

CHAPTER SIX : DISCUSSION AND INTERPRETATION OF THE EMPIRICAL RESEARCH

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6.1. INTRODUCTION

The present study was undertaken in view of the need to acknowledge that everyone learns in different ways, and that it is consequently necessary to explore alternative ways of facilitating learning that will allow individuals to realise their natural potential. Current learning systems, that propose to educate and re-educate the “whole” child, tend to favour predominantly linguistic and mathematical intelligences as opposed to a more pluralistic approach (Jensen, 1995). This is a consequence of the prevailing philosophy of current educational systems and therapeutic institutions which indicates that “intelligence” or “potential” is a single general capacity that enables the individual to achieve in all situations. This is an attractive philosophy as it is quantifiable and measurable allowing categorisation of the individual. Research has, however, indicated that this type of approach to developing learning potential, which is based on the I.Q., Piagetian and information processing approaches, is product versus process orientated, and does not develop the whole person in their full capacity (Iran-Nejad, 1990; Gardner, 1986; Jensen, 1995; Russell, 1986; Buzan, 1991). Many educators and philosophers concur that the most important goal of education and therapy is to facilitate thinking.

Consequently, an alternative approach that focuses on the dynamics of the thought processes and the pluralistic nature of the intelligences of the human mind has arisen, which can be termed the geodesic movement. The current study fits into this movement by proposing a framework that allows geodesic principles to be operationalised.

A number of questions were addressed in the study regarding the effectiveness of the MMA as a framework for the implementation of geodesic learning principles in teaching and therapy in order to better realise the learning potential of pupils. The results presented in Chapter 5 revealed a statistically significant improvement in the knowledge, attitude and skills of the teachers and therapists regarding geodesic learning principles, which was shown to be attributable to the MMA training. Furthermore, this changed knowledge, attitude and skills of the teachers and therapists also had a statistically significant positive effect on their pupils in terms of improved academic results.

6.2 THE RESULTS OF THE STUDY RELATING TO THE HYPOTHESES

This section summarises the results in terms of the hypotheses (see section 4.4) and determines which of the hypotheses can be accepted and which must be rejected.

- ❑ The results showed that overall the MMA training programme was effective in increasing, changing and improving the knowledge, attitude and skills of the teachers and therapists regarding geodesic learning principles. Furthermore, the application by the teachers and therapists of these principles in their educative and therapy environments led to a significant improvement in the academic performance of their pupils. The **first** and **second hypotheses**, that there would be a positive change both in the teachers and therapists and in the pupils as a result of the MMA programme, can therefore be accepted.
- ❑ The MMA training resulted in a positive improvement in the teachers' and therapists' **knowledge** of neuropsychological and metacognitive concepts, and therefore **hypothesis three** can be accepted.
- ❑ The MMA training resulted in a positive change in the **attitude** of the teachers and therapists towards neuropsychological concepts, but not towards metacognitive concepts. Therefore **hypothesis four** can only be partially accepted.
- ❑ There was a significant improvement in metacognitive and neuropsychological **skills** in the post-training phase, and therefore **hypothesis five** can be accepted.
- ❑ It was found that the teachers' and therapists' results did vary according to age, language and qualifications. Those in the middle age-group (aged 31-50) showed the most significant improvement; the Afrikaans-speaking as opposed to the English-speaking and bilingual groups demonstrated the most positive change; and those that had a teaching plus an extra qualification did better than the "professional" group and those with a teaching qualification only. The **sixth hypothesis**, namely that the biographical variables of age, language and qualifications would influence the change in knowledge, attitude and skills of the teachers and therapists, can therefore be accepted.

- The natural trend of academic results for the learning disabled pupils in this study was positive, that is, the academic results improved as pupils progressed to higher standards. Thus **hypothesis seven**, that the academic results of learning disabled pupils would worsen as they progressed to higher standards, must be rejected.
- With the introduction of the MMA principles during 1993 the natural upward trend of the academic results of the pupils over 1991 and 1992 was altered in a positive way in phase one, maintained in phase two, and altered negatively in phase three. **Hypothesis eight** can therefore only be partially accepted for phase one.
- The phase one pupils appeared to respond better to the introduction of the geodesic learning principles than the pupils in phase two or phase three. **Hypothesis nine**, that phase two would demonstrate the most benefit from exposure to the MMA learning principles, followed by phase three, and then phase one, must therefore be rejected.
- Regarding the subjects, the MMA methods worked the best with English, followed by cultural subjects and then Maths. The subject Afrikaans responded the least to the introduction of the methods. **Hypothesis ten**, which predicted that the greatest improvement would be demonstrated in cultural subjects, followed by English, Afrikaans and Maths, in that order, must therefore be rejected.

6.3 THE RESPONSE OF THE TEACHERS AND THERAPISTS TO THE MMA TRAINING PROGRAMME: THE FIRST MAIN AIM

6.3.1 THE CHANGE IN KNOWLEDGE, ATTITUDE AND SKILLS REGARDING THE GEODESIC PRINCIPLES OF THE MMA

6.3.1.1 The change in knowledge

The results showed that the teachers and therapists had more knowledge about the importance of neuropsychological concepts and learning than metacognitive concepts, and that neuropsychological knowledge in the pre-training phase was high. This result is predictable due to the amount of information in the media and books on the left and right hemispheres of the brain, and increased awareness that “whole-brain” learning requires alternative approaches.

The question can therefore be raised: if there is such widespread knowledge of how the brain works, why is this knowledge not being applied in learning environments? This is possibly because traditional behaviouristic approaches to learning do not consider the “how” of learning or a knowledge of the functioning of the brain to be a contributing factor to the improving and/or release of potential (Buzan, 1991; Jensen, 1995; Novak & Gowin, 1984). Iran-Nejad (1990) argues that traditional approaches undermine the creative and multimodal nature of learning, limiting its domain to the rote learning of facts and definitions. This is because traditional behaviouristic approaches to learning generally assume learning to be the internalisation of external knowledge controlled by a single central self-regulatory centre (Iran-Nejad, 1990; Derry, 1991).

According to surveys on the relationship between brain function and learning skills (Buzan, 1991; Russell, 1986, Jensen, 1995), little or no information is given to students about the function of the human brain and learning during the informative academic years. It appears then that traditional philosophies regarding learning principles persist even though the teachers and therapists “know better”.

Confirmation of the persistence of traditional learning philosophies is gained from an examination of the responses to individual questions. For example, the high percentage of teachers and therapists that considered repeated reading through ones work to be “learning” is evidence that traditional behaviouristic philosophies still persist in current educational institutions, as well as being evidence of how entrenched these beliefs are. Furthermore, all the means in the Knowledge Neuropsychology category, although changed were still low in the post-training phase, which leads to speculation regarding the consistency of the changes that occurred. It appears that the teachers and therapists were not sufficiently convinced that they needed to change their entire approach, and continuing to use predominantly traditional methods, adopting only isolated components of the geodesic approach in a disjointed fashion. The other erroneous paradigms or beliefs relating to the issue of neuropsychological knowledge that continued to persist were as follows:

- The human brain is not very creative (as opposed to the human brain being exceptionally creative given the correct facilitation).*
- The left hemisphere is dominant for learning (as opposed to a synergistic processing between the hemispheres being an essential requisite of effective learning).*

- ❑ *Too much stimulation in the learning environment will decrease learning (as opposed to the individual learning most effectively through multimodal multistimulation).*
- ❑ *Visualisation is a fun activity but plays no real role in the learning environment (as opposed to visualisation being the way information is stored in the brain, as well as being the activator of learning).*
- ❑ *Intelligence is one-dimensional and is measurable by I.Q. testing (as opposed to intelligence being multi-dimensional, and thus I.Q. testing giving an indication of mathematical and linguistic intelligence only).*
- ❑ *The teacher or therapist is responsible for what students should learn, and how, when and if they have learned (as opposed to the teacher or therapist being a process manager guiding self-directed content resourcefulness).*

The significant improvement noted in the Knowledge Metacognition category indicates that there was a change in the status of the teachers' and therapists' knowledge of metacognitive concepts. However, the means for this category were even lower than for the Knowledge Neuropsychology category, which indicates that metacognition is a problem area.

Metacognition seems to be a difficult concept for teachers and therapists to grasp. This is not surprising considering the confusion in the literature regarding this topic. According to Brown and Palincsar (1982), the definition of metacognition needs considerable clarification. The low means in the Knowledge Metacognition category provide further support to the idea of entrenched traditional learning paradigms that were difficult to change. Erroneous ideas on metacognition still persisting in the post-training phase were:

- ❑ *Reading fast reduces comprehension of the material being read (as opposed to increasing the comprehension due to the brain taking in whole units of meaning).*
- ❑ *Using a pacer whilst reading reduces comprehension (as opposed to increasing comprehension due to the pacer facilitating a more effective eye movement).*
- ❑ *Linear monochromatic note-making techniques facilitate learning (as opposed to inhibiting learning due to only a minimal amount of left-brain processing being activated).*
- ❑ *Key words and key concepts are the same (as opposed to being different, the concept being more important as the brain processes and stores units of meaning, which are concepts).*

- ❑ *Factual recall is more important than creativity in the learning situation (as opposed to creativity being the result of synergistic processing between the hemispheres and therefore vitally important to the learning process).*
- ❑ *Learning is the internalisation of external facts, or the storage of facts for later reproduction (as opposed to the view that a change will occur as a result of the creative reconceptualisation of knowledge).*
- ❑ *The non-conscious plays only a very basic perceptual role in learning (as opposed to controlling approximately 90% of the learning process).*
- ❑ *Accelerated learning does not exist (as opposed to accelerated learning being the norm, and traditional philosophies retarding what is normal).*
- ❑ *A good teacher can get children to rote-learn and produce a good end-product, that is high academic results (as opposed to a teacher having the function of process designer and manager, involving pupils in planning, linking to learning resources, and encouraging initiative).*
- ❑ *Thinking skills should be taught as a subject (as opposed to being an all encompassing structure guiding every interaction with pupils).*
- ❑ *The highest level of thought is cognition (as opposed to cognition being the result of conscious thought, which is in turn guided by metacognition, the highest level of thought).*

In summary, the MMA training made a difference to the neuropsychological and metacognitive knowledge levels of the teachers and therapists but the means were lower than predicted. This leads to the speculation that the change experienced by the teachers and therapists was not large enough to overcome the entrenched traditional paradigms regarding learning principles. Thus, the teachers and therapists will probably only use the geodesic methods partially and inconsistently and eventually become demotivated and revert to predominantly traditional behaviours in teaching and therapy. The question arises: how should the MMA training be adapted in order to effect a change in paradigms in the long term? It is posited that the attitude of therapists and teachers plays an important role in effecting change. Researchers have long recognised the practical importance of attitude change, as this process has been the subject of careful study for several decades in organisational behaviour and adult education (Byron, 1986; Byron & Byrne, 1984; Rajeci, 1982; Knowles, 1990). In the next section, the attitude to neuropsychology and metacognition will be explored in order to investigate the possibility of a correlation between the results of these two pairs of categories.

6.3.1.2. The change in attitude

As reported in Chapter Five, the results in the Attitude Neuropsychology category showed a significant improvement in the post-training phase, whereas the Attitude Metacognition category showed a non-significant negative trend, indicating that the teachers' and therapists' attitude to metacognitive concepts was either poorer or more confused.

Examination of the overall means in the Attitude Neuropsychology category and of individual questions on the questionnaire indicated that the teachers and therapists believed in the potentially significant implications of the brain being involved in all aspects of the learning process, which is consistent with the results of the study thus far. Metacognition, however, once again presented as a problem, as the means for the Attitude Metacognition category were low. There was also an even spread of frequencies in the individual questions, indicating either a lack of understanding of the concept of metacognition, or just reflecting the entrenched belief that teachers and therapists transmit prescribed content, control the way students receive and use it, and then test if they have received it (Knowles, 1990). This tends to reduce learning to simple incremental internalisation as opposed to creative reconceptualisation, which can only really be facilitated by geodesic approaches. From the increase in the number of neutral "unsure" and "of some importance" responses in this category, it appears that even after training the teachers and therapists were confused or uncertain as to the significance of metacognition.

Furthermore, analysis of the responses to the section E questions (the definitions), for both neuropsychology as well as metacognition, reveals a lack of understanding of the implications of geodesic approaches to learning, which is either a reflection of entrenched beliefs, or is the result of inadequate training regarding this concept. In order to explain why this result occurred, attitude as an entity needs to be examined.

According to Byron (1986: 142), attitude can be defined as "relatively lasting clusters of feelings, beliefs and behaviour tendencies directed toward specific persons, ideas, objects or groups". Attitudes are assumed to comprise three basic parts: an affective component (feeling), a cognitive component (belief), and a behavioural or intentional component (Byron & Byrne, 1984; Knowles, 1990).

From the spread in the results and the significant positive trend in the Attitude Neuropsychology category, it would seem that the affective and cognitive components were influenced by the

training, and to a certain extent, the behavioural or intentional component, which is needed to complete the cycle of change. However, in the Attitude Metacognition category, the spread was not even and the change was not significant, indicating that there was an imbalance between attitudes towards metacognitive concepts and attitudes towards neuropsychological concepts. It therefore appears that the teachers and therapists understood the need to change to more neuropsychological approaches, but did not fully comprehend the importance of the metacognitive non-conscious level in the learning process, which confirms their traditional cognitive conscious sequential approach to learning. In order to change to a completely new system of learning as in the MMA, the attitude to both neuropsychological and metacognitive concepts needs to change in a balanced way.

In an attempt to analyse the attitude of the teachers and therapists in more depth, the responses to the section D questions were used to ascertain whether there was in fact an imbalance between the three components of attitude in the sample of teachers and therapists in this study. For instance, for the statement “the learning environment must be quiet and serious” (question D1), there was a positive change in that the percentage of teachers who responded “of no importance” increased from 4,4% to 13,3% in the post-training phase, and those who responded “of very great importance” decreased from 20% to 15,6%. In order for this change to have taken place, the affective component must have been positive, as positive feelings result in a willingness to change the cognitive belief system (Byron, 1986). However, the majority of the teachers and therapists opted for the conservative “of some importance” option in both the pre- and post-training phases, indicating that the behavioural tendency will still be towards the “quiet and serious” option being applied in the classroom and therapy room.

In order to convince individuals to change their attitude, the affective, cognitive and behavioural components of attitude would need to change more or less equally, not in the imbalanced way as indicated in the results of the current study. Examination of the responses to the remaining attitude question revealed that this imbalance occurred repeatedly. The negative questions were not included for analysis because, according to Byron (1986), change will only be induced when feelings towards the ideas are positive, and not negative.

The criteria used to judge balance and imbalance in this respect were as follows. In order for balance to be considered to occur, responses to section D questions should show similar frequency percentages in category 1 (“of no importance”) and category 4 (“of very great

importance”) in the pre-training phase, with the higher frequency percentages concentrated in category 2 (“of some importance”), then category 3 (“of great importance”), the latter two being the options usually selected by unsure or conservative respondents. In the post-training phase this spread of responses should change to majority either category 1 or 4, depending on whether the question was negatively or positively phrased.

By implication, if the majority of frequencies are clustered around the central options (2 and 3) in the post-training phase, and only a small positive change is demonstrated in either 1 or 4, then it can be assumed that the attitude components have not changed in a balanced way. The results of this study indicate an imbalance in the responses to all the questions related to attitude, particularly those pertaining to metacognitive concepts.

It can be concluded that it is easier to change the attitude of teachers and therapists towards neuropsychological concepts because the ideas invoked are logical and relate to the current philosophy propounded in many magazine articles and books, that consideration of brain research is imperative in education. However, consideration of the metacognitive non-conscious has many non-traditional implications, such as that the “teacher tell - pupil listen” paradigm is incorrect. This idea does not “fit” into the traditional mode of thought regarding teaching and learning, and is therefore more difficult to accept and implement. The implication is therefore to find ways of changing the three components of attitude of teachers and therapists to both neuropsychological and metacognitive concepts in a balanced way in order to effect total system changes.

In summary, it appears that the teachers and therapists agreed that changes in traditional systems are needed, and that neuropsychological approaches incorporating thinking skills are a necessary part of this change. However, it appears from the results of this study that the teachers and therapists were not convinced about a complete change in the system. This is possibly because traditional systems have been in place for so long and appear to be working. Alternatively, the teachers and therapists do not understand the implications of the change. It is postulated that this is one of the reasons that the teachers and therapists in this study are selecting only isolated components of the MMA in a disjointed fashion. According to the law of paradigms, however, past success guarantees nothing; in fact past so-called successful philosophies can block future vision (Barker, 1986). As Dewey indicated in 1896 (in Knowles, 1990), humans are in a constant state of change or flux, thus a static unchanging system, such as

the current traditional educational system, will block human development. Knowles (1990) argues that perceptive observers of modern civilisation have long been asserting that the nineteenth century model of education is no longer functional in a world of accelerating change. He indicates that “contemporary educational enterprise is frozen into the nineteenth century model of education” (Knowles, 1990: 167). This unwillingness to change could also be the result of the elusiveness of the concept of learning, making a measurable, quantifiable and controllable system, as is the product of traditional behaviouristic and cognitive mechanistic theories, attractive. Alternative geodesic approaches, by contrast, may appear “uncontrollable”, as they propose methodologies that are process oriented as opposed to product orientated. For instance, geodesic approaches propound co-operative learning (Johnson, Johnson & Holubec, 1986), where the teacher plays a facilitative background role, as opposed to an authoritative expert foreground role.

From the results discussed above, the following attitudes to learning still persisted after training in the majority of the teachers and therapists:

- ❑ *Learning is controlled by the teacher or therapist (as opposed to being facilitated by the teacher and/or therapist, who requires the ability to convey respect, caring and support; provide data and feedback non-threateningly; ask probing questions while keeping the locus of responsibility in the pupil; use the pupil as a source for his own learning; and listen empathetically).*
- ❑ *The learning environment is controlled and disciplined (as opposed to fostering a healthy scepticism toward authority, a spirit of inquiry and intellectual curiosity being fostered).*
- ❑ *Students learn from texts and from the teacher or therapist (as opposed to having a knowledge of the resources available and how to use these resources, e.g. how to identify data available in printed materials using the table of contents, the index and so on; how to scan quickly).*
- ❑ *Learning is the acquisition of isolated skills and techniques by drill, and therefore students need to listen uncritically, retain information, and predict exam questions (as opposed to having the ability to solve problems, formulate questions answerable by data, analyse data to produce answers to questions, and test data against criteria of reliability and validity).*

- ❑ *A competitive relationship with other pupils promotes learning (as opposed to a co-operative relationship between pupils promoting learning).*
- ❑ *Learning is a means to an end such as an exam (as opposed to its being a lifelong skill).*
- ❑ *The learning environment needs to be quiet and serious (as opposed to its being fun, exciting, stimulating and non-threatening, that is, an environment of freedom within a structure).*
- ❑ *Logical and ordered teaching is important to the learning process (as opposed to multidimensional and collaborative teaching, which allows freedom of association, again within a structure).*
- ❑ *Laughing, playing and joking serve as breaks from the tedium of learning (as opposed to their being part of the whole learning process).*

Hence, 65,7 % of the teachers and therapists in the current study were found to be reactive as opposed to proactive with regard to the facilitation of the learning process. Traditional philosophies of learning “condition the student to respond to the teacher’s and therapist’s stimuli; the initiative in the transaction is almost wholly in the teacher and therapist; the role of the student is to react” (Knowles, 1990: 209). This keeps the learner in a dependent role, limiting the learning to the paradigms set by the teacher. This study therefore lends support to the claim made by Iran-Nejad (1990) that traditional attitudes to learning limit the role of learning to the simple incremental internalisation of facts in a rote-learning fashion, and that this in turn fosters the achievement and motivational problems that children experience in schools.

Finally, the application of alternative geodesic approaches requires different types of skills and consequently roles from the teacher and therapist. This can be threatening as well as challenging for teachers and therapists, who find it easier, therefore, to revert to “comfort zone” levels of skill. The skill level of change is examined in the next sub-section.

6.3.1.3. The change in skills

As indicated in the results, scores in both the Skills Neuropsychology and Skills Metacognition categories showed significant improvement after training. Examination of the means of the scores before and after training for both categories indicates that although there was an improvement in teachers’ and therapists’ skills, the skill levels were initially low. This would seem to provide support for what has been postulated regarding the results of the study thus far,

namely that traditional beliefs or paradigms are so entrenched or conditioned that even though the teachers or therapists are aware that a complete change to more geodesic approaches to learning is needed, they automatically revert to what they know, or are comfortable with. Alternatively, their conditioning or paradigms could be blocking their ability to understand and therefore apply more wholistic methods and consequently, they do not actually know what to do. Thus, their intentional, behavioural and actual skill application level of geodesic principles is low. These results confirm Knowles' (1990) postulation that contemporary educational enterprise is seemingly frozen into an outdated nineteenth century model.

Furthermore, even though change occurred during the post-training phase, traditional teaching and therapy methods were still being used, with only elements of the MMA methods being applied, which would account for the low means obtained for the skills levels. However, some improvement did occur, which indicates that benefit was derived by the teachers and therapists from the MMA training regarding skills. The effectiveness of this partial application can be judged in two ways: from an analysis of the results of section F of the questionnaire, where the teachers and therapists were given the opportunity to explain how they used the methods and the benefit, if any, they and their pupils derived from this exposure; and from the statistical analysis of the pupils' academic results, which is discussed in section 6.4 below.

With regards to the responses to the questions in section F (see Table 5.6), it appears that the majority of the teachers were using Mind-Mapping predominantly with cultural subjects and English, with very few using it with Afrikaans or Maths. Moreover, from the comments on the questionnaires, it appears that the teachers were using Mind-Mapping as a summary at the end of a lesson after "teaching" in the traditional format.

Thus the Mind-Mapping Approach was utilised as a supplementary aid and a way of summarising, not as a total system. The teachers and therapists did not use the co-operative teaching concept along with the Mind-Map, which is part of the presentation of information. It appears that they viewed the Mind-Map as a way of reinforcing the memorisation of facts, and of "getting the information into the pupils' heads for future reproduction", in other words, as a means to an end. The MMA was thus not viewed as a way of facilitating thinking and the creative expansion of thought, as a process of development. It is almost as if the geodesic methods of the MMA were changed into traditional "tools", and thus viewed as something

“extra to do”, and not as an alternative approach to turn the product of education into a lifelong learning experience.

For instance, music, which should be played throughout the lessons in order to facilitate concentration and increase the rate of learning, was used intermittently to relax the children, and only by 60% of the teachers and therapists; secondly, the relaxation exercises, which should be used at least daily to release the correct chemicals to facilitate the metacognitive and cognitive processes, were used sporadically by only 20% of the teachers; and, thirdly, the Mind-Map, which should be used continuously in exchanging information, solving problems, creating, memorising, organising thinking and information, and facilitating inquiry-directed research, was only really used as a summary “tool”, and study method.

Furthermore, difficulty was experienced with the following skill applications of the MMA methods:

- Getting students to read faster using a pacer in order to improve comprehension
- Stopping students re-reading within a sentence, which reduces comprehension
- Using Mind-Mapping all the time, that is for planning lessons, presenting lesson content, discussions, studying - in other words, wherever there is an exchange of information
- Improving comprehension through the “jig-saw puzzle” method of the MMA, which applies an organised inductive and deductive approach to a text culminating in a Mind-Map (see Appendix IVA) as opposed to reading and rereading through work, underlining key words and making linear notes
- Differentiating between key words and key concepts, and facilitating this understanding in children
- Becoming a facilitator as opposed to a teacher, that is, moving away from the “teacher tell - pupil listen” paradigm
- Using co-operative teaching techniques
- Teaching pupils how to make Mind-Maps independently as well as assisting pupils in the use of the MMA as a study technique.

Few teachers or therapists used the MMA geodesic methods as an entire global cycle. Most of the teachers only adopted isolated components in a disjointed fashion. It appears that teachers and therapists did not know how to use the various procedures, and therefore selected those that

they were comfortable with. Furthermore, the resistance to change by the therapists and teachers appears to be the result of being set in traditional paradigms.

6.3.1.4. General conclusion regarding the change in teachers' and therapists' knowledge, attitude and skills

Although the overall results of the current study indicate that a significant change did occur in the teachers' and therapists' knowledge, attitude and skills regarding the geodesic principles of the MMA, it is postulated that these changes were not sufficient to produce an attitude of complete change in the teachers that would be long-lasting. Thus in the post-training phase the teachers and therapists were not applying the MMA geodesic methodology as a an entire global cycle, they were adopting isolated components in a disjointed fashion. The results also indicated a persistence of traditional beliefs or paradigms regarding the learning process in the majority of the teachers and therapists. The speculation arises that this resistance to change is based on attitude, and that unless all three components of attitude (affective, cognitive, behavioural) are changed in a balanced way, long-lasting global changes will not be effected.

Therefore, it appears to be relatively easy to increase a person's knowledge and to improve a persons' skill under supervision, but unless there is a total change in all the components of attitude, this knowledge will not be utilised, and the skill levels regarding the use of the MMA will not increase sufficiently to allow effective autonomous and long-lasting application.

These findings support the literature dealing with the importance of attitude change (Byron, 1986; Rajecki, 1982; Byron & Byrne, 1984). This has important implications for the current research in that the MMA training needs to incorporate techniques that will facilitate a change in attitude towards alternative forms of education, and will therefore overcome existing traditional paradigms. This is discussed more fully in Chapter Seven.

6.3.2 THE INFLUENCE OF BIOGRAPHICAL VARIABLES ON BEHAVIOUR CHANGE

As reported in Chapter Five, it was the middle age group of teachers and therapists, the Afrikaans-speaking group, and those with a teaching qualification plus an extra qualification that showed the most improvement after the MMA training.

6.3.2.1. Age

In-depth analysis of the influence of age (Table 5.3a & b) revealed that the young and middle age groups had similar baseline levels (0,5 and 0,51) whilst the older age group had a higher mean of 0,54. The means of all three groups after the training were 0,57. The younger age group was significant on the 10% level possibly due to the smaller sample size. The scores of this younger group showed the greatest difference in the two phases. Therefore it appears that the capacity to change was easier for the younger and middle age groups of teachers and therapists, which is a predictable result in light of the fact that they are more recently qualified and thus are more likely to have been exposed to alternative methods. Furthermore, the younger the teachers and therapists are, the less likely they are to have established set teaching and therapy patterns and consequently the more open-minded they are likely to be towards alternatives. The older age group of teachers and therapists had a higher pre-training knowledge, but showed the least capacity for change, and were therefore the most resistant to new ideas. The older age group may have felt that their previous methods had worked in the past and were still working, and that they had the experience in education and therapy, and therefore may have been reluctant to change what appeared to be successful.

Analysis of the influence of age within the six individual categories revealed that the highest pre-training means were found to be in the Attitude Neuropsychology category for all three groups, and the lowest in both the skills categories, with the means in Skills Neuropsychology being lower than the means in Skills Metacognitive both before and after training. This would appear to indicate that the teachers and therapists in all three age groups realise the importance of neuropsychological concepts, but do not know how to apply this knowledge. Therefore their confidence in their ability to apply the concepts is not as strong as their confidence in their knowledge. Of the three age groups, the oldest had the most confidence in their skills, possibly due to their experience. The metacognitive aspect of all three categories, knowledge, attitude and skills, is definitely a problem area in all three age groups, and, once again, the older age group had the highest means, and thus knowledge, both before and after training. This appears to be more a lack of understanding of the concept of metacognition and its importance to learning, than a negativity towards it. It appears that it is easier to understand neuropsychological concepts as there are definite methods or exercises to enhance neuropsychological aspects of learning. Metacognition is more elusive, with less clearly defined parameters. This has implications for training, in that the model proposed in Chapter Three should possibly be included in the training of teachers and therapists in order to make the

concept of metacognition more manageable. This would need to be co-ordinated with more practical exercises and demonstrations on the application level.

6.3.2.2. Language

An in-depth analysis of the influence of language (Table 5.4a & b) revealed that the bilingual group had the highest pre-training means, but demonstrated the least change, as opposed to the Afrikaans-speaking group which had the lowest pre-training means and the highest post-training means, therefore demonstrating the most change. The English-speaking group had a marginally higher pre-training means than the Afrikaans-speaking group, and demonstrated a significant change, but not as much change as the Afrikaans-speaking group. This would seem to imply that the Afrikaans-speaking group was the least resistant to change, and the English-speaking group the most resistant, with the bilingual group in the middle. All three groups had low means after the training, and the change was therefore marginal.

These results appear to be demonstrating the effect of “paradigms”. According to Barker (1987), a paradigm can be defined as sets of rules and regulations which influence and guide thinking and hence decisions. A paradigm is the result of conditioning or sets of beliefs. In the case of the above results, it is possible that the conditioning in traditional education and therapy methods was too entrenched for the teachers and therapists to change their approaches radically. In other words, the MMA training was only partially successful, in that the teachers and therapists did not use the methods as an all-encompassing complementary teaching and therapy method. Traditional methods were still being used after training as the predominant form of facilitating learning, hence the low post-training means. With regard to the Afrikaans-speaking group being the most responsive to “new paradigms”, it may be that the English-speaking and bilingual groups had already experimented with alternative methods to a certain extent. Due to either incorrect application of the “new methods”, or proficiency with the older methods, or just coping with the curriculum or client load, the teachers and therapists reverted to their old methods, implying a weariness in the application of “more new methods”. The Afrikaans-speaking group, on the other hand, may not have experimented with alternatives to the same extent, and may have been at the point where their need to change was greater. This is corroborated by the results of section F of the questionnaire, where the teachers and therapists were able to express their opinion of the MMA methods in an open-ended way. An element of scepticism and negativity was evident in the remarks of the English-speaking respondents, whereas the responses of the Afrikaans-speaking group were very enthusiastic and positive.

In terms of the six categories tapped by the questionnaire (Table 5.4b), similar patterns presented with all three language groups. That is, the attitude towards, and the knowledge of neuropsychological concepts had higher pre-training means, and greater post-training changes than the corresponding metacognitive categories in all three groups. The metacognitive skills, on the other hand, were higher both before and after training than the neuropsychological skills in all three groups. These patterns were the same as the patterns identified across the age groups. This implies that understanding the concept of metacognition and its link to learning is equally elusive for all three language groups. Therefore, even though the means were higher after training in the Skills Metacognition category, these means were still low, implying minimal change had occurred. It is also possible that metacognition was not explained or demonstrated clearly enough in the MMA training course, which would also account for the results obtained. This has clear implications for future training, as already mentioned.

6.3.2.3. Qualifications

An in-depth analysis of the influence of the teachers and therapists' qualifications (Table 5.5a & b), revealed that those teachers and therapists with a teaching qualification plus an extra qualification such as remedial or special education showed the most significant improvement in the post-training phase. However, the "professional" group, which also demonstrated a significant change although not as significant as the "teaching plus" group, showed the most difference between the pre- and post-training means. The lower significance of this result is probably attributable to the small sample size of the "professional" group ($n = 9$) as opposed to the "teaching plus" group ($n = 24$).

The results appear to indicate that higher qualifications make teachers and therapists more receptive to new ideas and change. The results of the "professional" group (which had the highest post-training means and smallest sample size, indicating that their knowledge, attitude and skills improved the most) indicate that the professional could play a supportive and consultative role in the classroom with regard to the implementation and carrying-over of geodesic principles. As the "professional" group in this study included speech-language therapists, this result supports the proposal by Gerber (1986), who suggests that the speech-language therapist is ideally qualified to act as a consultant in the classroom.

Analysis of the results in each of the six categories revealed that once again Attitude Neuropsychology had the highest means both before and after training in all three qualification

groups. Furthermore, the skills categories demonstrated the most changes, but the means were once again low, especially in the Skills Neuropsychology category. This has important implications for the MMA training programme in that the trainer needs to provide more practical exercises in the form of demonstrations and practice of Mind Mapping in order to increase skill levels, which will in turn increase the application levels. This is necessary as it is becoming increasingly clear that all the teachers and therapists, regardless of age, language or qualifications, agree as to the importance of neuropsychological and metacognitive (geodesic) principles in learning situations, but are not sure how to integrate and apply this knowledge and belief with their current methodologies. The fact that the scores in the Attitude Metacognitive category were again low, and even lower after training, could also be due to inadequate training, as already mentioned.

6.4. THE RESPONSE OF THE PUPILS TO THE EXPOSURE TO THE MMA METHODS: THE SECOND MAIN AIM

In this section the effectiveness of the application of the MMA principles by the teachers and therapists on the academic performance of their pupils is discussed.

6.4.1. THE CHANGE IN LONGITUDINAL TRENDS OF ACADEMIC RESULTS IN GENERAL, PER PHASE, PER SUBJECT AND PER STANDARD

As reported in Chapter Five, the longitudinal trend of academic results showed a small but significant positive alteration in 1993. Therefore, it is concluded that overall the pupils benefited from the introduction of the MMA methods. However, these changes were limited which, considering the isolated componential use of the methods by the teachers and therapists discussed in the preceding section, is not surprising. It is postulated that, had the teachers used the entire system of the MMA as a new approach, much more significant change would have occurred.

Furthermore, the change that was measured in the pupils was academic results, a product. However, the MMA methods are process focused. Therefore, the question arises as to whether what was measured was actually what was facilitated. It could be that, had more process-oriented measures been used to evaluate success, a different type of result would have been

obtained. The changes identified in the results are more likely to be a “side effect” rather than a direct effect of the geodesic training. Improved memory is one of the side effects of the MMA. In a product-orientated environment where predominantly facts are tested in exams, marks can improve for factual recall using the MMA. It is postulated that this is the change that was identified in the current study as opposed to a process change.

Stated within the parameters of the MMA model of geodesic information processing and thinking (as described in Chapter Two), traditional testing evaluates predominantly declarative knowledge, whereas geodesic training develops the interaction of declarative, procedural and conditional knowledge. This implies that alternative geodesic evaluation measures need to be used to evaluate geodesic processes.

A better indication of process improvement can be obtained from the responses to section F of the teacher/therapist questionnaire. For instance, F3 queried whether the teachers and therapists felt that their pupils had derived any benefit from the MMA, and if so what. Fifty-five per cent of the teachers and therapists indicated that their pupils had benefited in terms of improved memory, improved organisational skills in projects and essays, and improved problem-solving skills in terms of certain group assignments. However, these latter projects were not considered to be for exam purposes and the marks given to the pupils were not recorded in the promotional schedules. This reflects the traditional conditioning of the teachers and therapists to focus on the product-orientated factual regurgitation of photocopied notes as measures of potential - a “maintenance effect” of the traditional philosophy of education.

Comments were even made by the teachers and therapists to the effect that the marks received were the result of group collaboration and thus not reflective of an individual’s potential and not used on reports; and that the marks were too high, the pupils were lucky. Therefore the academic marks measured in this research actually reflect the students’ factual recall in a pressurised unnatural exam situation and not their true potential. What the results do confirm, however, is that memory definitely improves using MMA methods.

Examination of the remainder of the longitudinal trends reveals the emergence of a consistent pattern: the pupils in phase one responded better to the MMA methods than those in phase three, whose results tended to worsen when using the methods; the pupils in phase two appeared to maintain the positive trend. Likewise, the improvement in the subjects of English, Afrikaans,

Maths and cultural subjects was greater in phase one than in phase two, whilst the results actually got worse in phase three.

The results of the analysis per standard confirms the above: grades one and two and standard one (= phase one) demonstrated significant improvements, whereas standards two and three (= phase two) maintained the same trend, and standards four and five (which span phase two and three) got significantly poorer marks. Therefore the younger children benefited the most from the MMA methods, and the older children benefited the least.

This pattern can be explained from various perspectives. Firstly, the younger pupils have not been in the traditional schooling environment long enough to have become over-reliant on active self-regulation and are thus still using predominantly dynamic self-regulation to learn, activating predominantly the metacognitive level. As they progress through to the higher standards, however, the executive controlling active self-regulation becomes progressively more involved at the expense of dynamic self-regulation. Learning consequently becomes encumbered by increasingly intentional rote and sequential one-thing-at-a-time learning; this learning is conscious, hence cognitively dominant. The pupils are going along the ineffective path of the effort to encode or memorise, thus making learning more difficult (Iran-Nejad, 1990).

The above finding is in contrast to what was hypothesised at the outset of the current study. It was predicted that the older pupils would have a greater need than the younger ones for a study method, and therefore would respond more favourably. It was also predicted that it would be easier to use the MMA methods with the more defined close-ended curriculum of the higher standards that have more specific product goals. It appears, however, that these selfsame paradigms served to limit rather than enhance the learning situation because pupils' marks worsened in the higher standards. Therefore, trying to slot geodesic methodology into a linear limiting traditional environment made matters worse rather than better. This could indicate that total system changes are needed in the higher standards, or that the higher standards need to go back to the methodology utilised in the lower grades in order to incur greater success.

The results of this study appear to confirm the results in the literature on learning (Lozanov, 1978; Dhority, 1991; van der Vyver, 1985; Iran-Nejad, 1990; Gardner, 1986; Jensen, 1995), namely that learning methodology has to have more of an emic perspective. The "teacher tell -

pupil listen” paradigm that becomes prominent in the higher standards does not allow for analytical, evaluative or creative thinking or for the application of knowledge in problem-solving (Adams & Wallace, 1991). Furthermore, “the content-overload of most syllabi prevents even the most skilled teacher from using time to develop pupils’ active thinking rather than just memorisation in order to accrue marks” (Adams & Wallace, 1991: 105). This study underscores the seriousness of the situation in that incorrect facilitation of learning will actually inhibit the development of potential. Further confirmation of this trend of thought was found in the responses to section E and F of the questionnaire, where it appeared that the teachers and therapists who taught in phase three had more difficulty applying the concepts of the MMA than the teachers in phase one.

6.4.2. THE LONGITUDINAL TREND IN EACH SUBJECT PER PHASE AND PER STANDARD

Examination of the patterns that emerged from the phase and standard breakdowns of the results in each subject revealed that the subject of English responded the best to the introduction of the MMA methods, followed by the cultural subjects, then Maths, then Afrikaans. Furthermore, English was the only subject that consistently demonstrated significant improvement across all three phases.

The fact that the MMA methods had the most positive effect on the subject of English is possibly due to English generally being facilitated through more creative and wholistic means than the other subjects. The curriculum includes literature, poetry, plays, creative writing, debates. The mark in the subject of English is usually obtained from a factual grammar test and a creative writing test. It is possible that the marks on the creative writing test were higher after exposure to the MMA methods, and that the grammar marks also improved because they were taught thematically within a communication content. In contrast cultural subjects are normally taught in a very segmented factual way, with the objective being to learn the facts provided in the text book or the photocopied notes. In the higher standards exercises often comprise filling in the “missing word”. Thus, traditionally there is limited creative thematic and wholistic methodology utilised with cultural subjects, and the improvement seen in cultural subjects in this study is probably due to the “side effect” of improved memory referred to earlier.

With regard to Maths, which is traditionally divided into units, and then sub-divided again into weekly and daily plans (Jensen, 1995; Knowles, 1990). This segmented approach provides

unconnected bits of information out of context, and detracts from the wholistic overview required to understand Maths concepts. In order to use Mind-Mapping in the subject of Maths, the whole must first be presented thematically, followed by an analysis of how to get to the whole, and, most importantly, the information must be context related. This requires a different orientation to the traditional pedagogical approach and is thus harder to apply. In fact, only one teacher, a phase one teacher, out of the 45 teachers and therapists, actually used Mind-Mapping with the subject of Maths, whereas 38 of the teachers and therapists used the methods with English.

With regard to the subject of Afrikaans, only five of the teachers and therapists used the MMA methods. This may be due to the fact that the MMA training was in English, or because the subject of Afrikaans is still taught in a very traditional way in contrast to English, which made it very difficult to apply the MMA methods.

In conclusion, in order to adopt geodesic philosophy into the teaching environment, a wholistic multimodal thematic approach has to be adopted. This requires total systems changes rather than trying to slot geodesic methods into traditional formats. There appears to be more extensive use of the neuropsychological and metacognitive philosophy in the lower classes (grade 1 to standard 2). Furthermore, it appears that the subject of English is facilitated within these parameters to a certain extent in all the phases. However, the remainder of subjects are taught, or facilitated in therapy, in a fragmented piecemeal fashion, which is probably the result of conditioned traditional training.

6.5. A CRITICAL REVIEW OF THE EXPERIMENTAL PROCEDURE

Based on the preceding discussion of the results of this study, it is concluded that the efficacy objective of the research was reached. A critical evaluation of the experimental procedure takes into account the different aspects that must be considered during the evaluation of an experiment, and for the planning of future research. This section contains a critical review of the research design and research procedures.

6.5.1. RESEARCH DESIGN

The current research employed an adapted ABA experimental design due to the need to build in effective controls, as well as to deal with the complex layered design of the study. There were three forms of control involved in the study's tectonic structure, which served to strengthen the conclusions drawn. These were:

- The design, which comprised of two experiments, where the influence of the MMA philosophy was evaluated through the change in the teachers and therapists who received direct training, as well as through the change in the pupils who received indirect training
- A pre and post questionnaire so that each teacher or therapist served as their own control
- The establishment of longitudinal trends of pupils, who acted as subjects, academic results to serve as baseline measures and controls.

This combination of controls provided a sophisticated methodology for accounting for variability in behaviour, in that the changes in behaviour were evaluated in different ways (Leedy, 1989).

As control is fundamental to the experimental method, what was initially the study's weakness with regard to the subjects controls became its strength. It was impossible to create a matched control situation because all the pupils were exposed to the independent variable, the MMA methods, in the experimental year, and there were thus no pupils available who had not been exposed, to serve as a control. This led to the development of longitudinal trends which, due to the historical time factor, served not only as baselines but also as controls. Furthermore, these trends also provided important additional information regarding trends in remedial primary schools.

The development of the longitudinal trends led to the purification of the datasets used in the study. Initially there was one dataset of academic results, which consisted of a random sample of 790 sets of results over three years from the three remedial schools. However, the random sampling procedure, which normally adds validity to a study (Leedy, 1989), in this case resulted in dependent data - in that some pupils' results were used more than once over the period 1991 to 1993 - a situation which could lead to false positives being obtained. Therefore a second purer dataset was created of the results of those pupils whose results appeared for each of the

three years. However, this dataset contained the results of only 75 pupils, the majority of whom were in phase three. This was unbalanced and moreover was actually only a subset of the first dataset.

The dependency factor was therefore accounted for by the creation of a third dataset, which combined the first two datasets, and in addition by the use of various statistical procedures. The results obtained from this third dataset were therefore more accurate and were hence used for the analyses.

Building these multiple controls into the design allowed for the exploration of the relationship between the independent variable (the MMA methods), and the dependent variables (the behaviour of the teachers and therapists and the academic results of the pupils).

Despite the above, there were, however, limiting factors in the tectonic design of this study that must be considered. These relate to the concept of bias which is an inherent part of any research. The sampling for the three datasets of pupils' results was carefully planned and statistically tested. Therefore, according to Leedy (1989), the conclusions drawn from the data should not be distorted or biased. The sample of teachers and therapists was homogenous in terms of their experience with learning disabled pupils, and one can thus assume that they all had similar experience regarding learning disabilities. However, 28,9% of the teachers and therapists in the study were in phase one, 19,9% were in phase two, and 8,9% were in phase three. Therefore, the weighting was in favour of the teachers in phase one.

The second possible area where bias must be acknowledged in this study is in the questionnaire. The questionnaire is a descriptive survey technique that was used in the current study in conjunction with the experimental method (Leedy, 1989). According to the literature, descriptive survey research is particularly susceptible to distortion through the introduction of bias (Kornhauser & Sheatsley, 1976). It is therefore imperative to bear bias in mind when interpreting the results of the questionnaire.

The MMA training for the teachers and therapists was not compulsory. All the teachers and therapists in the schools selected were briefed as to the contents of the course, and used this information to make their decision whether to come or not. They therefore had a general idea of what to expect. The high knowledge levels of neuropsychological concepts among the

respondents, as well as the awareness of the need for change, may have been the result of the briefing; it may also be the case that those who chose to attend may have been more favourably inclined towards the principles put forward, a possible bias that needs acknowledgement.

6.5.2. RESEARCH PROCEDURES

This section evaluates the procedures employed in the research. As already reported, although overall the MMA proved to be effective as a vehicle for change, the results do indicate that the changes in both the teachers and the pupils were conservative.

The training of the teachers and therapists in the MMA could have been lengthened to include more practical work, allowing for more demonstration of the methods and for supervised application of the methods by the teachers and therapists in classrooms and therapy rooms.

Furthermore, in order to increase the external validity of the study, the experimental procedure could have been extended to provide a longer period of exposure for the pupils to the MMA methods. This could have been a controlled supervised situation in order to establish whether the improvements were maintained, and if periodic training of the teachers and therapists is needed to sustain the use of the alternative approach of the MMA.

Regarding the procedures used to measure changes in the pupils, this was done through an analysis of the academic marks according to the promotional schedules. As discussed previously, these are product orientated, whereas the MMA methods are process orientated. Thus, alternative measures of academic potential and thinking skills are needed in addition to straight academic marks. Improvement in the latter only really reflect memory improvements (Gardner, 1985).

A geodesic model such as the MMA would work more efficiently if used within a collaborative transdisciplinary approach. However, the study was carried out by the researcher alone and few collaborative techniques were used in training. The success factor of the MMA might well be increased within a collaborative transdisciplinary approach.

The study could therefore be lengthened to include a transdisciplinary team involved in the training as well as in the practical classroom and therapy room exercises, where consultative and collaborative techniques could be demonstrated and practised. This suggestion falls within

the realms of a systems approach which would necessitate basic changes in the structure of the current research.

It appears, however, that the experimental method fulfilled the requirements of scientific research. Therefore, on the basis of the results, it is concluded that the MMA is an effective geodesic technique that is able to alter and improve the potential of teachers, therapists and pupils in remedial schools.

6.6. THEORETICAL IMPLICATIONS FOR GEODESIC LEARNING

The results of the current research indicated that the MMA training programme was effective in bringing about significant improvement in the teachers' and therapists' knowledge, attitude and skills regarding alternative geodesic principles. The results also indicated that the pupils that were exposed to these techniques benefited academically. The patterns emerging from the results revealed certain theoretical implications which will be discussed forthwith.

6.6.1 CHANGES IN THE TEACHERS AND THERAPISTS

The current research suggests that alternatives to the current traditional learning methods are essential if learning institutions are to provide people with effective life skills and enable them to be autonomous learners.

This suggestion is based on a body of literature on alternative learning which stresses the need for fundamental change in the perception of learning in order to cope with the world-wide information explosion (Lozanov, 1979; Gardner, 1985; Iran-Nejad, 1990; Knowles, 1986; Gould, 1973; Capra, 1982; Faure, 1972; Jensen, 1995; Slabbert, 1991; Novak & Gowin, 1984; Kline, 1988; Glasser, 1990; Palmer, 1985; de Capdevielle, 1986; de Andrade, 1986; Nummela & Rosengren, 1985; Wenger, 1985; Adams & Wallace, 1991). The alternative non-traditional approach proposed in this study is geodesic learning. Gould (1973) defines non-traditional learning as an attitude more than a fixed system, with delimited paradigms that can never be defined except tangentially. According to Gould (1973: xv), "this attitude puts the student first and the institution second, concentrates more on the former's needs than the latter's

convenience, encourages diversity of individual opportunity rather than uniform prescription, and de-emphasises time, space and even course requirements in favour of competence and, where applicable, performance. It has concern for the learner of any age and circumstance, for the degree aspirant as well as the person who finds sufficient reward in enriching life through constant, periodic or occasional study.”

Thus, alternative approaches to learning consider that learning how to learn and self-directed inquiry are essential life skills which enable systems as well as the people within the systems to bring about their own transformation in response to changing situations and requirements. Faure (1973) indicates that education and learning must be conceived of as an existential continuum as long as life, and not limited in time to “school age”, or confined in space to “school buildings” and institutions.

The literature indicates that alternative non-traditional approaches to learning require an attitude change in order to deal with the flexibility of society and all of its institutions, which are in a continuing state of transformation (Schon, 1971; Iran-Nejad, 1990; Gardner, 1986; Jensen, 1995; Knowles, 1990; Okebukola, 1992). The results of the current study lend support to this contention in that attitude was found to be a fundamental criterion for effecting a change in perception towards learning. The results reflected a need in teachers and therapists to change to a more wholistic neuropsychological approach to learning. However, the attitude levels of the teachers and therapists were very low. This was presumed to be due to an imbalance in the components (affective, cognitive and behavioural) of the attitude phenomenon in the teachers and therapists. Furthermore, it is postulated that this imbalance increases the resistance to change. This in turn produces what is known as the “maintenance effect”. Botkin, Elmandjra and Malitza (1979) indicate that “serious doubt must be raised as to whether conventional human learning processes are still adequate today”. They state that traditional learning methods foster a pattern of “maintenance learning”, where fixed methods, outlooks and rules - paradigms - are used to deal with known situations, which increases an individual’s ability to cope with what is known but ignores what is not known. This can be compared to the Khunian effect where the unexpected is ignored and changed to fit into an existing paradigm (Khun, 1979, in Barker, 1986). Maintenance learning therefore maintains an existing system or way of life. This “maintenance” or “Khunian” effect was observed repeatedly in the current study where the MMA methods were adapted and changed by the teachers and therapists to fit into the traditional approach, as opposed to being adopted as a new entire global system different from

the traditional system. Maintenance learning plays an indispensable role in the functioning of societies, but, for long-term survival, “learning that can bring change, renewal, restructuring, and problem reformulation” is essential (Elmandjra et al., 1979: 9). Hence, learning institutions need to develop innovative as well as maintenance learning, and not maintenance learning alone. The latter will create the paradigm effect where “past success can block future vision” (Barker, 1986). The results of current study emphasise the strong effect of maintenance learning and the need to foster innovative learning.

In summary, it is postulated that the “maintenance learning” and “Khunian effect” phenomena are the result of resistance to change, which is an accepted facet of human nature (Barker, 1986). Furthermore, resistance to change is only overcome when all the components of attitude are changed in a balanced way. Okebukola (1992) researched the attitudes of teachers, who are the key agents in the diffusion process of an educational innovation, towards the use of concept-mapping and “vee-diagramming” (Novak & Gowin, 1984). The underlying philosophy of these techniques is of a geodesic nature which requires a change in teachers to a new alternative approach. He found that, after a five-day training course which included practical application in the classroom, there was a favourable attitude in the teachers towards the use of the geodesic concepts - particularly concept-mapping which is similar to Mind-Mapping - in cultural subjects, but not in Maths. He also found that although the teachers’ skill levels improved, they experienced difficulty in teaching the methods to the pupils. The current study confirms Okebukola’s (1992) findings that attitudes and skills can be changed, and that teachers perceive geodesic methods as easier to apply with cultural subjects than with Maths. However, it is believed that the “favourable” attitude of Okebukola’s (1992) study was the equivalent of a change in only the cognitive component of attitude and the knowledge levels of the current research, and not indicative of a permanent change in the teachers’ philosophy. Furthermore, although the underlying philosophy of concept-mapping and vee-diagrams is geodesic, the methods themselves have remnants of traditional linear methodology in them.

This lends support to the proposition that, in order to effect a global and lasting change in the perception of learning, the three components of attitude have to be altered in a balanced way, which will in turn reduce the resistance to change and overcome the “maintenance effect”. How to change the three components of attitude in order to overcome the resistance to change and to create innovative learning environments and innovative learners, provides speculation for future research (see Chapter Seven).

It is postulated that once the “maintenance effect” is reduced by influencing attitudes, then a paradigm shift will start to occur in accordance with the law of paradigms (Barker, 1986). This shifting of paradigms was evident in the current study, because, even though the means were low, significant positive changes occurred in four of the six categories measured (Knowledge Neuropsychology, Attitude Neuropsychology, Skills Neuropsychology and Skills Metacognition). The overall results also demonstrated a significant positive change. Furthermore, there is evidence that the pupils benefited significantly from the introduction of the geodesic principles, even though the principles were not used as a global system. It therefore appears that the componential use of the MMA methodology succeeded in altering positively the natural trend in the pupils’ academic results. Furthermore, the teachers and therapists appeared to sense a substantial growth in themselves and their pupils, which is not always measurable on achievement tests.

This supports research by Palmer, Ellis and Alexander (1989), who did an in-depth case study of in-service training of an entire school staff in accelerative learning (Lozanov 1978) and teaching. According to Palmer et al. (1989: 56), the results of their study were both sobering and promising: “sobering in the realisation that a deeper examination must be made of what is required to produce universal implementation of any innovation by a school staff, and promising in terms of results seen in changes in attitudes, student achievement and aspirations”.

6.6.2. CHANGES IN THE PUPILS

Borkowski, Schneider and Pressley (1989), who conducted researched on the challenges involved in teaching information processing to learning disabled pupils, found limited performance gains in pupils who received strategy instruction in information processing, and thinking and problem-solving skills. This was attributed to the fact that individual learning styles were not incorporated in the strategy training. Although the neurological deficiencies of the learning disabled pupil can undermine metacognitively-oriented training, and the special educator needs to confront realistically all the possible constraints, there is, however, considerable evidence from the current research, as well as from the literature, that it is possible to improve the learning potential of academically delayed as well as normal pupils. According to Scruggs and Brigham (1987) and Borkowski et al. (1989), wholistic education can do much to improve the functioning of pupils with learning disabilities and average achieving pupils by attempting to train information processing. It is proposed that the training of information processing can only occur within a geodesic system where students are allowed to explore at

their own pace what their strengths and learning styles are, which is inhibited by the traditional system. There are countless “thinking skills” and metacognitive training programmes available (for example De Bono, 19; Adams & Wallace, 1991; Paris & Winograd, 1990; Kaniel & Reichenberg, 1990; Palmer, 1985; Derry, 1990) which all encourage the use of metacognitive strategy training to improve the performance of the learning disabled and normal population.

All these programmes report exciting but fairly conservative gains in potential. Analysis of the frameworks employed in the above programmes reveals an emphasis on behaviour modification and cognitive philosophies. Therefore, although wholistic skills were being trained by these programmes, they were being trained within traditional frameworks. As has been demonstrated in the current study, trying to incorporate geodesic methods into behaviouristic traditional philosophies does not work; it can in fact cause a lower performance in pupils. Entirely new systems have to be created that adopt the geodesic philosophy into which strategy training can fit, and it is believed that higher success rates will then be achieved.

There are some studies reported in the literature (Kaniel & Feuerstein, 1989; Derry, 1990; Erskine 1986; de Capdeville, 1986; Van der Vyver, 1985; Van der Vyver & Capdeville, 1990; Thembela, 1986; Schuster, 1983; Edwards, 1983; Dhority, 1984; Odendaal, 1986; Botha, 1985) which employ a more wholistic geodesic orientation, that are more in line with the philosophy of the current research, and that provide promising results. These studies report greater success in students’ process and product performance rates than in product performance alone. Currently in South Africa there is a project called the Uptrail trust that has been underway since the mid-eighties. Its inception was at the University of Stellenbosch, and it was designed to deal with the major problems inherent in black education. The Uptrail project is based on suggestopedic philosophy, and employs a systems approach which suggests that there is a systematic relationship between social conditions and educational competence (Thembela, 1986).

The scientific monitoring of the Uptrail project, currently in progress, reveals that beneficial gains in terms of innovative lifeskill learning are being made. The current research falls in line with this research in that it promotes complete system changes that endeavour to place the benefits of knowledge and the development of potential at everyone’s disposal. Once the positive results of such research, as well as of the current research, are demonstrated to

education departments, the private sector and institutions, wider implementation of similar in-service programmes may take place.

In conclusion, the speculation is made that, if the utilisation of isolated elements of geodesic approaches, as in the current study, is able to produce a positive change in teachers, therapists and pupils, how much more of an effect will utilisation of the entire global spectrum of geodesic learning produce.

6.6.3. THE SPEECH LANGUAGE THERAPIST

The discussion around teachers and therapists in section 6.6.1 applies to the speech-language therapist as well as other therapists and teachers. In this section, the changing role of the speech-language therapist in particular and the profession of Speech-Language Therapy and Audiology is elaborated on.

The paradigm shift that is occurring in the perception of learning is paralleled in the field of Speech-Language Therapy and Audiology, and has resulted in a paradigm shift in the professional self-concept of and role played by the speech-language therapist. This paradigm shift has emerged in response to the increasing awareness of the inefficiency of traditional approaches in meeting the needs of clients, with alternative service delivery models proposed to provide a more accountable service to clients (Paul-Brown, 1992; Simon, 1987; Leaf et al., 1990; Lewis, 1994; Lazar, 1992). The current study provides evidence of this paradigm shift as the speech-language therapists demonstrated a significant positive change in their knowledge, attitude and skills regarding geodesic concepts (see Table 5.5a & b). This indicates that they responded to the need to change in order to provide a more accountable service to pupils with learning disabilities.

The speech-language therapists in this study formed only a very small contingent of the sample (three out of 45) and for this reason were grouped with the remedial teachers, psychologists and occupational therapists for statistical purposes. However, the positive improvement demonstrated by the professional group, where the speech-language therapists numbered 3 out of 19, was significantly greater than that demonstrated by the teachers.

One of the communication needs stressed in the alternative service delivery literature, and which has particular bearing on the current study, is the need to integrate communication skills

with academic material (Paul-Brown, 1992). Speech-language therapists need to broaden their role to be able to promote overall school success, and in this way, provide a more accountable service to clients. Speech-language therapists need to become more involved in facilitating the language and communication skills needed in the learning process in the classroom.

This change therefore implies an evolution. According to Johnson (1987: 225), “the evolution from ‘speech-language therapist’ to ‘communication instructor’ has been the result of adopting an educational model versus a medical model, through integrating communication instruction into the students natural learning environment, and through collaborating with other educators”. This entails the use of classroom and curriculum based service delivery models where the basis for the content of treatment would be the concepts and vocabulary from the academic curriculum. This was one of the reasons for the development of the MMA training programme as a curriculum-based service delivery model to be utilised by both the teacher and the speech-language therapist. It was envisaged that the speech-language therapist would utilise the MMA methods in therapy, and in addition to this, would collaborate with the teachers regarding the pupils, and finally, would serve in a consulting role, assisting and facilitating the utilisation by the teachers of the MMA methods in the classroom.

The consultative role was identified for the speech-language therapist to allow for their background and abilities to be utilised to a greater extent. Not only can speech-language therapists provide direct therapy, but they can also provide input on the communication and social difficulties exhibited by the pupils as observed in the naturalistic learning environments, as well as about the process of language in general (Thurman & Widerstrom, 1990).

Section F of the questionnaire (see Table 5.6 and Appendix III) of the current study provided the opportunity to analyse whether the speech-language therapists’ changed perception of themselves was actualised, and thus whether they saw themselves as becoming more involved in the classroom in a consultative and collaborative role. The comments revealed that the speech-language therapists used the MMA methods in 1:1 therapy, that more group therapy initiated, and that there was more collaboration with the teachers.

However, none of the three speech-language therapists who acted as respondents reported actually going into the classroom and working with the teacher and children in a consultative role. It appeared that three of the 12 remedial teachers, rather than the speech-language

therapists, played more of a consultative role, and were the driving force regarding Mind-Mapping in the classroom.

These results need to be interpreted with caution as the sample size of speech-language therapists was extremely limited. However, certain theoretical implications can be deduced. It appears that, despite the awareness of the need for change, the sin the current study were not comfortable with the classroom environment and did not feel competent to deal with the curricular and language demands nor with the larger groups. The remedial teachers, on the other hand, had a better understanding of the academic environment due to their pedagogical background, and for this reason may have been more comfortable. Therefore, it appears that speech-language therapists need to be familiarised with the academic environment and the process of teaching in order to feel more comfortable in the classroom.

This supports research done by Gerber (1987) and Simon (1987), who indicate that some form of continuing education is essential if collaboration and consultation between teachers and therapists is to be successful. It would appear that the appropriate way forward would be to provide teachers with training about the nature of language and communication, and the dynamic nature of the learning process; likewise, speech-language therapists need training in the nature of classroom curriculum and its associated language demands. According to Tattershall (1987: 181), speech-language therapists need to “learn how a classroom works before its too late”. Furthermore, the traditional training of speech-language therapists needs to include consultation skills as required competencies (Marvin, 1987).

Lastly, the results of this study indicate that teachers and therapists need training relating to the geodesic nature of metacognition and learning. The importance of the speech-language therapist as a collaborative consultant utilising alternative geodesic approaches is highlighted by Simon (1987), who postulates that well-meaning traditional speech-language therapists have actually ended up creating “educational casualties” as a consequence of segregating and labelling students, leading them to becoming addicted to 1:1 attention. This has contributed to the development of passive attitudes towards learning in so-called “learning disabled” students, who fall into patterns of “learned helplessness” due to their believing the label “disabled” (Altwerger & Bird, in Damico, 1987). The speech-language therapist can play an essential role in the creation of active, responsible and innovative learners specifically with those clients with learning disabilities who have long histories of attending 1:1 therapies.

6.7. CONCLUSION

The current study identifies the reasons why change in traditional perceptions of learning is needed by tracing the philosophies of contemporary traditional methods and their effect on the perception of learning, and proposes an alternative geodesic approach, the MMA model. Inherent in the model is the implication that traditional methods do not facilitate effective wholistic thinking and as a result, do not produce innovative life-long learners.

The broad topic of teaching and providing therapy to pupils with language, communication and learning disabilities consists of the distinctive domains of curriculum, instruction, management and assessment (Palmer et al., 1989). The MMA procedures lie within the domain of instruction and may be applied to any curriculum or therapy context and any age level. The MMA philosophy also provides an approach to curriculum, management and assessment. Therefore, extrapolated from the MMA model and its assumptions, is a practical framework, the MMA, that, when implemented within learning environments, will foster geodesic thinking which is in natural compliance with the functioning of the brain and therefore to be preferred.

The study tested the validity of the above assumption by providing an alternative geodesic approach, the MMA, to a group of teachers and therapists that work with learning disabled pupils. In this way both the MMA as a geodesic framework, and the actual effectiveness of the MMA training programme in conveying geodesic principles, were evaluated. The results indicate that significant benefit was derived by the teachers and therapists from the MMA training. Furthermore, the overall longitudinal trends of the pupils' results indicated that a significant positive change was experienced by the pupils with the introduction of the MMA methods. Thus it can be said that the partial application of the MMA methods by the teachers and therapists did improve the performance of the pupils, and that this study was therefore successful.

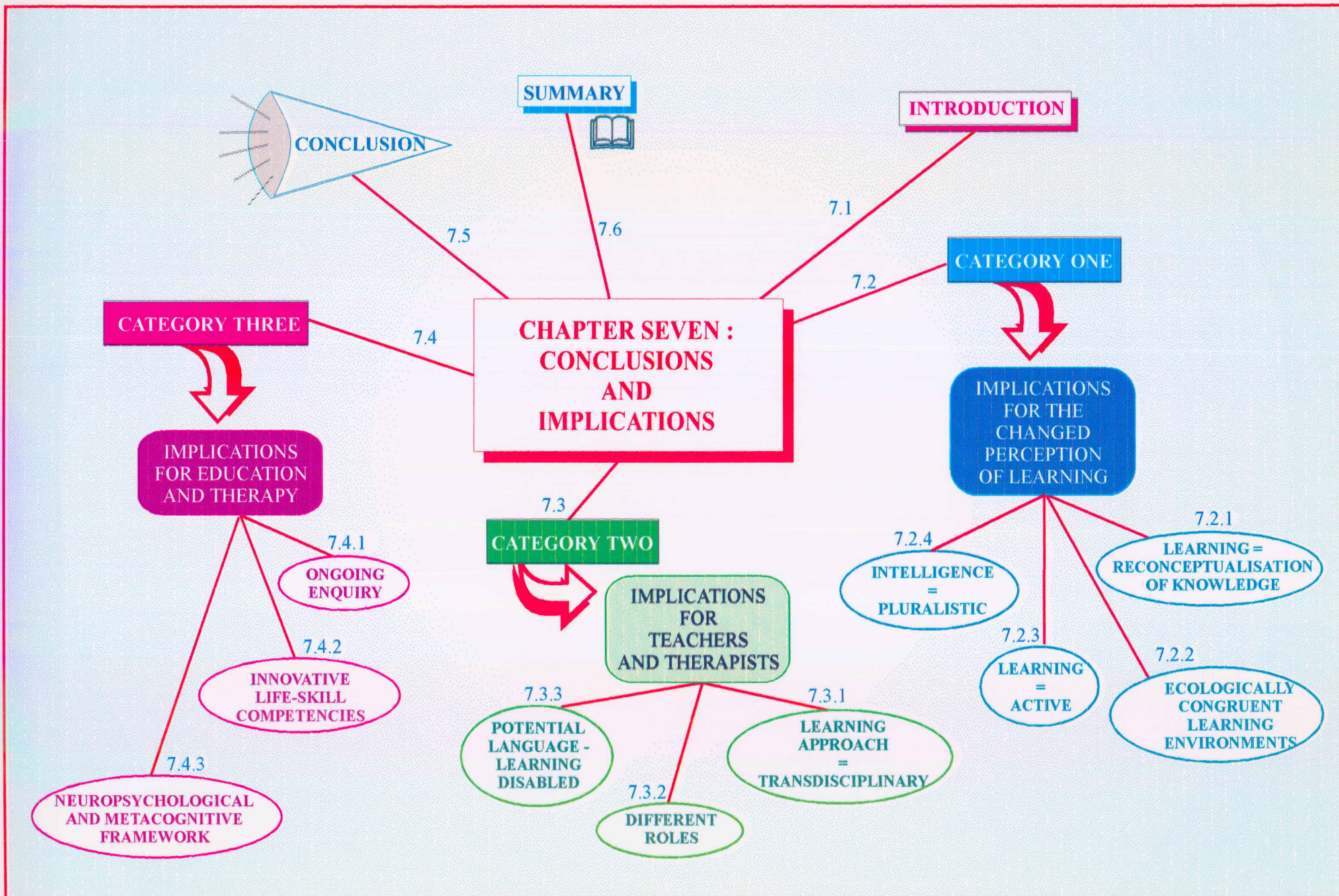
However, the pupil improvement, as measured using academic results, was not as large as predicted. Analysis of the results for the teachers and therapists also revealed that the positive improvements were conservative. It is speculated that this conservative, although significantly positive, improvement in the teachers and therapists and in the pupils is attributed to the fact

that the MMA methods are geodesic, facilitating improved thinking, problem-solving and research skills, and innovative learning. However, traditional methods of testing and marking do not evaluate these skills, as their emphasis is on the regurgitation of facts taught in the classroom using the “teacher tell - pupil listen” paradigm. Therefore, it is postulated that a different set of much more positive results would have been obtained had the pupils been evaluated in a way that matched their training, that is through using research projects, assignments, presentations and discussions.

It is possible that the results of this study simply reflect the “carry-over” effect of geodesic training, of which one of the “side effects” is improved memory. Improved memory results in better recall of facts and the resultant improved “product” - the academic percentage. The results obtained could be enhanced and valuable additional information provided if the pupils’ metacognitive skills could be analysed through a parallel study where metacognitive thinking skills are evaluated before and after exposure to geodesic methods. The results of the study do, however, provide valuable information as to the effect of geodesic methods on traditional systems, which became an ad hoc additional objective of the current study.

6.8. SUMMARY

In this chapter, the empirical research, the results thereof and the MMA geodesic philosophy and training were critically examined in order to extrapolate the theoretical implications. The experimental and therapeutic criteria were invoked in order to examine and draw conclusions regarding the observed behaviour changes, that is, to determine whether the intervention had a reliable effect on behaviour under specific experimental conditions (Uys, 1989). The experimental criteria were met, indicating that the MMA training was effective in facilitating a change to more geodesic learning and learning environments. However, certain observations were made: the teachers and therapists only utilised the methods of the MMA componentially in an isolated fashion, and not as an entirely new system. It was surmised that this was a result of attitudes, which produce a “maintenance effect”. Furthermore it was felt that the changes in the pupils’ academic results were a “side effect” and not a direct effect of the application of the MMA methodology.



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7.1. INTRODUCTION

The current research provides a model and framework for geodesic learning, the Mind-Mapping Approach, as an alternative approach to the realisation of the potential of pupils in learning environments. The central thesis of the current research is to change the perception of the traditional view of learning as a “mosaic of educational and therapeutic programmes conducted by a plethora of largely unconnected institutions” (Knowles, 1990:171), into a lifelong learning resource system or learning community. This implies that learning should be viewed as an internal construction process controlled by the learner, as opposed to the internalisation of external facts from an external source such as a teacher.

This alternative approach can be accomplished via the restructuring of learning environments so that they reflect the dynamic and spontaneous learning approaches that worked for children before school, and that follow the natural laws of brain functioning. This would entail: the eradication of memorizing isolated materials for an end result such as an exam - a product, and replacing it by the facilitation of meaningful and useful knowledge extension and understanding of concepts and their interrelations - a learning process; creating authentic learning opportunities in real world contexts. Therefore, learning intentions within a geodesic framework are changed from optimizing the conditions for encoding and retrieval under other-regulation, to optimizing the conditions for understanding and personal growth under self-regulation (Iran-Nejad, 1990; Gardner, 1985; Knowles, 1990; Jensen, 1995).

Geodesic methodologies are alternative systems as opposed to “methods” that can be componentially adopted ad lib into a traditional system. It is postulated that the ad lib componential adoption of geodesic methods will result in improved “side effects”, as opposed to an improved thinking and processing system in an individual. It is proposed that this is what has happened in the current study. Initially it was predicted that geodesic methodologies could be adopted into traditional frameworks, and in this way, new systems could be created. However, the results of the study indicate otherwise. It would seem that the new system has first to be created and adopted by the teachers and therapists. Then, once the philosophy and methods of the new system have become implicit or conditioned, the positive aspects of the

traditional system could be reintroduced in a componential fashion. In this way, the positive aspects of traditional systems could be utilised and the damaging negative aspects discarded.

This research then meets the current educational and therapy needs for transforming traditional approaches to education and therapy in South Africa which are in a process of review. The results of the study show that this change can be facilitated by using the geodesic approach which will be discussed further under clinical applications.

It has become evident that “merely increasing financial resources on a system which is incapable of providing human society with the enhanced human capabilities necessary to operate and contribute to a better society can be counterproductive” (LTFA, 1995). In 1974 a World Bank report concluded that the two previous decades of formal traditional educational systems had proved irrelevant to the needs of developing countries, as they tended to kill entrepreneurial and community interests (LTFA, 1996). Clearly new systems are needed to resolve the situation. A new system is a broad view which transcends technological problems and demands, and implies a basic reorientation in scientific thinking (Knowles, 1990), in other words, systems theory (von Bertalanffy, 1968). It is into the systems theory that the geodesic approach fits as “systems theory is not a theory in the usual scientific sense of a discrete system of assumptions, constructs, and functional relationships which explains and predicts the behaviour of some particular phenomena. Systems theory is a set of principles, an orientation in thinking, a general body of knowledge applicable in a wide variety of circumstances” (Knowles, 1990). It applies in situations where “wholeness” is important, and this is usually the case when dealing with problems of education and learning (Hayman, 1975: 3).

The uniqueness of the MMA geodesic approach is specifically is that it offers an unified theoretical account, as well as a practical model, of a number of geodesic psychological phenomena that are discussed and evaluated in the literature, but have heretofore been unrelated into a unified theory and practical application. That is, the elements or procedures of the MMA are examples of what many teachers and therapists would recognize as basic as well as desirable tenets of a wholistic learning environment, and which have been used in isolation in learning environments before. The uniqueness of the MMA is the degree to which these components are integrated into a practical framework functional within daily therapist/teacher/pupil interactions. Therefore, the geodesic approach of the MMA not only provides a set of principles and an

orientation in thinking, but also a practical framework enlisting geodesic philosophy and systems theory to be operationalised.

Arising out of the current research are various implications for education and therapy and the facilitation of learning in general. They are grouped into three categories, namely, implications for the changed perception of learning; implications for teachers and therapists; and implications for education and therapy. Each implication is outlined and then suggestions are made for implementation it and for future research.

7.2. CATEGORY ONE: IMPLICATIONS FOR THE CHANGED PERCEPTION OF LEARNING

7.2.1. LEARNING IS THE RECONCEPTUALISATION OF KNOWLEDGE AS OPPOSED TO THE INTERNAL INCREMENTALISATION OF FACTS

Discussion

Traditional philosophy limits the domain of learning to the simplistic internalization of externally available knowledge resulting in predominantly rote-type learning of facts and definitions (Iran-Nejad, 1990).

Most of the factual information taught within traditional environments has questionable value in terms of lifeskills, and therefore lacks in quality and usefulness (Glasser, 1986). Learning is an interactive multimodal process system, not a sequential accrual system - which is only a sub-function. It is thus limiting and inhibiting to design education around the simple behaviouristic one-thing-at-a-time stimulus response. This is not congruent with biological theories of brain functioning, which indicate that the genetic structure of the brain results in behaviour being the attempt to satisfy needs, and is thus proactive, not reactive and stimulus bound (Glasser, 1986).

Operationalisation and future research

If the alternative perception of learning really is adopted, then the emphasis will move from the memorising of facts, information and formulas, which are readily available in both books and computer software, to processes and skills.

For instance, preferred activities would be writing a play, as opposed to a grammatical writing lesson; or using co-operative groups to solve problems, or to understand a process as opposed to learning photostated notes off by heart for a test. The idea is to immerse learners in multimodal stimulation using as many varied learning opportunities as possible. The focus would then be on the process of how to learn, which is recreating knowledge, and would therefore avoid simple incrementalisation of existing facts. The reconceptualisation of knowledge would enable students and clients to develop their ability to use what is learned, not just to know what it is. A further consideration is that special education environments dealing with children with learning difficulties are usually characterised by a passive-acceptant approach (Kaniels & Feuerstein, 1989). Familiar simple subject matter is offered at a slower pace with emphasis on reproducing material - a simple incrementalisation of facts (Kaniels & Feuerstein, 1989; King & Goodman, 1990). This results in learning environments lacking any creativity, the facilitation of higher levels of thinking or the independent performance of higher level functions - the reconceptualisation of knowledge. In order to raise children with learning difficulties to higher levels of development, a passive-acceptant approach must be replaced by a proactive geodesic approach. According to this approach, the individual is an open system capable of mental and emotional modification (Kaniels & Feuerstein, 1989; Jensen, 1995). A proactive geodesic approach will encourage children with learning difficulties to be actively involved in normal education environments and society. This requires a process of integration facilitated by the professional in the learning environment, who needs to recognise that language, learning and communication do not exist in a vacuum (Paul-Brown, 1992; Marvin, 1987). Instruction to facilitate language, learning and communication skills should be presented in natural environments requiring communication (Johnson, 1987). As school is normally the natural environment for most school-going children, communication skills need to be integrated with academic content. Thus, if the professional, specifically the speech-language therapist who has expertise in language and communication, works directly in the classroom where the problems occur, strategies can be provided for pupils to better understand academic material and classroom instructions (Paul-Brown, 1992). Viewed functionally, speech-language therapists are not “re-mediating” or “re-habilitating” communication, language and learning disabilities, but are attempting to proactively assist in the mediation of a school communication system for them. In this way, the passive reactive incrementalisation of existing facts can be replaced by the active recreation of knowledge.

As discussed previously, the findings of this research indicated high levels of awareness in the teachers and therapists of the need to change to a more neuropsychologically-based approach, as well as the indication that many of the above techniques are already being used in teaching and therapy. However, the use of the technique was componential, thus the question for future research becomes how to encourage global use of geodesic systems that will facilitate the reconceptualisation of knowledge as opposed to the incrementalisation of facts. This would possibly entail comparative studies of traditional versus geodesic evaluation procedures.

7.2.2. LEARNING ENVIRONMENTS NEED TO BE ECOLOGICALLY CONGRUENT AND AUTHENTIC WITH AN EMIC PERSPECTIVE, IN ORDER TO FACILITATE EFFECTIVE LANGUAGE, LEARNING AND COMMUNICATION

Discussion

The majority of learning needs to be contextually embedded as realistically as is possible (Johnson, 1987). This is because “the brain is actually very poor at learning large amounts of material from books. It is naturally good at learning in the locations and circumstances of everyday life” (Jensen, 1995: 333). Knowledge is more easily reconceptualised into useful knowledge that can be utilised when it is associated with a novel experience, or location or feeling, or some type of hook that will tie it in with the content. Therefore neither the traditional “stand and deliver” context of teaching nor the isolated 1:1 therapy model are authentic, ecologically congruent or emic as the focus is on the teacher and therapist delivering content or remediating an identified “deficit”. Rather, the learner needs to be guided to discover the meaning of the content. Furthermore, language, learning and communication are active creative processes. Whether the focus is on speaking, listening, reading, or writing, language and communication involve the creation of meaning and making sense (King & Goodman, 1990). A curriculum or therapeutic approach that fragments language, communication and learning into small, abstract pieces with the expectation that if the parts are mastered, the whole will eventually be mastered, inhibits learning and communication (Schory, 1990). The opposite perspective is a whole language perspective where the learning direction is from the whole to the parts, (King & Goodman, 1990; Schory, 1990), and therefore falls within the realms of a geodesic approach.

According to Miller and Sabatino (1978), children pass a crucial test, before school, suggesting that they are spontaneously proficient learners, because they master in a few years one of the most complex systems of rules known, their mother tongue. They also become quite proficient in the knowledge of the world around them (Iran-Nejad, 1990). By contrast, “only a few children in school ever become good at learning in the way we try to make them learn. Most of them get humiliated, frightened and discouraged. They use their mind, not to learn, but to get out of the things we tell them to do - to make them learn” (Holt, 1964: vii). Bereiter (1985) indicates that there is a complex relationship between the multisource nature of learning and the environment in which this learning is fostered. A young child’s learning environment is multisource, creative and natural with the various sources that contribute, operating simultaneously. It facilitates a balance between active and dynamic self-regulation to occur.

This is in contrast to the less than authentic traditional learning environments of later life that foster a climate of encoding facts in an increasingly analytic and sequential way. This fosters an over-reliance on untrained or incorrectly-trained active self-regulation at the expense of dynamic self-regulation, which results in training children out of the natural way of learning (Holt, 1964). Therefore, the more wholistic, natural and meaningful the learning environment, is the more ecologically congruent and authentic it will be. This will ultimately result in more effective language, learning and communication skills.

Operationalisation and future research

Educationalists and therapists have a responsibility to change learning environments such that predominantly dynamic self-regulation operates with active self-regulation playing a minor role (Iran-Nejad, 1990; King & Goodman, 1990; Schory, 1990). This can be done by applying the principles of the philosophy of geodesic learning which have authentic ecological environments built into their methodology.

Geodesic approaches have to have authentic learning environments in order to work. By adopting geodesic approaches such as the MMA, authentic learning environments will automatically be created. Further research is needed to explore geodesic learning environments that foster a climate of authentic learning. In summary, transformation of learning in the schools of the future will need to consider the neuropsychological aspects that allow the interaction of dynamic and active self-regulation which will facilitate innovative learning.

7.2.3. LEARNING IS A PROCESS OF ACTIVE RESEARCH INITIATED AND CONTROLLED BY THE LEARNER

Discussion

Learning as a process of active research means that one's learning intentions need to be changed from those aimed at optimizing the conditions for encoding and retrieval under other-regulation to optimising the conditions for understanding and personal growth under self-regulation (Iran-Nejad, 1990). The latter implies that co-operation between teachers, therapists and pupils is required in the development of any course or therapy purporting to meet their needs. Thus the learners take responsibility for their learning and the quality of their work in co-operation with the facilitator (Glasser, 1986). This is in contrast to traditional philosophy of education and institution-based rehabilitation (IBR) which identifies the teacher and therapist as being solely responsible for what is learned, and how, when, why and if it is learned.

Currently, however, in the field of Speech-Language Pathology, there is a move away from institution-based rehabilitation to community-based rehabilitation as a result of the increasing awareness of the inefficiency of traditional approaches, and the recognition of the social interactive nature of language (Paul-Brown, 1992). This is evident in the whole body of literature on alternative service delivery models designed to meet more efficiently the needs of clients with communication, language and learning problems (Paul-Brown, 1992; Lewis, 1994; Schory, 1990; King & Goodman, 1992).

If learners are guided into taking responsibility for their learning, then this will lead to learning that is based on curiosity, need and relevance, and thus the motivation becomes intrinsic. Hence, the classroom and therapy room becomes focused on learning and not maintaining control. Teachers and therapists have authority, and are content specialists, but learners also have the right to be respected and given an opportunity to learn. According to Jensen (1995) and Iran-Nejad (1990), students in a fully-implemented geodesic learning environment will rarely have behavioural, motivational and learning problems because they are fully engaged, curious, engrossed, challenged and excited about learning.

Operationalisation and future research

Students need to play a major role in the decision about what they have to learn and how this can be done; that is, learners need to take a higher level of responsibility for their own learning

(Schory, 1990; King & Goodman, 1990). Thus the learner needs to self-monitor and self-evaluate with the facilitator, with the emphasis on teaching the student how to assess the process and not just the end result of the process, the product (Glasser, 1986). The learners and facilitators should engage in continual constructive examination of how to improve the process of learning. This can be done by the teacher and/or speech-language therapist orally making decisions and solving problems concerning her own reading, writing, communication or learning activity in order to demonstrate the problem-solving process (Schory, 1990). This is especially important for the language-learning disabled students who frequently experience difficulty solving problems related to language, learning and communication (Damico, 1987).

Finally, comparative studies should be conducted between self-regulated students in geodesic environments and other-regulated students in traditional environments in terms of problem-solving, research skills, thinking skills and general life skills in order to compare the differences in performance and learning potentials. There is research of this nature in the literature, but concerning predominantly suggestopaedic techniques (Dhority, 1990; Lozanov, 1978; Adams & Wallace, 1991). There are, however, relatively few programmes that offer the unique combination of the MMA, and it is felt that geodesic methods need to be used as wholistically as possible within a systems theory approach as opposed to componentially within a traditional approach to education. Thus, true geodesic systems need to be created and studied scientifically in order to create the body of evidence that is lacking in traditional learning approaches. Furthermore, this body of evidence will underscore the pitfalls of the traditional environments in education and therapy that were created, with relatively minimal scientific basis, (Gardner, 1985; Jensen, 1995; Iran-Nejad, 1990; Knowles, 1990), as well as supporting the intimation made by Gerber (1987) that traditional environments “de-educate” students turning them into rote-learning “junkies”.

In addition, the speculation that behavioural, motivational and learning problems will decrease in fully operating geodesic systems (Jensen, 1995; Iran-Nejad, 1990) needs scientific and documented research as this has profound implications for students. This is because the ability to take a proactive role in initiating and controlling the learning process allows personal effort and ability to take on a determining role. According to Glasser, (1986) persons who see themselves in control of a given situation make a greater effort to achieve success than those who do not. Language-learning disabled pupils in particular need to be allowed to have a sense of control over their own learning processes in order to overcome the passive-acceptant and

learned helplessness that comes from repeated failure and being continually guided (Kaniel & Feuerstein, 1989). When a teacher or therapist continually corrects and guides students' efforts, they prevent them from taking charge of their own learning. This leads to overdependency on others and decreased confidence in one's own abilities (Marvin, 1987). Thus, the language-learning disabled child needs to be shown how and allowed to take control of the language, learning and communication situation in and out of school.

7.2.4. INTELLIGENCE IS PLURALISTIC AND IN EVERY INDIVIDUAL THERE IS A UNIQUE BLEND THAT DETERMINES THEIR INDIVIDUALITY

Discussion

The multiple intelligence theory (Gardner, 1985) challenges the prevailing concept of intelligence as a single general capacity that enables individuals to perform in all situations. According to Gardner (1985) every normal human being is born with seven different intelligences. Of these, one will be dominant and one secondary and this contributes to individualistic learning styles. If this does not conform to the dominant traditional teaching style, which emphasises verbal and mathematical intelligence, then individuals are at a disadvantage.

Thus, learning environments and facilitators need to recognise that intelligence is made up of different capacities, not just mathematical and linguistic, which results in a diversity of learning styles requiring highly individualised programmes and consequently, "freedom within structure". Furthermore, I.Q. testing, which is based on the single unitary concept of intelligence, cannot predict or determine potential as these tests are based on mathematical and linguistic intelligences alone. I.Q. testing can only predict how well a student can play the "school game", and may erroneously label a student, limiting aspirations.

Operationalisation and future research

Successful teaching and therapy needs to reinforce and affirm the different ways in which individuals learn. Facilitators of learning need to incorporate situations where students have opportunities for the creative exploration of their individual interests and talents while also learning valued skills and concepts through multimodal means. Information needs to be presented in numerous ways offering students many opportunities to succeed. Therefore,

manipulation and actual experience, moving, touching and doing should be part of the learning process. Learning environments need to help students to identify their areas of strength and to develop these so that they can become active contributors in society in their future. The more authentic the environment, the more effective the generalisation of skill mastery and problem-solving performance will be. In addition, learning is more effective if a process (for example: learning plan) and open-ended product structure (for example: therapy objectives, course outline) is applied, as opposed to a close-ended (traditional) product structure alone. Within the field of speech-language pathology, the whole-language approach (Schory, 1990) is evidence of this idea being practiced. The suggested geodesic methodology provides a broader framework enabling neuropsychological concepts to be incorporated into the whole-language approach, enhancing its effectiveness.

The practical application of facilitating the seven different intelligences in learning environments is currently available in the literature (Campbell et al., 1992). What is needed is scientific research incorporating these applications into geodesic frameworks such as the MMA, and into learning environments in order to demonstrate their success.

7.3. CATEGORY TWO: IMPLICATIONS FOR TEACHERS AND THERAPISTS

7.3.1. THE LEARNING APPROACH NEEDS TO BE TRANSDISCIPLINARY REQUIRING FACILITATORS, DIRECTORS AND THERAPISTS TO ASSUME INTERCHANGEABLE ROLES AND RESPONSIBILITIES FOLLOWING THE NEEDS OF THE CHILD, THE FAMILY AND THE COMMUNITY

Discussion

A geodesic approach requires pupils, therapists, teachers and parents to commit to teaching and learning from each other by working together. This approach involves a collaborative and consultative methodology and as such, can be considered transdisciplinary (Thurman & Widerstrom, 1990). A transdisciplinary approach falls within the realms of systems theory which allows any social system to be conceptualised as a system of learning resources, or an

interdependent learning community (Knowles, 1990). A wholistic learning system is a complex of elements in mutual interaction (Griffiths, 1964).

Therefore, to account for wholism and interdependence, there has to be co-operative interaction between all the people within the system. The key issue, however, is the interchangeability of roles required and hence a transdisciplinary as opposed to interdisciplinary approach is essential for a truly geodesic learning environment to be created.

Operationalisation and future research

In order to operationalise the above implication, collaborative and consultative skills have to be included in any training of teachers and therapists (all types) (Simon, 1987; Damico, 1987). This would also include systems theory training which emphasises community-based learning systems. Future research needs to explore the benefits of transdisciplinary principles within wholistic geodesic learning environments such as those created when using the MMA, specifically the advantages of such an approach to the community as a whole. Resources are readily available in every environment, and thus a primary research focus is to identify these and introduce learners to them. Systems need to be put into effect where all resources within a community are explored and utilised in an organised interactive way within a geodesic framework. It is now recognised that services are most successful when teams of professionals and families collaborate forming partnerships. A transdisciplinary approach involves a collaborative consultative methodology involving both professionals and the community (Briggs, 1993).

7.3.2. TEACHERS AND THERAPISTS PLAY DIFFERENT ROLES IN A GEODESIC AS OPPOSED TO TRADITIONAL LEARNING ENVIRONMENTS

Discussion

Historically, the classroom teacher provided the student with the curriculum material to be learned, and the speech-language therapist provided the student with remediation strategies for specified communication difficulties (Shapiro et al., 1988). However, the most important objective of a geodesic model such as the MMA is adapting the child's academic instruction so that he can achieve to the best of his ability. Many students are not successful learners and the differences between the educational experiences of students from different racial, linguistic and

socio-economic backgrounds has led to many revisionist movements, which fall within the realms of geodesic philosophy, and which share the common goal of changing what does not appear to work. One direct result of this change is the re-discovery of the role language-proficiency plays in the education process (Damico, 1987). Here, the speech-language therapist, who is a language expert, can be extremely effective in mainstreaming into the classroom. This implies changed roles for both the speech-language therapist and the teacher who would need to work together in a consultative and collaborative manner in order to take advantage of their combined expertise. This whole-language approach (Schory, 1990) would change the focus from the identification and fixing of deficits to the purpose and nature of learning.

A teacher or therapist in a geodesic learning environment is a facilitator of learning. This implies that teachers and therapists are managers of the process of learning as opposed to content-transmitters. Being a content resource or a content specialist should be a secondary role to that of being a facilitator of learning. According to Knowles (1990) and Glasser (1986), being a process manager as opposed to a content planner and transmitter requires relationship building, needs assessment, involvement of students in curricular planning, linking students to learning resources and encouraging student initiative. This idea is developed within the whole-language approach (Schory, 1990; King & Goodman, 1990) which provides a distinct philosophy as well as practical ideas on how to implement Glasser (1986) and Knowles (1910) postulations.

Operationalisation and future research

In order to operationalise the different roles of the teacher and therapist within the geodesic environment, classroom and curriculum-based models which utilise the concepts of collaboration and consultation have to be developed. Classroom-based language and communication intervention has the distinct advantage of allowing the speech-language therapist to use the pupils' academic programmes as the basis upon which to build language intervention because pupils can stay in their classrooms and thus be present when important content information is given (Schory, 1990). Under such a system, known as the whole-language approach (Schory, 1990), the speech-language therapist would be able to monitor the development of oral language skills within a more natural setting than a therapy room; there could be a more frequent exchange of information between the teacher and speech-language therapist regarding the specific needs of each language-learning disabled child resulting in improved language-learning experiences; there would also be the opportunity to provide

teachers with suggestions for incorporating all the varied forms of oral language within their lessons; the speech-language therapist could mediate the communicative interaction between the teachers and pupils; and finally the speech-language therapist could assist in the implementation of the MMA methodology initially as an expert consultant, and thereafter as a partner in a collaborative process. In this way the teacher and therapist together become facilitators of language, communication and learning.

In summary, a facilitator of learning allows learners to work, learn and grow at their own pace, not according to the teachers' and therapists' preset time-table. The facilitator will allow for new and different ways to solve problems without the traditional limits. The facilitator will supply the resources that will enable the learner to find the meaning enabling them to focus on the process and not the product.

7.3.3. THE SO-CALLED “LANGUAGE-LEARNING DISABLED POPULATION” CAN BECOME INNOVATIVE THINKERS IF THEIR LEARNING IS FACILITATED WITHIN A GEODESIC ENVIRONMENT USING GEODESIC METHODOLOGY

Discussion

Recognising the possible neurological constraints of the language-learning disabled population, it is believed that within environments using geodesic frameworks such as the MMA many of the problems of the language-learning disabled pupil can be overcome enabling them to become innovative lifelong learners. Research (Jensen, 1995; Buzan, 1991; Dhority, 1991; Gardner, 1985) suggests that the brain thrives on novelty, challenge and enrichment, and therefore it is only logical and fair to put all types of learners into an environment that takes advantage of the natural functioning of the brain. According to Kaniel & Feuerstein (1989), restricting the level of requirements of the language-learning disabled child by simplifying the environment and reducing challenges, will lower levels of motivation, aspiration and achievement. Thus, in order to empower children with language-learning disabilities to reach higher levels of development, the traditional passive-acceptant approach must be replaced by an active approach to learning. According to this approach, the individual is an open system capable of mental and emotional modifiability. Therefore, low levels of achievement are reversible and it is possible to learn efficiently if the proper effort is invested in diverse and integrated ways (Kaniel & Feuerstein, 1989; Jensen, 1995; Gardner, 1985).

Operationalisation

In order to operationalise this implication, learning environments need to change, from being passive-acceptant to active-modification. Entire new global systems need to be created that will allow all learners, whether language-learning disabled or not, to develop their potential together. A geodesic system of learning will focus on individuals and developing them; and not on fitting the individual into a system. Separate schools for learning disabled students are not necessary, they are in fact making the situation worse. Individual help can be given when required, but within the system. Therefore the child with language-learning disabilities should be mainstreamed and not protected within isolated educational frameworks (Marvin, 1987). According to Kaniel and Feuerstein (1989: 166), “the ultimate purpose is to bring him satisfaction, not by isolating him and avoiding confrontation, but rather by providing tools for the daily struggle with a normal environment in which he may achieve satisfaction”. The geodesic approach of the MMA, which is an active modification approach, has faith in the exceptional child’s ability to change and grow, and accordingly great effort is invested in offering him many choices, as well as providing “tools” for change for example: the Mind-Map and the MMA strategies.

In addition, a system of “pull-out” programmes within the mainstream (Simon, 1987) could be created for students with special needs. Instead of the traditional approach which primarily teaches content more slowly, these should focus on the processes and values of learning, for instance, how to spell, rather than lists of rote spelling words; how to learn; Mind-Mapping; communication skills; and finally social skills (Jensen, 1995).

7.4. CATEGORY THREE: IMPLICATIONS FOR EDUCATION AND THERAPY

7.4.1. LEARNING IN A WORLD OF CONTINUING ACCELERATING CHANGE IS A PROCESS OF ONGOING ENQUIRY

Discussion

Within the field of Speech-Language Pathology and Audiology, the increased awareness of the inefficiency of traditional approaches has led to the emergence of alternative treatment

approaches. The alternative service delivery models (Morvin, 1987; Paul-Brown, 1992) have been the result of speech-language therapists being required to serve a wider range of persons who present with a greater variety of communication disorders (Van Kleeck, 1992; Lewis, 1994). This has resulted in a paradigm shift in the professional self-concept of and role played by the speech-language therapist.

This necessitates the ability to learn to understand, guide, influence and manage these transformations or paradigm shifts. Learning activity should be deformed and replaced by flexible diversified models, such as the MMA, in order to move learning into the twenty-first century (UNESCO, 1972, in LTFA, 1996). It therefore becomes an imperative task for individuals, institutions and society as a whole to learn about the process of learning. This is not complex, as has been demonstrated in the current study. Through the collaboration of teachers, therapists and pupils, significant improvement in the teachers' and therapists' knowledge, attitude and skills regarding geodesic principles and the process of learning, as well as significant improvement in the pupils' academic results was attained by the partial implementation of the alternative geodesic approach to learning, the MMA. Although the changes were smaller than predicted, due to the way the methods applied piecemeal by the therapists and teachers, what was evident in the study was the high levels of awareness and knowledge in the teachers and therapists of the need to change to more process-orientated learning environments.

Operationalisation and future research

In the attempt to overcome the maintenance effects of conditioned traditional paradigms, and to foster a climate of change, as well as to deal with the education and therapy crises, it is believed that the basic training of therapists and teachers needs to change to adopt a geodesic philosophy which allows for more flexible and diversified models to be created and implemented. The training of facilitators and pupils or learners within geodesic philosophies such as the MMA has to aim at changing attitudes in order to create global changes in traditional learning philosophies. This will have long-lasting effects on the skill level of application in teachers and therapists and their pupils and clients, and by implication, on the educational and therapeutic environments in which learning is facilitated.

The results of the current study confirm findings in the literature (Knowles, 1990; Byron, 1986) that attitudes are holding people back from going beyond the "awareness of the need to change"

stage, to actually changing and operationalising the paradigm shift. Hence, the focus of future training should highlight the changing of attitudes, in particular the three components of attitude - cognitive, affective and intentional (Byron, 1989) - in a balanced way, as discussed in Chapter Six of the current study. On a practical level, this can be done by balancing theoretical input with practical application. For instance, the MMA training programme presented in the current study places more emphasis on theory than on practical application. It is believed that if the researcher had demonstrated classroom application of the entire system both on video and during the training for all subjects, a more global adoption of the geodesic philosophy would have been achieved. Therefore, expanded practical application is required. Furthermore, the conversion of the traditional curriculum to a geodesic alternative learning curriculum needs hands-on demonstration. Finally, the collaborative process between teacher and therapist needs facilitation to overcome the fear of crossing the boundaries of the 2 professions. It is therefore proposed that the creation of geodesic systems can be achieved through facilitators providing training inside classrooms and therapy rooms as opposed to teachers and therapists going to a venue to sit through, for example, a twelve-hour training programme as in the current study. The latter will increase knowledge and basic skills, and may even influence the cognitive component of attitude. However, the affective and intentional components of attitude will only change in an equivalent way when individuals internalise something that they see as being meaningful through practical application (Byron, 1986).

Furthermore the institution of training programmes to achieve the objective of creating global changes to geodesic systems for education and therapy needs to recognise the complex interrelationship between the diverse institutional learning environments in order to be successful. If the philosophy of systems theory (von Bertalanffy, 1968), which visualises the complex interaction of systems and sub-systems, is adopted, then geodesic frameworks such as the MMA could be applied within the larger framework of lifelong learning. The systems theory could therefore provide the principles of creating infrastructures within which geodesic frameworks could be implemented for education and therapy on all levels of learning. For instance Knowles (1990) visualises an infrastructure for a lifelong learning resource system based on systems theory that emphasises the need to teach the community as a whole how to learn. The role of geodesic frameworks such as the MMA in such an infrastructure is that of providing the “how” of the implementation of facilitating geodesic learning environments.

Thus, the systems theory (von Bertalanffy, 1968) provides the infrastructure for the creation of geodesic learning environments, and programmes such as the MMA provide the methods of training and facilitation within the geodesic learning environment. It is proposed that future research should concern itself with the interaction of the creation of geodesic infrastructures and the programmes providing the methods of facilitating geodesic learning. Therefore the results of this study, and those of other similar research, need to be integrated with systems theory to create long-term and long-lasting changes that will ultimately equip learners with innovative lifelong learning skills.

Further research regarding the manner in which the attitudes of teachers, therapists, parents, pupils, and all those conditioned in to the traditional system can be enlightened in order to change their perceptions of their roles as learners.

7.4.2. THE PURPOSE OF “EDUCATING” AND “REMEDIATING” IS TO FACILITATE INNOVATIVE LIFE SKILL LEARNING COMPETENCIES

Discussion

Students should be excited about learning as it is a natural neuropsychological law that the brain is designed to learn. In a geodesic environment, students learn about life, they learn from each other, they learn what is in the curriculum and in therapy objectives, and they are ready to become lifelong learners that can contribute to society.

Operationalisation and future research

By utilising geodesic methodologies such as the MMA of the current study, lifelong learning competencies can be developed. The MMA framework focuses on the learner, not the content. The organisation of lesson and therapy objectives is based around creating conditions optimal for learning. It allows immersion into an integrated, thematic and interdisciplinary curriculum. This is in contrast to traditional formats of education and institution type therapy that emphasize learning one thing at a time so that a subject is divided into small chunks, and then sub-divided again and again. Each day a micro chunk of the whole is presented out of context, for instance, “introduce unit A, learn it, take a test on it; now go to unit B” (Jensen, 1995: 301). Rather should one learn in an integrated thematic way. According to Jensen (1995: 303), “our brain is designed to learn multi-path, in order, out of order, on many levels, with many teachers, in many contexts and from many angles. We learn with themes, favourite subjects, issues, key

concepts, questions, trial and error and application. The thematic approach urges you to follow threads that weave through your student's world instead of a single subject or text book". This is the philosophy adopted by the MMA, as the actual structure of the Mind-Map promotes this type of thinking because it creates patterns of meaning. The MMA provides a strategic approach that can assist in the facilitation of innovative learners with good life-skills.

Future research needs to concentrate on creating and planning entire new systems using geodesic approaches such as the MMA in drawing up the curriculum for lifelong learning. This is in contrast to fitting geodesic philosophy and methodology into traditional formats, as was done by the teachers and therapists trained in the current research.

7.4.3. GEODESIC LEARNING FRAMEWORKS NEED TO BE NEUROPSYCHOLOGICALLY AND METACOGNITIVELY ORIENTED

Discussion

The key issue in geodesic information processing model of the current research is the intimate interaction and interdependence of metacognition and neuropsychology. The model proposes that metacognition is the non-conscious level, elevating metacognition to the level where most learning (approximately 90 per cent) occurs. This is the highest level of thought, where thinking begins. The model then proposes that cognition is the next level of thought, the level of conscious thinking responsible for approximately 10 per cent of learning. Both levels need to be fully activated according to the ratio of their responsibility in order for learning to be effective and result in usefully reconceptualised knowledge. If methodologies and systems are used that are incompatible with natural neuropsychological laws, then the cognitive level will be predominantly activated, with limited intermittent involvement of the metacognitive non-conscious level. This will result in inefficient rote-type learning with a product orientation as opposed to a process orientation.

It is believed that geodesic methodologies such as the MMA are neuropsychologically based and will thus activate both metacognition and cognition in the correct way. In contrast, traditional methodologies stimulate predominantly cognitive processes with the concomitant learning limitations. Furthermore, the Mind-Map itself is viewed as the "tool" which directly accesses and trains the metacognitive non-conscious. The emphasis of the MMA is on the facilitation of improved language, learning and communication through a strategic versus skill-

based approach. Communication, language and learning are seen as being controlled by metacognition, which will in turn influence information processing and thus the effectiveness of communication, language and learning - oral or written. In other words, strategies are being facilitated at the root level and once automatized, will have a more effective result in terms of generalisation than if fragmented skills are trained.

Operationalisation and future research

The global utilisation of geodesic frameworks such as the MMA allows geodesic principles to be operationalised. When geodesic environments are created and geodesic methodologies are utilised, then the under-utilised metacognitive non-conscious will be allowed to operate more effectively releasing potential.

The MMA needs to be expanded, developed and improved based on ongoing research in the fields of neuroscience, neurobiology, neuropsychology, metacognition, and the non-conscious. The Mind-Map itself needs to be explored as the “tool” of thought and intelligence and also as an assessment “tool”.

7.5. CONCLUSION

The current research proposes a model of learning which parallels the way the brain is biologically designed to learn. If a learning environment is designed which is antagonistic to the natural and effortless way that the brain can learn, motivational, behavioural and learning problems will result with concomitant cost implications. Thus learning environments need to be designed around questions such as “how does the brain learn most effectively?” and “how do we create successful learning organisations?” The MMA employed in the current research offers a framework that designs effective geodesic learning organisations. The preceding chapters presented the theory of a geodesic model of learning and why it works, and identified the positive and negative aspects of the MMA training. The current study has the following to offer in terms of an alternative approach to the facilitation of improved language, communication and learning:

- It provides a motivation and rationale for changing to alternative geodesic approaches, highlighting the setbacks of maintaining the traditional systems.

- ❑ It explains the philosophy of alternative geodesic approaches.
- ❑ It provides the development of a theoretical model as a product of this research as to how information is processed within geodesic frameworks, as well as the construction of a framework for the implementation of geodesic training. It is assumed that this type of geodesic induced thinking is more effective than that produced by traditional formats due to being based on natural laws of neuropsychological functioning
- ❑ It provides a practical framework within which to operationalise geodesic principles, and as such is a vehicle of change from traditional learning systems
- ❑ It reveals that the prevailing attitude of teachers and therapists towards the concept of learning is one of awareness of the need for change to more neuropsychologically-based approaches
- ❑ It reveals that there are strong traditional maintenance effects in teachers and therapists that are the result of attitudes, which accounts for the mismatch between the high levels of neuropsychological knowledge and awareness of the need for change, and the actual application thereof.
- ❑ It reveals that even the partial introduction of the geodesic methods of the MMA made a significant difference to the performance of the pupils. However, the significant improvement of the pupils was a side-effect as opposed to direct effect of the geodesic methodology because what was being trained with the MMA methods is not what was tested in the end-of-year product-focused exams.
- ❑ It reveals the urgent need to create low-cost infrastructures that will facilitate the adoption of geodesic methodologies into neuropsychologically-based learning environments in order to create accountable and effective learning and therapy environments, that is, the need to link up systems theory with practical geodesic methodologies in the facilitation of the paradigm shift from traditional to geodesic methodology.
- ❑ It reveals the importance of training the speech-language therapist to be more actively involved in the learning environment in a collaborative and consultative role.
- ❑ Finally, this research provides evidence that the learning disabled population, given the chance in systems that create geodesic environments, and use geodesic methodology, have the potential to become active innovative thinkers that can make a contribution to society. Furthermore, if geodesic methodology can significantly improve performance in those with so-called “language-learning problems”, what level of effect will it have on the so called “normal” population?

The central issue of the current research is that there is sufficient evidence for believing that a geodesic approach to learning, such as the MMA propagated by the current study, can achieve significant changes in the potential of pupils to benefit from their schooling, as well as in their ability to deal with the problems of daily existence in an effective way. Much will depend on the capacity of teachers, therapists, pupils and administrators to cope with the changes and paradigm shifts that will be required if geodesic approaches to learning are adopted.

“Throughout history only a few people have benefited from the growing corpus of scientific knowledge which permits the development of human potential and development. Inequality of human beings was not determined genetically. They all have more or less the same potentiality, the same capacity to think” (Van der Vyver & Capdevielle, 1990: 61). Therefore, every effort should be made to develop this potential of individuals. Everyone should be allowed the opportunity to learn how to learn.

7.6. SUMMARY

Chapter Seven presents the general conclusions of the current research. Ten implications of the results of the study for the geodesic philosophy of learning are put forward and described. Each is then elaborated on in terms of how they can be put into practice and suggestions for future research are made. A general conclusion is reached that it is everyone’s democratic right to be able to learn how to learn.

***EVERY CREATIVE ACT INVOLVES ...
A NEW INNOCENCE OF PERCEPTION,
LIBERATED FROM THE CATARACT
OF ACCEPTED BELIEF.***

Arthur Koestler

1989