

Feuerstein's mediated learning experience as a vehicle for enhancing cognitive functioning of remedial school learners in South Africa

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ABSTRACT

The study investigated the effects of mediated learning experience (MLE) intervention on Remedial school learners' cognitive functioning as measured by the Ravens Coloured Progressive Matrices (RCPM). The sample comprised 67 participants (males = 35; females = 32; mean age = 11.8) from Grade 4 through to Grade 7. Participants were given the RCPM on two occasions, and in-between, a non-randomly constituted experimental group was exposed to MLE intervention. Pre-post test results revealed significant improvement within the experimental group on the RCPM, while non-significant pre-post test results were found within the control group. These findings provide support for further development and application of dynamic assessment and its MLE construct.

INTRODUCTION

There has been a growing concern internationally regarding dissatisfaction with traditional (static/normative) measures of cognitive ability. These traditional measures have been amongst other things criticized for bias and unfairness to cultural socio-economic minorities in the Western countries (Tzuriel, 2000) and majorities of disadvantaged communities in African countries who largely reside in remote rural areas with limited/no access to educational toys (Seabi & Amod, 2009). Furthermore, they have been found to lack the ability to provide remedial strategies for enhancing cognitive functioning (Lidz, 2002), and they do not require or allow active intervention on the part of examiners. Research has shown that traditional intelligence test scores underestimate the abilities of children who come from low socio-economic backgrounds and those who have learning difficulties (Resing, 1997; Tzuriel, 2000a). Given the socio-economic and educational disadvantages that majority of the South Africans were exposed to during the apartheid regime, and still do under the current regime, there is a need for assessment approaches that focus on future potential rather than on current ability. Sternberg and Grigorenko (2001a) report that traditional intelligence tests measure skills acquired in the home or at school. Therefore, it is hardly surprising that "children from socially disadvantaged backgrounds and from ethnic minorities under-perform on such measures, since they struggle with items that are unfamiliar and unpracticed" (Elliott, 2003, p.16). Reliance on traditional methods of psychological and psycho-educational measures has been found to be unreliable within the South African context (Skuy & Skuy, 2005).

Given dissatisfaction with these traditional methods, dynamic assessment (DA) has been suggested as an alternative assessment approach to overcome many of the abovementioned

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difficulties. However, a review of literature demonstrates that dynamic assessment is infrequently used, particularly in South Africa and for those studies in which it has been implemented, it is mostly undertaken for selection purposes (that is for selection and placement of students in institutions of higher learning or the placement of employees into various occupations), and less so for remedial purposes (Murphy & Maree, 2006). Haywood and Tzuriel (2002) note that DA is not widely utilized and in fact, there is a dearth of research based on DA for several reasons. For instance, that DA is not widely taught in institutions of higher learning; the school personnel who receive psychologists' reports typically do not yet know how to interpret the recommendation made from DA; and that it is far more time-consuming than traditional static measures. It was therefore the intention of the current study to apply DA approach in a remedial school context to determine whether learners exposed meaningful and adequate learning experience using approach would perform better than those only exposed to traditional measurements.

Dynamic assessment

Dynamic assessment is an "umbrella term used to describe a heterogeneous range of approaches that are linked by a common element, that is instruction and feedback are built into the testing process and are differentiated on the basis of an individual's performance" (Elliott, 2003, p.16). The most often cited definition of DA is that it commonly follows a sequence of a pre-test phase, followed by an intervention or mediation (as opposed to the assessment and categorization of the learner only) and concluding with a post-test phase (Campione, 1996). An important characteristic that distinguishes DA from traditional measures is the focus on how change can be produced within a learner in a structured learning situation rather than comparing a child's performance with his/her peers (Zaaiman, Van der Flier & Thijs, 2001). Karpov and Tzuriel (2009) report that unlike traditional measures, DA provides educators with data required to suggest specific strategies for effective instruction and intervention.

Lidz (2002) notes that DA evaluates particular cognitive processes underlying successful performance and not necessarily the product (or current ability). DA assesses not only what an individual has already been exposed to but also what one can do (potential) under appropriate guidance. Vygotsky (1978) coined the phrase zone of proximal development to refer to the "distance between a child's actual developmental level as determined by independent problem solving and the higher level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (p.86). This zone is believed to be an index of the learning potential of the child (Vygotsky, 1978). Elliott (2003) concurs that an evaluation of a child's capacity to learn when provided with scaffolded instruction that is tailored to offer a minimum assistance necessary for successful performance is more valid and meaningful for home and educational settings than contexts whereby learners are assessed without taking into account their socio-educational backgrounds. Learning, in this context defined as the ability of the individual to modify existing cognitive structure through exposure to mediated intervention.

The major goal of DA is "to assess processes of thinking that are themselves constantly changing...and examiners do some active and directed teaching precisely in order to produce change, with the focus on how do examinees learn new things? How does the removal of learning obstacles change their performance? (Haywood & Tzuriel, 2002, p. 41)". Therefore, DA refers to assessment of thinking, perception, learning and problem solving by an active teaching process aimed at modifying cognitive functioning.

Although there are several DA models, Feuerstein's (1979) approach, in particular his notion of mediated learning experience (MLE) is the most influential and it is this approach that the current study is based upon.

Mediated learning experience

Mediated learning experience (MLE) refers to those "human interactions that generate the capacity of individuals to change, to modify themselves in the direction of greater adaptability and toward the use of higher mental processes" (Feuerstein, 1979, p.110). During the MLE process, the

mediator/examiner not only makes the stimuli meaningful but also elicits in the learner how the learning or thinking is applicable to other areas of life, thus enabling transfer. It is through mediation that the mediator attempts to rectify the mismatch between the nature of the cognitive deficits in a culturally deprived individual and the instruments used in assessing these deficits.

Childhood is probably one developmental stage when the advantages of MLE have the greatest impact on cognitive development. According to Feuerstein (1980, p.16) "the more and the earlier an organism is subjected to MLE, the greater will be his/her capacity to efficiently use and be affected by direct exposure to sources of stimuli as suggested by Piaget in 1952".

During the interactive mediation, the mediator attempts to delineate the behaviours which could be hindering a child's performance. The mediator observes if the child responds impulsively, if he or she is able to follow verbal instructions, and if he or she can make a plan to solve a problem. To identify the causal factor that impedes the child's learning, the mediator observes the limitations of the child's cognitive functions. Amongst the identifiable obstacles to one's access to and effective application of one's intelligence are ignorance, impoverished vocabulary, cultural differences in learning habits, and a host of motivational variables plus inadequate development of cognitive and metacognitive structures and strategies (Haywood & Tzuriel, (2002).

Feuerstein *et al.* (1979) developed the cognitive functions list that enlightens the mediator about the difficulty experienced by the "mediatee". Feuerstein conceptualized these cognitive functions into three phases of cognitive processing: input (data gathering), elaboration (data processing), and output (data expression). Failure to comprehend instructions and gather information at the input phase impacts negatively on the ability to process information at the elaboration phase. This also leads to production of incorrect responses. These cognitive functions are discussed in detail elsewhere (Feuerstein *et al.*, 1979; Skuy *et al.*, 1996). It was therefore essential in the current study that the author noted any cognitive deficiencies displayed by the learners so that adequate and appropriate mediated intervention could be provided.

Feuerstein *et al.* (2002) maintain that cognitive development of individuals is often masked not by distal conditions (such as poverty, neurological impairment, emotional disturbance in the child, or low socio-economic status), but by proximal condition (inadequate exposure to MLE opportunities). Haywood and Lidz (2007) argue that although distal conditions are commonly found in individuals with less than optimal cognitive development that does not mean they are causal factors but rather correlational variables. It was therefore argued in the present study that if remedial school learners are exposed to sufficient MLE interventions, their cognitive functions can be enhanced.

Learners with learning difficulties are of concern because their learning problems appear difficult to "remedy" within a mainstream classroom using normal teaching methods (Yuen, Westwood & Wong, 2004). As a result, it is commonly accepted that these learners require intensive remedial intervention from a trained specialist educator if they are to make progress (Pikulski, 1994; Pinnell, 1997).

Application of mediated learning experience

In support of Feuerstein's notion of MLE, numerous studies (including Schur, Skuy, Zietsman & Fridjhon, 2002; Tzuriel & Kaufman, 1999) have been conducted not necessarily with remedial school learners. Tzuriel and Kaufman (1999) explored the relation between MLE and cognitive modifiability among the children who had undergone cultural change. Before the mediation intervention, a group of Ethiopian children ($n = 29$) was compared with a group of Israeli-born children ($n = 23$) on the Coloured Progressive Matrices (CPM) and on two preschool dynamic assessment measures of learning potential, namely, the Children's Inferential Thinking Modifiability test (CITM) and the Children's Analogical Cognitive Modifiability test (CATM). The results demonstrated initial significant differences ($p < 0.01$) on all the three measurements in favour of the Israeli-born children. After a short period of exposure to intensive mediation, the Ethiopian group had improved significantly and performed at the same level as their counterparts.

In another study, Schur et al. (2002) investigated the effectiveness of teaching about the earth (EAC) to a group of low functioning high school learners in Israel based on a combination of MLE and a constructivist approach. This study included an experimental and a control group, each of which comprised 16 Grade nine learners. Although learners within both groups received instruction on earth for three hours per week, the experimental group did so within the framework of the EAC, while the control group was exposed to a conventional approach to earth studies. The results revealed that the experimental group (receiving the curriculum through a combination of MLE and constructivism) improved their cognitive functions and learnt about the earth to a significantly greater degree than a comparable control group (receiving a conventional approach).

In a South African context, Skuy, Gewer, Osrin, Khunou, Fridjhon and Rushton (2002) investigated the effects of Mediated Learning Experience on improving cognitive functioning of psychology students ($n = 98$) in a predominantly White tertiary institution. The Raven's Standard Progressive Matrices (RSPM) served as a pre- and post-test measurement of cognitive ability. Mediation was only provided to the experimental group, which was divided into four subgroups (race), for purposes of the intervention. Although analysis of the pre-test scores yielded significant difference due to the effect of race, the post-test results yielded significant difference as an effect of the mediation and non-significant results as an effect of race.

Recently, Seabi and Amod (2009) conducted a study in which the effects of a mediated intervention programme on a sample of grade five learners in a remedial school were explored. The purpose of the study was to compare the effects of one-to-one mediation in comparison to group mediation. It was proposed that participants within the Individual Mediation group ($n=10$) would perform significantly better than those within the Group Mediation group ($n=10$). Mediation tools/instruments (i.e. Set Variations B-8 to B-12 from Feuerstein's Learning Potential Assessment Device) served as a vehicle for mediating cognitive deficiencies. Results revealed a significant improvement in scores only within the Individual Mediation group. Despite the statistically significant improvement yielded within the Individual Mediation group, no statistically significant difference was found between the Individual Mediation and the Group Mediation sample.

It is argued in the current study that the above mentioned study (Seabi & Amod, 2009) may have underestimated the effects of mediation since the two groups which have been exposed to mediated learning intervention were compared without using a control group. The current study therefore investigated the effects of mediation in improving performance on nonverbal intelligence assessment, using Raven's Coloured Progressive Matrices. This Raven's test was chosen in order to follow up Seabi and Amod's (2009) study on remedial school learners. It was hypothesized that following the MLE intervention, the experimental group would perform significantly better than the control group on the Raven's Coloured Progressive Matrices scores.

METHOD

Participants

Participants were drawn from Grade four to Grade seven classes in an urban Remedial School. This study was conducted in a multi-racial school in Johannesburg. There are no more than 15 learners in a class. Learners admitted to this school could not cope with mainstream learning for variety of reasons including issues related to learning, behavioural and cognitive challenges. A majority of these learners have been diagnosed with a "learning disability", which is a generic term that refers to a heterogeneous group of disorders manifested by significant difficulties in the acquisition and use of listening, speaking, reading, writing, reasoning or mathematical ability (Hammill, 1990).

Sixty-seven learners participated in this study with a mean age of 11.8 and age ranges from 9 to 14 years. There were 52 percent ($n=35$) males and 48 percent ($n=32$) females. In an effort not to disrupt the learning programme, 42 percent ($n=28$) of learners from Grade four and Grade five were assigned the experimental condition, whilst 58 percent ($n=39$) of learners from Grade six and

Grade seven comprised the control group. Therefore, learners were not randomly assigned to different conditions.

Instruments

Instruments used in the current study derived from the Learning Potential Assessment Device (LPAD). Only the Raven's Coloured Progressive Matrices (RCPM) and the Set Variations B-8 to B-12 were utilized.

The Raven's Coloured Progressive Matrices (Raven, 1956)

The Ravens Progressive Matrices (RPM) are among the most researched and widely used of all culture-reduced tests (Raven, 2000). It is a nonverbal problem solving test in which each sets starts with an obvious problem and becomes progressively more difficult. The Raven's Coloured Progressive Matrices (RCPM) items are presented on a coloured background in order to make the task visually stimulating, with the exception of the last few tasks which are presented on black and white. The RCPM has been evaluated for validity, reliability and internal consistency (Kazem *et al.*, 2007). Rand and Kaniel (1987) reported reliability coefficients of .8 and .9. The RCPM test consists of three sets of problems; A, AB, and B. The possible scores on this test range from 0 to 36. Problems A and AB were utilized in this study as pre-post measurements, whereas set B was used for the mediation. As a result, the scores ranged from 0 to 24. Although the RCPM has been standardized only in the United Kingdom (1992), United States of America (1993) and Germany (1997), several studies conducted in South Africa confirmed the significance of the RCPM as a measure of intellectual functioning (Grieve & Viljoen, 2000; Seabi & Amod, 2009; Skuy *et al.*, 2002).

Learning Potential Assessment Device (LPAD) Variations B8 – B12 (Feuerstein, Haywood, Rand, Hoffman and Jensen, 1986)

The LPAD materials include tools that involve higher cognitive processes and mental operations, such as the Verbal Analogies, The Organizer and LPAD Set Variations B-8 to B-12. The LPAD Variations B-8 to B-12 consists of sets of six variations on five Raven's Coloured Progressive Matrices items. These Variations were selected for the current study because "they permit the examiner to access and to modify the area of abstract thinking, and also represent tasks that under normal circumstances are rarely offered to the low-functioning individual" (Jensen & Feuerstein, 1987, p.396). Like the RCPM, it measures the same components such as an individual's ability to form comparisons, to reason by analogy and to organize spatial perceptions into systematically related wholes (Tzuriel & Haywood, 1992).

Procedure

The current study adopted a pre-post quasi-experimental design with an intervention in between. As usual with dynamic assessment on the LPAD, participants underwent the pre-test and post-test phases, whereby they completed the RCPM measure according to standard administrations. The study focused on improving scores on the Raven's matrices using the Set Variations II B8-B12 of the LPAD as the mediation task.

During the pre-test phase (day 1), all the participants were administered the RCPM in a group setting. Participants within the experimental group were then exposed to one-to-one MLE intervention for approximately 30 to 45 minutes depending on the needs of the learner (day 8).

During the intervention (mediation), the author assumed the role of a mediator between the mediatees' thinking processes and the cognitive strategies being taught. The mediation was geared towards correcting thinking patterns that impair learning, developing accurate perception, and insight and understanding of the participant's thought processes. As cited in Seabi and Amod (2009, p.191), "the mediatees were encouraged to develop effective thinking strategies, refrain from impulsivity, be precise and systematic in gathering of data, clearly identify and define problems, devise a plan of action and avoid trial-and-error responses, look for logical evidence and

reflect before responding". The mediator intervened when it was necessary and assisted the participant/mediatee as much as needed to complete the tasks. As already mentioned, aspects that were covered included:

- *Regulation of behaviour*, which implies inhibiting impulsivity, overcoming blocking that may obstruct mediatee's successful performance;
- *Developing accurate perception* through systematic approach to gathering of and understanding of the problem, and being precise and clear;
- *Production of reflective and analytic insight*, whereby mediatees were assisted to think about the nature of tasks and their requirements and to be critical of their solutions; and
- *Provision of appropriate verbal tools* necessary to receive, store, process/elaborate and express information (Feuerstein et al., 1979; Skuy, Mentis & Mentis, 1996).

Detailed procedure regarding mediation is provided elsewhere (Feuerstein et al., 1979; Seabi & Amod, 2009; Skuy et al., 1996).

The approach was of a process-oriented nature rather than content-focused. It is essential to note that during the mediation process, many of these learners were highly anxious and hesitant to respond. It appears that their learning difficulty had resulted in emotional upset. It was essential for the mediator to address emotional issues first, so the learners could be able to focus on the tasks. The mediator acknowledged their feelings and assured them that inability to respond accurately to a question was part of the learning process, and that they were not going to be punished for getting anything wrong. A rapport was established with the mediatees and the mediator helped with the behavioural and cognitive deficiencies displayed by the participants. A week after the intervention period, the RCPM was then re-administrated to all the participants.

Ethical considerations

Given that this sample is considered a vulnerable population, consent was obtained from parents or guardians, the principal, educators and the learners themselves. The participants were initially invited to participate in the research process and were informed that non-participation would not disadvantage them in any way. Confidentiality was also guaranteed by informing the learners about what would happen with the data, who would see it and how it, would be utilized. They were informed of their right to withdraw at any point in time and that participation in this research was completely voluntary.

Data analysis

An independent t-test was utilised to compare pre-test scores of the experimental and control groups on the RCPM scores. This analysis was done to determine the groups' initial level of performance. A paired t-test was also conducted to determine if significant improvement in the RCPM scores from pre-test phase to the post-test phase could be demonstrated within the control and experimental groups. It was expected that the experimental group would demonstrate significant improvement as a result of the mediation intervention, while no improvement was expected within the control group. An Analysis of Covariance (ANCOVA) was performed to test whether there was significant difference between the experimental and control groups on the RCPM post-test scores. The pre-test scores of the RCPM served as the covariates. By controlling the effects of the differences that the groups (experimental and control) may bring to the picture, effectiveness of the intervention were easily investigated without confounding variables. Given the composition of the control and experimental groups, (that the control group was composed of participants in higher grades, i.e. Grade 6 and Grade 7, unlike those in the experimental group-Grade 4 and Grade 5) it was expected that gap between the groups would narrow as a result of the mediation intervention.

RESULTS

Table 1 Pre-test and post-test Mean RCPM Scores within the Groups

Variable	n.	RCPM (Out of 24)				t.
		Pre		Post		
		Mean	SD	Mean	SD	
Experimental	28	16.75	4.9	19.67	3.5	-6.14**
Control	39	20.05	4.1	20.23	3.5	-1.42

**p<0.01

The pre- and post-test means and standard deviations of the RCPM scores are presented in Table 1 for both the experimental and control groups. A statistically significant difference ($t [1, 66] = -5.48, p < .01$) was found between the pre-test RCPM scores, in favour of the control group. As shown in Table 1, a statistically significant ($t [1, 27] = -6.14, p < .01$) improvement of scores from the pre- to the post-test phase was only found within the experimental group.

To determine whether there was a significant difference between the control group and experimental group on the post-test RCPM scores, an ANCOVA was conducted. The results revealed no statistical significant difference ($F [1, 66] = 0.39, p > 0.5$) between the experimental and control groups on the RCPM scores.

As illustrated in Figure 1, it can be seen that the gap between the experimental and control groups on the RCPM mean scores narrowed from pre-test to post-test teaching phase, in favour of the experimental group.

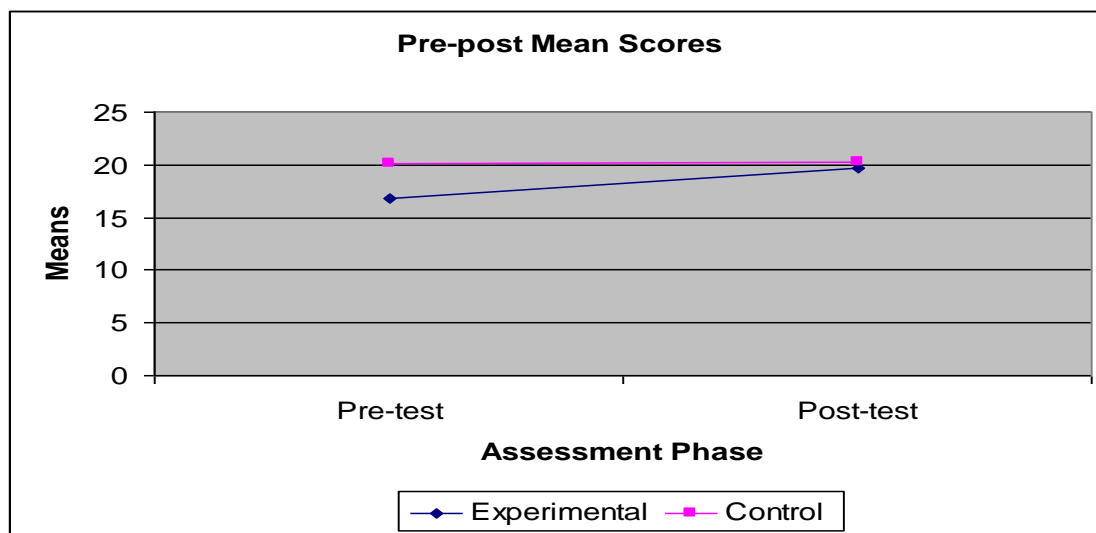


Figure 1. Pre-post test mean Raven's scores within the experimental and control groups

DISCUSSION

The major objective of the study was to investigate whether Feuerstein's mediated learning experience could be used as a vehicle for enhancing cognitive functioning of learners in a remedial school. The findings showed, as expected that learners within the experimental group which was

exposed to mediated learning experience demonstrated significant improvement from pre-test to post-test teaching phase. Consistent with the reviewed literature (Seabi & Amod, 2009; Skuy, *et al.*, 2002), these results suggest that provision of mediated learning experience is crucial to learners with special educational needs and that these learners have more potential ability than is estimated by traditional intelligence tests.

No significant difference was found between the experimental and control groups on the post-test RCPM scores. Of significant interest is that the gap between these groups on the RCPM means narrowed in favour of the experimental group, as an effect of the mediation. These findings are of special importance as they suggest that learners could benefit from interacting with a mediator, thereby enabling them to reach a level of cognitive functioning that they themselves could not access without assistance from a knowledgeable adult. These results confirm Vygotsky's (1978) notion of a zone of proximal development in which cognitive structures can be enhanced when the learner interacts with a more experienced adult.

Given that 30 to 45 minutes of intervention was provided to each learner within the experimental group, it is speculated that a five-day intervention of 30 to 45 minutes per day could have resulted in more significant improvement.

Implications for education

The present findings have educational implications. On the basis of the results, it is asserted that the learners exposed to mediated learning experience intervention were better able to cope with the cognitive problems. This supports Feuerstein's theory that initial poor performance was a result of a lack of mediated learning experience rather than inherent differences or deficiencies. In addition, provision of appropriate mediated learning opportunities enabled the learners to function adequately thereby accentuating the importance of stimulating and facilitating environments. The modification that transpired after such a short investment holds out the promise for even greater change after longer-term intervention. Therefore utilization of dynamic assessment provides a more accurate and fair assessment of abilities which enables the examiner to identify the individual's potential.

Limitations and recommendations

Limitations of the present study provide avenues for further research. A major limitation of the current study was the composition of the groups. While the composition of the experimental group comprised learners in Grade four and Grade five, the control group was composed of learners in Grade six and Grade seven. The lack of equivalence between the groups poses a threat to internal validity. It was not possible to randomly constitute the groups, as it was the school principal's request that the learning programme should not be significantly disrupted, since the intervention was carried out during school hours. The mediated learning experience intervention was of a short duration. A long-term intervention programme where cognitive modifiability could be more permanent and pervasive is suggested.

Conclusion

The results of the present study suggest that the deficiencies that impede performance on cognitive tasks for remedial school learners are amenable to mediation. The fundamental rationale for assessing cognitive potential in this way is that if modifiability can be observed through such a short period of intervention, cognitive structural change may be possible through a long-term investment. According to Feuerstein (1979, p.71), mediated learning experience is a "prerequisite to effective, independent and autonomous use of environmental stimuli by the child". Impoverishment of this meaningful experience tends to conceal cognitive potential and as a result, traditional intelligence tests may be insensitive, as they largely assess environmentally learned abilities. Consequently, low educator expectations and placement to special schooling may limit learners' cognitive development.

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