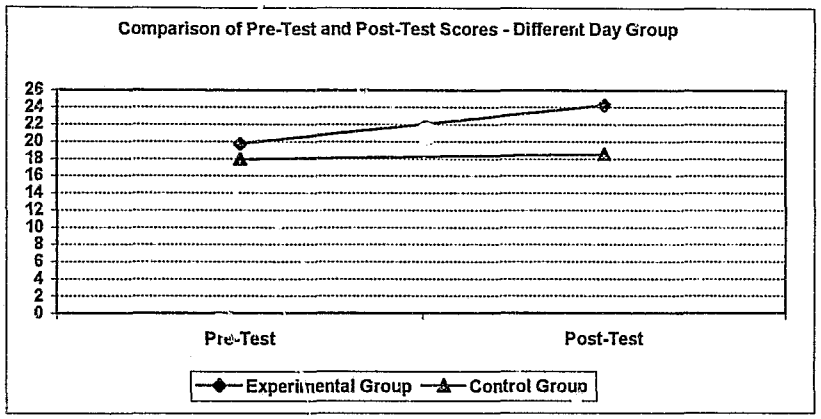
Source	DF	Type III SS	Mean Square	F Value	Pr > F
GROUP	1	24.38224885	24.38224885	8.56	0.0047
DAY	1	1.76144007	1.76144007	0.62	0.4343
GROUP*DAY	1	2.49456559	2.49456559	0.88	0.3526
PRE_TEST	1	27.74528680	27.74528680	9.75	0.0027

3.Graphs representing comparisons of same and different day scores








Comparison of Pre-Test and Post-Test Scores - Different Day Group
26
24
22
20
18
16
14
12
10
8
6
4
2
0
Pre-Test
Post-Test
Experimental Group
Control Group

Rey-Osterrieth Complex Figure Test

1. One-way ANCOVA Copying Scores

Dependent Variable : COPYING2

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	4072.37275956	2036.18637978	67.35	0.0001
Error	69	2086.12724044	30.23372812		
Corrected Total	71	6158.50000000			

Source	DF	Type III SS	Mean Square	F Value	Pr > F
GROUP	1	920.84868907	920.84868907	30.46	0.0001
COPYING1	1	2703.37275956	2703.37275956	89.42	0.0001

2. One-way ANCOVA Memory Scores

Dependent Variable : MEMORY2

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	4498.56322639	2249.28161319	73.73	0.0001
Error	69	2104.93677361	30.50633005		
Corrected Total	71	6603.50000000			

Source	DF	Type III SS	Mean Square	F Value	Pr > F
GROUP	1	975.05088086	975.05088086	31.96	0.0001
MEMORY1	1	2734.56322639	2734.56322639	89.64	0.0001

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