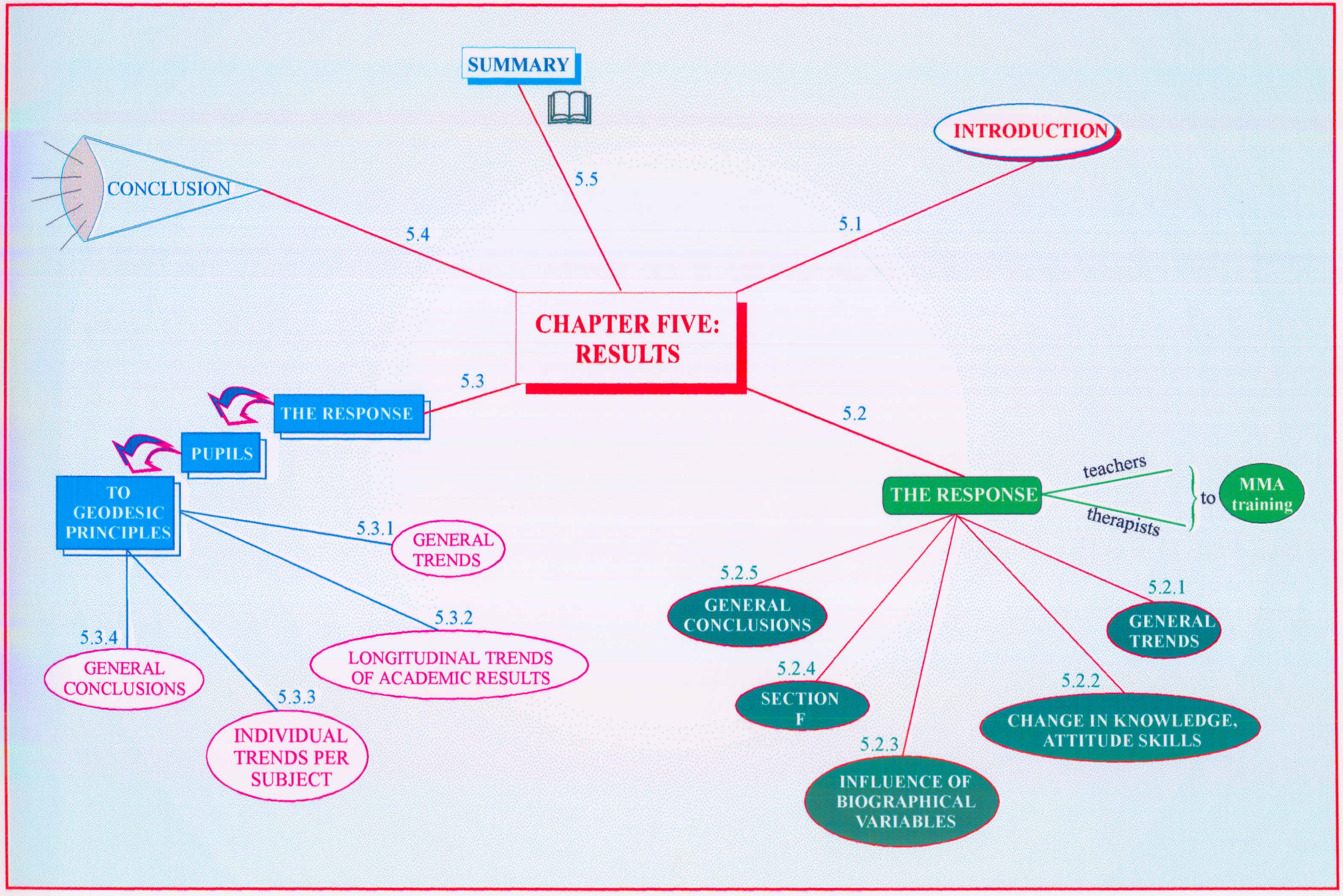


CHAPTER FIVE: RESULTS

5.1. INTRODUCTION

The purpose of this study was to determine the effectiveness of the MMA training programme as a consultative tool for empowering teachers and therapists to create geodesic learning environments that will improve the thinking, learning and intellectual potential of their students.

In order to determine and draw conclusions about behaviour change, the experimental criteria are invoked to evaluate data (Risley, 1970, in Leedy, 1989). The experimental criteria determine whether intervention (in this instance the MMA training) has had a reliable effect on the behaviour (the teachers' and therapists' knowledge, attitude and skills regarding geodesic learning principles). Therefore this criterion is met when there is a reliable change in the subjects behaviour under specific experimental conditions (Uys, 1989).

In the current research, the experimental criteria will have been met if there is a statistically significant change in the teachers' and therapists' knowledge, attitude and skills regarding geodesic learning principles; and if this change in the teachers and therapists results in the improved academic performance of their pupils.

In order to evaluate whether the experimental criterion has been met, the data will be described in different ways, namely: qualitative analysis of the descriptive data and quantitative statistical analyses. The aim of this chapter is therefore to present the results of the correlation phases according to the aims of this study in order to describe the trends that occurred. Finally, the efficacy of the MMA training programme in effecting changes from traditional to more geodesic philosophies in the learning environment of therapy and teaching situations, will be discussed to determine whether the experimental criteria have been met.

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

This section deals with the first main aim of the study, which was to determine the effect on teachers and therapists of the MMA training. The responses obtained from the pre- and post-training questionnaire are presented statistically and descriptively. A summary of the general trends is followed by detailed results corresponding to each of the sub-aims.

5.2.1. THE GENERAL TRENDS

Non-parametric statistical analysis of the pre and post questionnaires revealed a significant improvement in the teachers' and therapists' knowledge, attitude and skills regarding the geodesic learning principles of the MMA (Table 5.1). From this it would appear that the MMA training succeeded as a vehicle for effecting the change from traditional to more geodesic approaches in therapy and teaching.

More specifically, the scores in four of the six categories (Knowledge Metacognition; Attitude Neuropsychology; Skills Neuropsychology; Skills Metacognition) were statistically significant. Although the Knowledge Neuropsychology category did not show a significant improvement; the trend was positive, indicating that slight improvement may have occurred. In the last category (Attitude Metacognition), the trend was slightly, but not significantly, negative, indicating that change for the worse may have taken place.

When the trends were broken down according to various biographical variables (age, language and qualifications of the teachers and therapists), the overall results were as follows. The middle age group (31 to 50 years) showed the most significant improvement, followed by the younger age group (20 to 30 years). In terms of language, both the English-speaking and Afrikaans-speaking groups showed a significant improvement in knowledge, attitude and skills, with the Afrikaans group demonstrating more improvement. The bilingual group did not show a significant improvement although the trend was positive.

Table 5.1 : The change in knowledge, attitude and skills regarding the geodesic principles of the MMA

Results of the Wilcoxon Signed Rank Test: Comparing the 6 Pre vs Post Learning Categories of the Questionnaire (N = 45)					
CATEGORY	**PRE**		**POST**		**P-VALUE**
		S		**S**	**≤ 0.05**
KNOWLEDGE NEUROPSYCHOLOGY (KN)	0.61	0.11	0.63	0.06	0.2821
KNOWLEDGE METACOGNITION (KM)	0.45	0.10	0.54	0.10	0.0001 *
ATTITUDE NEUROPSYCHOLOGY (AN)	0.73	0.12	0.78	0.09	0.0067 *
ATTITUDE METACOGNITION (AM)	0.55	0.10	0.53	0.11	0.2363
SKILL NEUROPSYCHOLOGY (SN)	0.30	0.17	0.39	0.10	0.0003 *
SKILL METACOGNITION (SM)	0.48	0.10	0.55	0.10	0.0001 *
TOTAL SCORES (All six categories above)	**0.51**	**0.077**	**0.57**	**0.07**	**0.0001 ***

S = Standard deviation

With regard to the subjects' qualifications, the group that had a teaching qualification plus an extra qualification such as remedial or special education showed the most significant improvement. The group of other "professional" (speech-language therapists, psychologists, remedial teachers and occupational therapists) also demonstrated a significant improvement but not as much as the first group. The group that had only a teaching qualification did not show a significant improvement but the trend was still positive indicating that improvement did occur.

5.2.2. CHANGE IN KNOWLEDGE, ATTITUDES AND SKILLS REGARDING GEODESIC LEARNING PRINCIPLES

This section reports in detail on the teachers' and therapists' knowledge, attitudes and skills before and after the MMA training programme and the change that occurred.

5.2.2.1. Levels of knowledge, attitudes and skills before training

This information is presented in Table 5.1. and in more detail in the pre-training sections of Tables 5.2a-e and Figures 5.1a-e. The results revealed higher levels of neuropsychological and metacognitive knowledge than predicted pre-training. With regard to attitude, neuropsychological concepts were viewed by the teachers and therapists as being more important than metacognitive concepts. Lastly the teachers and therapists considered their skills regarding geodesic principles inadequate.

5.2.2.2. Levels of knowledge, attitudes and skills after training

This information is presented in Table 5.1. The overall statistical result across all six categories (Knowledge Neuropsychology, Knowledge Metacognition, Attitude Neuropsychology, Attitude Metacognition, Skills Neuropsychology and Skills Metacognition) indicates that a significant change occurred in the teachers' and therapists' knowledge, attitude and skills regarding metacognitive and neuropsychological concepts after training. This implies that the MMA programme was successful. However, an analysis of the individual categories and questions within the categories reveals that this change, although significant, did not occur to the extent predicted.

The means within the Knowledge Neuropsychology category changed from 0,61 per cent to 0,63, a non-significant change. The mean of 0,61 is fairly high, indicating that the respondents had a good knowledge of neuropsychological concepts prior to training.

Table 5.2a : The change in Neuropsychological Knowledge (KN)

QUESTION	PRE-TRAINING VALUES			POST-TRAINING VALUES		
	YES	UNSURE	NO	YES	UNSURE	NO
B1	93.3%	0%	6.7%	88.9%	4.4%	6.7%
B2	84.4%	8.9%	6.7%	88.9%	4.4%	6.7%
B3	91.1%	6.7%	2.2%	88.9%	11.1%	0%
B4	4.4%	8.9%	86.7%	0%	6.7%	93.3%
B7	26.7%	11.1%	62.2%	13.3%	6.7%	80%
B9	88.9%	2.2%	8.9%	88.9%	8.9%	2.2%
B11	75.6%	22.2%	2.2%	86.7%	8.9%	4.4%
B13	97.8%	0%	2.2%	95.6%	4.4%	0%
B18	86.7%	8.9%	4.4%	93.3%	4.4%	2.2%

QUESTION	PRE-TRAINING VALUES			POST-TRAINING VALUES		
	EXPERT	SOME	LITTLE	EXPERT	SOME	LITTLE
C1	8.9%	57.8%	33.3%	2.2%	88.9%	8.9%
C3	8.7%	64.4%	26.7%	4.4%	86.7%	8.9%
C8	4.4%	62.2%	28.9%	2.2%	80%	17.8%
C9	6.7%	71.1%	22.2%	6.7%	86.7%	6.7%

QUESTION	PRE-TRAINING VALUES					POST-TRAINING VALUES				
	ELEMENTS					ELEMENTS				
	1	2	3	4	5	1	2	3	4	5
E2	64.4%	68.9%	26.7%	20%	4.1%	80%	80%	28.9%	22.2%	13.3%
E3	6.7%	77.8%	6.7%	4.4%	0%	6.7%	91.1%	15.6%	2.2%	

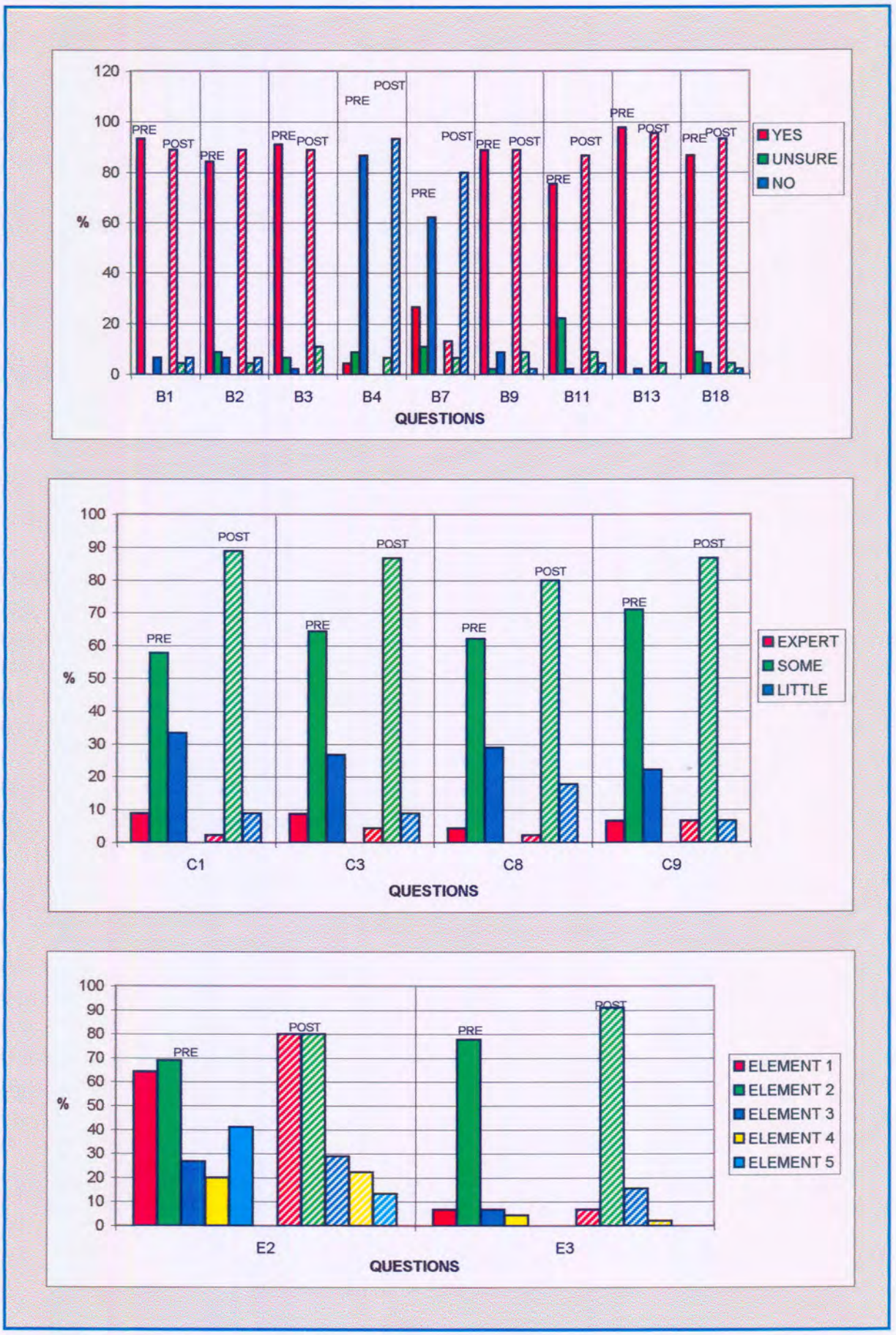


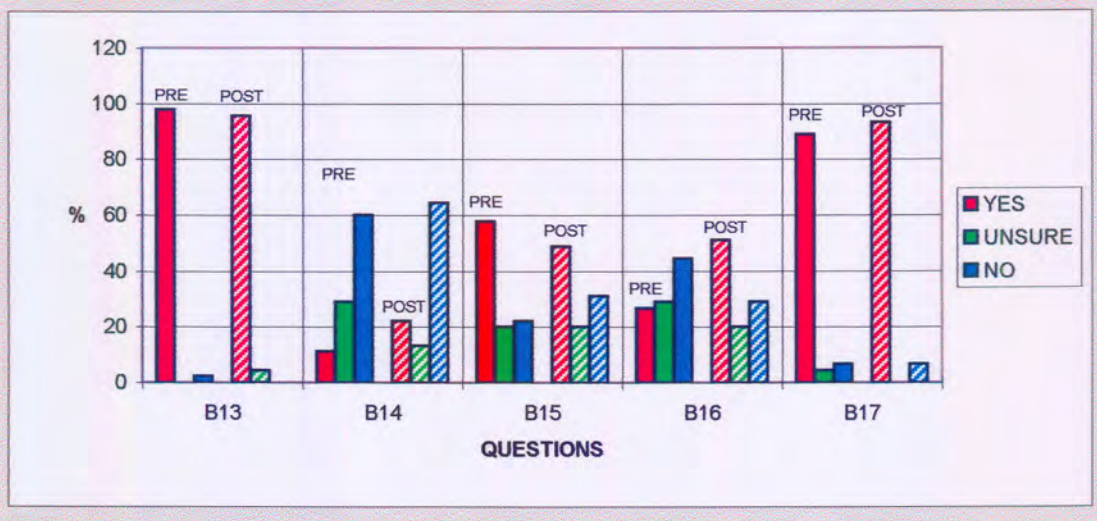
Figure 5.1a : The Change in Neuropsychological Knowledge (KN)

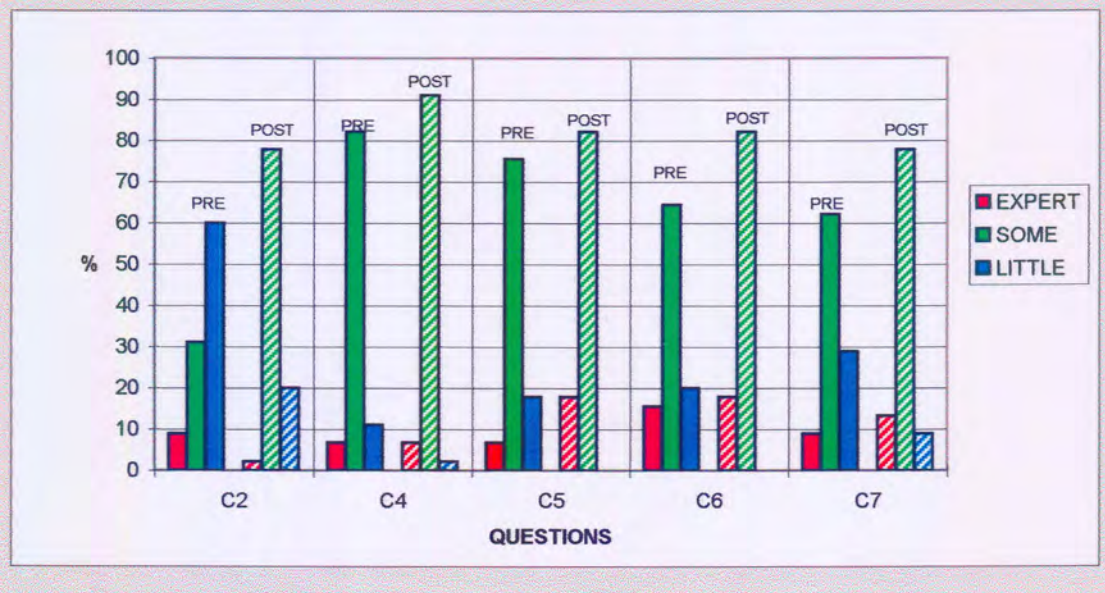
Table 5.2b : The change in Metacognitive Knowledge (KM)

QUESTION	PRE-TRAINING QUESTIONNAIRE VALUES			POST-TRAINING QUESTIONNAIRE VALUES		
	YES	UNSURE	NO	YES	UNSURE	NO
B13	97.8%	0%	2.2%	95.6%	4.4%	0%
B14	11.1%	28.9%	60%	22.2%	13.3%	64.4%
B15	57.8%	20%	22.2%	48.9%	20%	31.1%
B16	26.7%	28.9%	44.4%	51.1%	20%	28.9%
B17	88.9%	4.4%	6.7%	93.3%	0%	6.7%

QUESTION	PRE-TRAINING VALUES			POST-TRAINING VALUES		
	EXPERT	SOME	LITTLE	EXPERT	SOME	LITTLE
C2	8.9%	31.1%	60%	2.2%	77.8%	20%
C4	6.7%	82.2%	11.1%	6.7%	91.1%	2.2%
C5	6.7%	75.6%	17.8%	17.8%	82.2%	0%
C6	15.6%	64.4%	20%	17.8%	82.2%	0%
C7	8.9%	62.2%	28.9%	13.3%	77.8%	8.9%

QUESTION	PRE-TRAINING VALUES					POST-TRAINING VALUES				
	ELEMENTS					ELEMENTS				
	1	2	3	4	5	1	2	3	4	5
E1	0%	11.1%	2.2%	4.4%	71.1%	8.9%	15.6%	6.7%	11.1%	86.7%
E4	17.8%	8.9%	8.9%	13.3%	4.4%	26.7%	17.8%	11.1%	28.9%	11.1%
E5	13.3%	13.3%	37.8%	15.6%	17.8%	24.4%	13.3%	40%	28.9%	24.4%





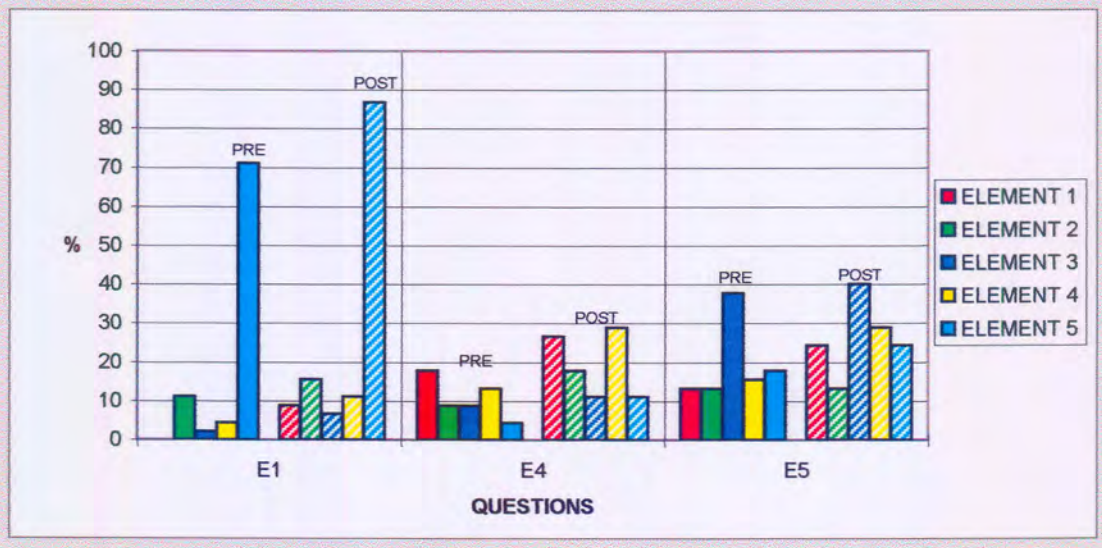


Figure 5.1b : The change in Metacognitive Knowledge (KM)

Table 5.2c : The change in attitude towards Neuropsychological Concepts (AN)

QUESTION	PRE-TRAINING VALUE			POST-TRAINING VALUE		
	YES	UNSURE	NO	YES	UNSURE	NO
B2	84.4%	8.9%	6.7%	88.9%	4.4%	6.7%
B3	91.1%	6.7%	2.2%	88.9%	11.1%	0%
B10	62.2%	8.9%	28.9%	77.8%	4.4%	17.8%
B11	75.6%	22.2%	2.2%	86.7%	8.9%	4.4%
B12	93.3%	4.4%	2.2%	88.9%	11.1%	0%
B13	97.8%	0%	2.2%	95.6%	4.4%	0%
B16	57.8%	20.0%	22.2%	51.1%	20.0%	28.9%
B18	86.7%	8.9%	4.4%	93.3%	4.4%	2.2%

QUESTION	PRE-TRAINING VALUE				POST-TRAINING VALUE			
	NO IMP.	SOME IMP.	GREAT IMP.	VERY IMP.	NO IMP.	SOME IMP.	GREAT IMP.	VERY IMP.
D2	0%	20%	35.6%	44.4%	0%	15.6%	37.8%	46.7%
D3	2.2%	11.1%	37.8%	48.9%	6.7%	2.2%	42.2%	48.9%

QUESTION	PRE-TRAINING VALUE					POST-TRAINING VALUE				
	ELEMENTS					ELEMENTS				
	1	2	3	4	5	1	2	3	4	5
E2	64.4%	68.9%	26.7%	20%	4.4%	80%	80%	28.9%	22.2%	13.3%
E3	6.7%	77.8%	6.7%	4.4%	0%	6.7%	91.1%	15.6%	2.2%	2.2%

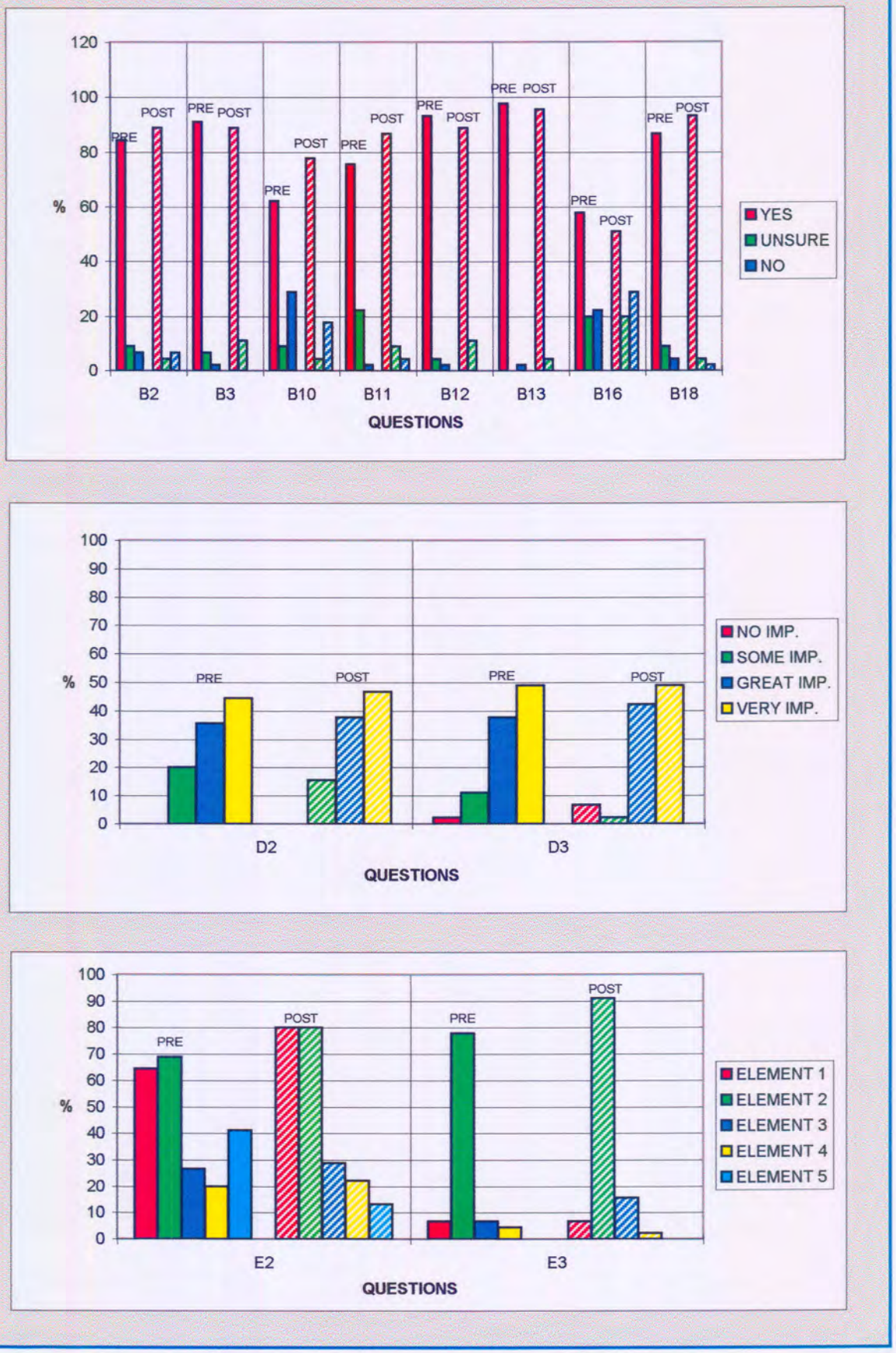


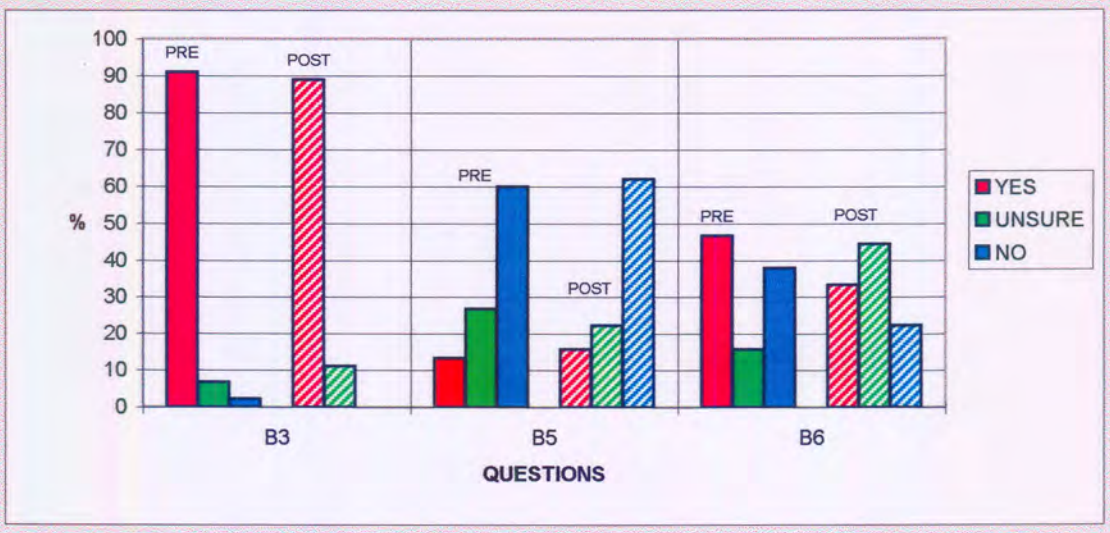
Figure 5.1c : The change in attitude towards Neuropsychological Concepts (AN)

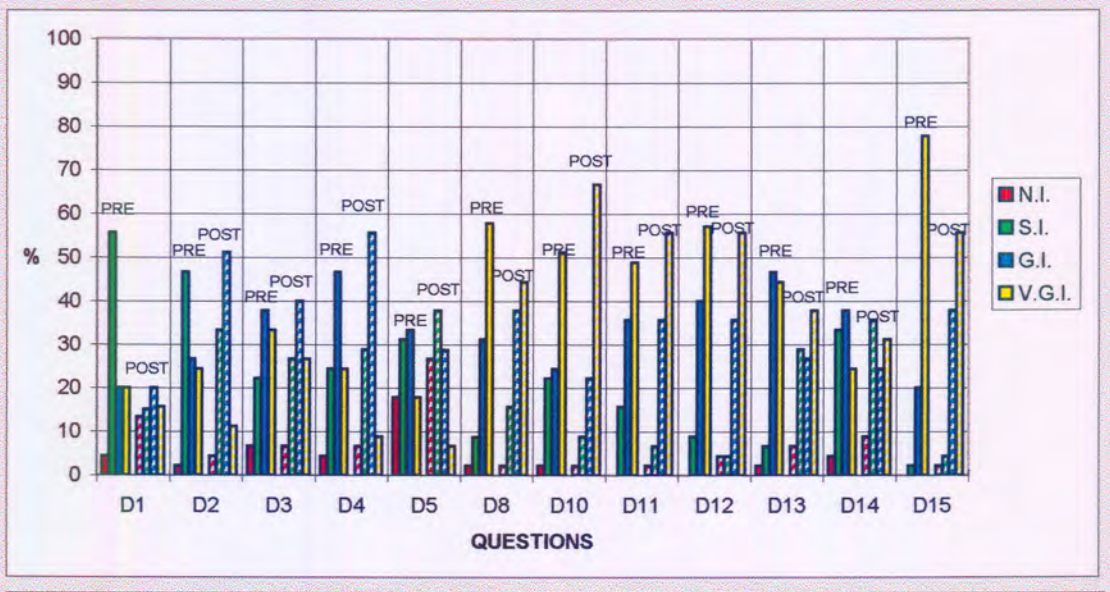
Table 5.2d : The change in attitude towards Metacognitive Concepts (AM)

QUESTION	PRE-TRAINING VALUES			POST-TRAINING VALUES		
	YES	UNSURE	NO	YES	UNSURE	NO
B3	91.1%	6.7%	2.2%	88.9%	11.1%	0%
B8	13.3%	26.7%	60%	15.6%	22.2%	62.2%
B6	46.7%	15.6%	37.8%	33.3%	44.4%	22.2%

QUESTION	PRE-TRAINING VALUES				POST-TRAINING VALUES			
	N.I.	S.I.	G.I.	V.G.I.	N.I.	S.I.	G.I.	V.G.I.
D1	4.4%	55.6%	20%	20%	13.3%	15.1%	20%	15.6%
D2	2.2%	46.7%	26.7%	24.4%	4.4%	33.3%	51.1%	11.1%
D3	6.7%	22.2%	37.8%	33.3%	6.7%	26.7%	40%	26.7%
D4	4.4%	24.4%	46.7%	24.4%	6.7%	28.9%	55.6%	8.9%
D5	17.8%	31.1%	33.3%	17.8%	26.7%	37.8%	28.7%	6.7%
D8	2.2%	8.9%	31.1%	57.8%	2.2%	15.6%	37.8%	44.4%
D10	2.2%	22.2%	24.4%	51.1%	2.2%	8.9%	22.2%	66.7%
D11	0%	15.6%	35.6%	48.9%	2.2%	6.7%	35.6%	55.6%
D12	0%	8.9%	40%	57.1%	4.4%	4.4%	35.6%	55.6%
D13	2.2%	6.7%	46.7%	44.4%	6.7%	28.9%	26.7%	37.8%
D14	4.4%	33.3%	37.8%	24.4%	8.9%	35.6%	24.4%	31.1%
D15	0%	2.2%	20%	77.8%	2.2%	4.4%	37.8%	55.6%

QUESTION	PRE-TRAINING VALUE					POST-TRAINING VALUE				
	ELEMENTS					ELEMENTS				
	1	2	3	4	5	1	2	3	4	5
E1	0%	11.1%	2.2%	4.4%	71.1%	8.9%	15.6%	6.7%	11.1%	86.7%
E4	17.8%	8.9%	8.9%	13.3%	4.4%	26.7%	17.8%	11.1%	28.9%	11.1%
E5	13.3%	13.3%	37.8%	15.6%	17.8%	24.4%	13.3%	40%	28.9%	24.4%





KEY: N.I. - NOT IMPORTANT S.I. - SOME IMPORTANCE G.I. - GREAT IMPORTANCE
V.G.I. - VERY GREAT IMPORTANCE

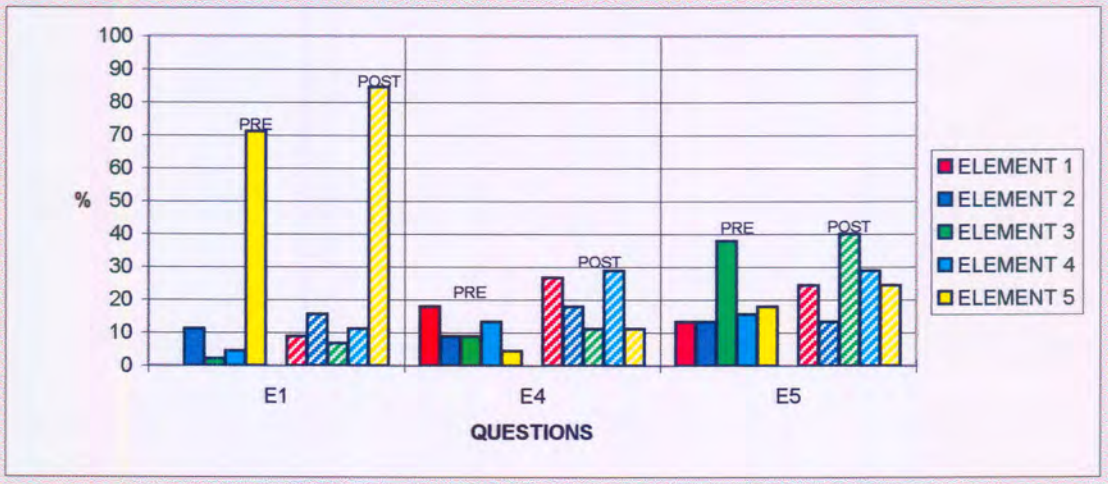


Figure 5.1d : The change in attitude towards Metacognitive Concepts

Table 5.2e The change in Neuropsychological Skills (SN) and Metacognitive Skills (SM)

QUESTION	PRE-TRAINING VALUES			POST-TRAINING VALUES		
	YES	UNSURE	NO	YES	UNSURE	NO
B13	97.8%	0%	2.2%	95.6%	4.4%	0%
B14	11.1%	28.9%	60%	22.2%	13.3%	64.4%
B15	57.8%	20%	22.2%	48.9%	20%	31.1%
B16	26.7%	28.9%	44.4%	51.1%	20%	28.9%
B17	88.9%	4.4%	6.7%	93.3%	0%	6.7%

QUESTION	PRE-TRAINING VALUES			POST-TRAINING VALUES		
	EXPERT	SOME	LITTLE	EXPERT	SOME	LITTLE
C4	6.7%	82.2%	11.1%	6.7%	91.1%	2.2%
C5	6.7%	75.6%	17.8%	17.8%	82.2%	0%
C6	15.6%	64.4%	20%	17.8%	82.2%	0%

QUESTION	PRE-TRAINING VALUES					POST-TRAINING VALUES				
	ELEMENTS					ELEMENTS				
	1	2	3	4	5	1	2	3	4	5
E1	0%	11.1%	2.2%	4.4%	71.1%	8.9%	15.6%	6.7%	11.1%	86.7%
E4	17.8%	8.9%	8.9%	13.3%	4.4%	26.7%	17.8%	11.1%	28.9%	11.1%
E5	13.3%	13.3%	37.8%	15.6%	17.8%	24.4%	13.3%	40%	28.9%	24.4%

Figure 5.1e : The change in Neuropsychological Skills (SN) and Metacognitive Skills (SM)

The Attitude Neuropsychology category had even higher pre-training means (0,73), confirming that the respondents recognised the need to incorporate a more neuropsychological approach in teaching and education. The post-training mean for this category was 0,78, which was a significant change, implying that the respondents were more convinced of this fact after training.

By contrast, the means within the Knowledge Metacognition category were low before the training, but increased significantly after the training (0,54). However, the post-training means was still low, possibly indicating that the respondents' knowledge about metacognitive concepts was still weak. The respondents' attitude to metacognition was higher before the training (0,55) than their knowledge, but decreased after the training to 0,53, although this change is not significant. It appears that the respondents do not recognise the importance of metacognitive concepts.

In both the Skills Neuropsychology (SN) and Skills Metacognition (SM) categories, the means were low before the training (SN = 0,30; SM = 0,48). It is interesting to note that the Skills Neuropsychology category was lower than the Skills Metacognition category bearing in mind that the respondents' knowledge and attitudes were higher in respect of neuropsychology than metacognition before the training. Although both skills categories demonstrated significant changes after training, the means were still low (0,39 and 0,55 respectively).

In the ensuing sections a more detailed analysis of the respondents' answers in each of the six categories is provided. A qualitative analysis is provided through an examination of responses to specific questions.

5.2.2.3. The change in neuropsychological knowledge (KN)

Certain questions in the questionnaire were designed to analyse the teachers' and therapists' knowledge of neuropsychological concepts related to teaching and therapeutic situations. Table 4.4 shows which questions were concerned with this aspect and each of the other categories. The questions probed the teachers' and therapists' knowledge of brain-behaviour relationships and the importance of this knowledge in the learning situation.

More specifically, these questions dealt with the respondents' knowledge of how the brain functions, how a person learns, and whether this "how" knowledge will assist in the learning situation and in the release of potential. Also asked is whether a knowledge of the influence of music on the brain will influence learning; whether a knowledge of eye movements will influence reading; whether relaxing the brain affects learning; and whether a knowledge of how memory functions will improve learning. The objective was to determine the level of knowledge of the "how" of learning and whether the MMA training provided sufficient information to change these levels.

The overall statistical result for all the questions in this Knowledge Neuropsychology category (Table 5.2a and Figure 5.1a) indicates that there was a positive trend, as already discussed, but that this trend was not significant. Therefore, there was a slight improvement in the teachers' and therapists' overall knowledge of neuropsychological concepts after training.

However, the non-parametric statistical analysis of each of the Knowledge Neuropsychology questions on the pre and post questionnaire revealed that there was already a fairly high knowledge of the importance of the relationship between learning and the structure and function of the brain pre-training. For example, for question B1, prior to the MMA training 93,3% of the teachers and therapists (42 out of 45) indicated that a knowledge of the structure of the brain and its functioning in relation to learning is important. Only 6,7% of the teachers and therapists answered "no" to this question and none indicated that they were unsure. What is interesting to note is the change that occurred on this question after the exposure to the MMA training. Post-training frequencies revealed a drop in the "yes" category to 88,9% and a corresponding increase in the "unsure" category to 4,4%. The "no" category remained at 6,7%. Although not significant, this would seem to indicate that a few of the respondents felt more confused after the training than before. However, the high percentage of "yes" responses to question B1 would appear to indicate that the majority of the teachers and therapists are in agreement as to the importance of a knowledge of brain-behaviour relationships. This is in contrast to the traditional belief that this knowledge is not important.

A high percentage of "yes" responses on question B2 was also achieved by the respondents on the pre-training questionnaire but an improvement to 88,9% was achieved post-training.

Although this achievement was not significant, it was a positive trend indicating that some improvement in knowledge did occur.

The responses to question B3 followed a very similar pattern to the responses to question B1, whilst the responses to questions B4, 9, 11, 13, and 18 followed a similar pattern to the responses to question B2 (see Table 5.2a).

Question B7, which asked whether reading through one's work several times is the equivalent of learning, showed a much larger improvement after training than the other questions. Responses in the "no" category increased from 62,2% to 80%, with the "yes" and "unsure" category decreasing from 26,7% to 13,3% and 11,1% to 6,7% respectively. As this question was negatively stated, this is a positive result. This result is interesting in that the pre-training responses reflect the knowledge that most people have of how to learn, that is, by reading through one's work. The teachers' and therapists' knowledge in this regard changed considerably after the training, when they accepted that reading alone is not sufficient.

In section C, respondents had to indicate whether they had expert, some or little knowledge of certain concepts related to brain function and the learning process. These questions were slightly more ambiguously worded and thus more likely to identify what people really knew, as opposed to what they thought they ought to know (Jensen, 1995). In questions C1, 3, 8 and 9, the "some" category (that is, average knowledge) was the highest both pre- and post-training, but this category demonstrated much higher increases post-training than any of the categories in the section B questions.

For example, for question C1, which queried how much the teachers and therapists knew about one's eyes and the reading process, there was a 57,8% response in the "some" category pre-training. This increased to 88,9% post-training, with a corresponding decrease in the "little" knowledge category from 33,3% to 8,9%. These changes indicate an improvement in knowledge post-training.

In section E, respondents had to provide definitions for various concepts. In the Knowledge Neuropsychology category, these were "memory" and "visualisation". Each definition had five elements (see Appendix I), and respondents were credited for each element of the definition they provided. Table 5.5a provides the results of the statistical analysis of these

responses. Examination of this table shows that there was a positive trend in that provision of elements of the definition by the respondents increased post-training. For example, for question E2, in the pre-training questionnaire 64,4% of the respondents were able to identify the first element of the definition of "memory". This rose to 80% post-training. Identification of the rest of the elements of both the "memory" and "visualisation" definitions showed similar improvements post-training, ranging from 2% to 13%.

In conclusion, in the Knowledge Neuropsychology category, although the overall trends were not significant, they were positive, indicating that some improvement in neuropsychological knowledge did occur post-training. The level of neuropsychological knowledge was already high pre-training, making it possible that the positive trend was evidence of a deeper understanding of existing knowledge levels, as opposed to a simple increase in knowledge levels and thus that an internal reconceptualisation as opposed to simple incrementalisation process occurred..

5.2.2.4. The change in metacognitive knowledge (KM)

The questions on the questionnaire that probed knowledge of metacognitive concepts are detailed in Table 4.4. These questions probed the teachers' and therapists' knowledge of the thought process; what it is and how it works; and the relationship of thinking to comprehension, problem-solving and learning in general. The objective of this section of the questionnaire was to evaluate understanding of metacognition and its importance in learning, and whether the MMA training provided sufficient information to change the level of understanding of the importance of applying metacognitive principles in teaching and therapy. Table 5.2b and Figure 5.1b provide the statistical results of the Knowledge Metacognitive category.

The overall statistical result for the Knowledge Metacognition questions indicate that significant change occurred in the teachers' and therapists' knowledge about metacognition. However, analysis of the individual questions revealed certain patterns in their perceptions. For questions B15, 16 and 17, the trend was positive, indicating an improvement in knowledge of metacognitive concepts in the post-training phase. For question B14, which queried whether reading faster would reduce the comprehension of the material being read, there was a different pattern. Prior to training, 60% of the teachers and therapists indicated "no", and post-training this increased to 64,4%. However, responses in the "yes" category

increased significantly as well from 11,1% to 22,2%, which is a negative trend because reading faster does not reduce comprehension.

It appears that the teachers and therapists were mostly aware of the fact that reading faster does not reduce but enhances comprehension. This percentage is, however, low and thus does not affect the overall results. Responses to question B13 followed a similar pattern to B14.

Responses to all the C questions linked to the Knowledge Metacognition category demonstrated a significant positive change in terms of improved knowledge regarding metacognitive concepts. For example, question C6 probes knowledge about the nature of key concepts as opposed to key words, and how these relate to note-making, imagination and learning. Prior to training 64,4% of the teachers and therapists indicated that they had "some" knowledge; 20% indicated that they had "little" knowledge; and 15,6% indicated they had "expert" knowledge. In the post-training phase, the percentage of "some" responses increased to 82,2%, and of "expert" responses increased to 17,8%, whilst non-one indicated that they had "little" knowledge.

In the E questions, the teachers and therapists had to provide definitions for the concepts "learning", "accelerated learning" and "super teaching". Post-training, there was an increase in the identification of elements of the definition. For example, pre-training, no-one was able to identify element one of the definition of E1, "learning" (see Appendix II). After the training, identification of this element rose from 0% to 8,9%. Scores obtained on the remaining elements of the definitions showed an increase of between 2% and 16%.

In conclusion, it appears that the MMA training was successful in effecting a change in the teachers' and therapists' understanding of the importance of metacognition in the learning environment. However, the percentages in the pre-training phases were higher than predicted, and the percentages post-training were not dramatically higher than these. Thus the teachers' and therapists' knowledge levels in both categories (Knowledge Neuropsychology and Knowledge Metacognition) were higher than predicted to start off with and the MMA training possibly only consolidated this information. Once again, knowledge appeared to be reconceptualised as opposed to incrementalised.

5.2.2.5. The change in attitude towards neuropsychological concepts (AN)

Once again the specific questions on the questionnaire that probed this category are identified in Table 4.4. These questions examined the feelings, beliefs and behaviour tendencies directed towards brain-behaviour relationships, the learning situation and geodesic principles in order to determine the influence of attitude on the application of neuropsychological principles in teaching and therapy. Table 5.2c and Figure 5.1c present the statistical results in this category.

The overall statistical result for all the questions in the Attitude Neuropsychology category showed that a significant change took place. Analysis of the individual questions revealed certain patterns. Questions B2, 10, 11 and 18 showed improvements in the "yes" category with corresponding decreases in the "unsure" and "no" categories in the post-training phase. This indicates that there was a positive change in attitude of the teachers and therapists towards neuropsychological geodesic learning principles after training. For example, for question B10, which queries whether the average person is using limited brain potential, 62,2% of the respondents answered "yes" pre-training, 8,9% answered "unsure", and 28,9% answered "no". After the training, the "yes" scores increased to 77,8%; the "unsure" scores decreased to 4,4%, and the "no" scores decreased to 17,8%.

Questions B3, 12, 13 and 16 also demonstrated change, but in a negative as opposed to positive direction. For example, for question B16, which queries whether using a pacer whilst reading will improve comprehension, in the pre-training phase 57,8% responded "yes", 20% indicated "unsure", and 22,2% indicated "no". In the post-training phase, the "yes" responses decreased to 51,1%, the "unsure" responses stayed the same, and the "no" responses increased to 28,9%. The spread of these percentage was also very similar in this section, indicating that little change had taken place.

In questions D7 and 9, which queried whether imagination, intuition and playfulness, and feelings and random associations respectively are important in the learning situation, minimal change occurred. An increase did occur, but it was very small. For example, for question D7 the responses "of very great importance" only increased from 44,45 to 46,7%. This indicates that only one respondent changed their attitude.

In questions E2 and 3, which asked for definitions of memory and visualisation, there was a significant improvement in the correct identification of the elements of the definitions. This change ranged from 2% to 16%. For example, the percentage of respondents who correctly identified the first element of the definition of memory increased from 64,4% to 80%.

In conclusion, it appears that the MMA training did effect a change in the attitude of the teachers and therapists towards the importance of having a more neuropsychologically orientated approach to teaching and therapy. The low percentages and fairly even spreads, however, appear to indicate that although the attitudes of the teachers and therapists were influenced, they were not influenced significantly enough to induce major changes.

5.2.2.6. The change in attitude towards metacognitive concepts (AM)

The questions in the questionnaire relating to this category are identified in Table 4.4. These questions probed the teachers' and therapists' feelings, beliefs and behaviour tendencies towards thinking, both conscious and non-conscious, and towards the link between thinking and the learning situation. The objective of these questions was to investigate the influence of the MMA training on the attitude of the teachers and therapists towards incorporating metacognitive concepts in their teaching and therapy. Table 5.2d and Figure 5.1d provide the statistical results of this category.

The overall statistical result for all the questions of the Attitude Metacognition category indicate that no significant change took place. The trend for this category was in fact negative, whereas positive trends were found in the Knowledge Neuropsychology, Knowledge Metacognition and Attitude Neuropsychology categories already presented. This indicates either that the teachers' and therapists' attitude to metacognition was worse, or that they were more confused after training than before. For example, for question B6, which queried whether one works and achieves better under pressure, the percentage of teachers who answered "no" decreased from 37,8% to 22,2%, which was lower than predicted. However, the percentage who answered "yes" also decreased, from 46,7% to 33,3%, but the percentage who answered "unsure" increased from 15,6% to 44,4%. The increase in the unsure category indicates confusion. Similar patterns occurred with questions B3 and 8.

In the D section questions, which are particularly sensitive to attitudes towards metacognition, positive changes were determined for questions D1, 2, 3, 4, 5, 8, 10, 11 and

12, indicating that the trends changed according to what was predicted. However, the changes were minimal and the spread of percentages quite similar pre- and post-training. Therefore the changes that occured were not as large as predicted.

For example, for question D1, which queried whether the learning environment needs to be quiet and serious, in the pre-training phase 4,4% of respondents indicated this to be "of no importance" and 20% indicated this to be "of very great importance". In the post-training phase, the first category increased to 13,3% and the "of very great importance" category dropped to 15,6%. The middle two categories stayed at similar percentages. Responses to questions D13, 14 and 15 also did not change in the direction predicted, that is, the attitudes were less in favour of geodesic principles than before training. Most respondents answered "of no importance" or "of some importance", possibly indicating that the teachers and therapists were still not significantly convinced as to the effectiveness of geodesic principles, or that they were confused.

In the E questions, the ability to define "learning", "accelerated learning" and "super teaching" improved. This possibly indicates that the respondents' perception of learning was beginning to change, but because the percentages were low, there is still room for much change. However, this is in itself a positive result, as something was happening.

In conclusion, the results show that the MMA training did not influence the attitude of the teachers and therapists towards the importance of the incorporation of metacognitive concepts in therapy and teaching. However, a change in the respondents' perception of learning was beginning to occur.

5.2.2.7. The change in skills in the application of neuropsychological and metacognitive principles (SN and SM)

It can be seen from Table 4.2 that the same questions probed the teachers' and therapists' skills in applying neurological principles and their skills in applying metacognitive principles. This section therefore considers the categories, Skills Neuropsychology (SN) and Skills Metacognition (SM) together. The objective of this section of the questionnaire was to determine how the teachers and therapists rated their skills in applying geodesic principles in the classroom and in therapy. Table 5.2e. and Figure 5.1e provide the statistical results of these categories.

The overall statistical result of all the questions in these two categories indicated that a significant positive change occurred. This indicates that when completing the post-training questionnaire, the teachers and therapists felt more able to apply the geodesic principles of the MMA in the classroom and therapy rooms. Responses to questions B13, 15, 16 and 17 changed significantly in the direction of an increase in knowledge post-training. B13 and 17 had high percentages prior to training, indicating a fairly high competence level in neuropsychological knowledge, which is consistent with previous discussions. B14 had a slightly negative answer indicating a possible confusion, and questions B15 and 16 had a fairly even spread across the three categories indicating that no dramatic changes occurred in the teachers' skills in those particular areas.

In the responses to the relevant questions from section C, the "some" category increased and the "little" category decreased, both significantly. The section E questions relevant to the skills categories, the definitions of "learning", "accelerated learning" and "super-teaching", once again showed significant improvement in terms of the identification of the elements of the definition, but these percentages were low as in the previous categories.

In conclusion, overall the teachers and therapists felt their skills had improved, but the low means indicate that there were not totally confident in their ability to apply neuropsychological and metacognitive concepts in teaching and therapy.

5.2.3. THE INFLUENCE OF BIOGRAPHICAL VARIABLES ON BEHAVIOUR CHANGE

The second sub-aim was to determine the influence of the biographical variables of age, language and qualifications of the teachers and therapists on the change in knowledge, attitude and skills regarding the geodesic principles of the MMA training programme.

In Tables 5.3a, 5.3b and 5.3c, the details of the respondents' age, language and qualifications are provided. Three age groups were formulated (Table 5.3a), namely, those teachers and therapists 30 years old or younger (group 1), those between the ages of 31 and 50 years (group 2); and those aged 51 or older (group 3). Of the 45 teachers and therapists, the largest number (20) fell into the middle category, followed by 17 in the older category, and 8 in the younger category.

Table 5.3a : The influence of age on the pre and post scores

AGE GROUP	N	PRE	POST	DIFF	P-VALUE
1					
(≤30 years)	8	0.5	0.57	0.07	0.0781 ** (p ≤ 1)
2					
(31-50 years)	20	0.51	0.57	0.06	0.0010 * ((p ≤ 0.05)
3					
(51+ years)	17	0.54	0.57	0.04	0.2769

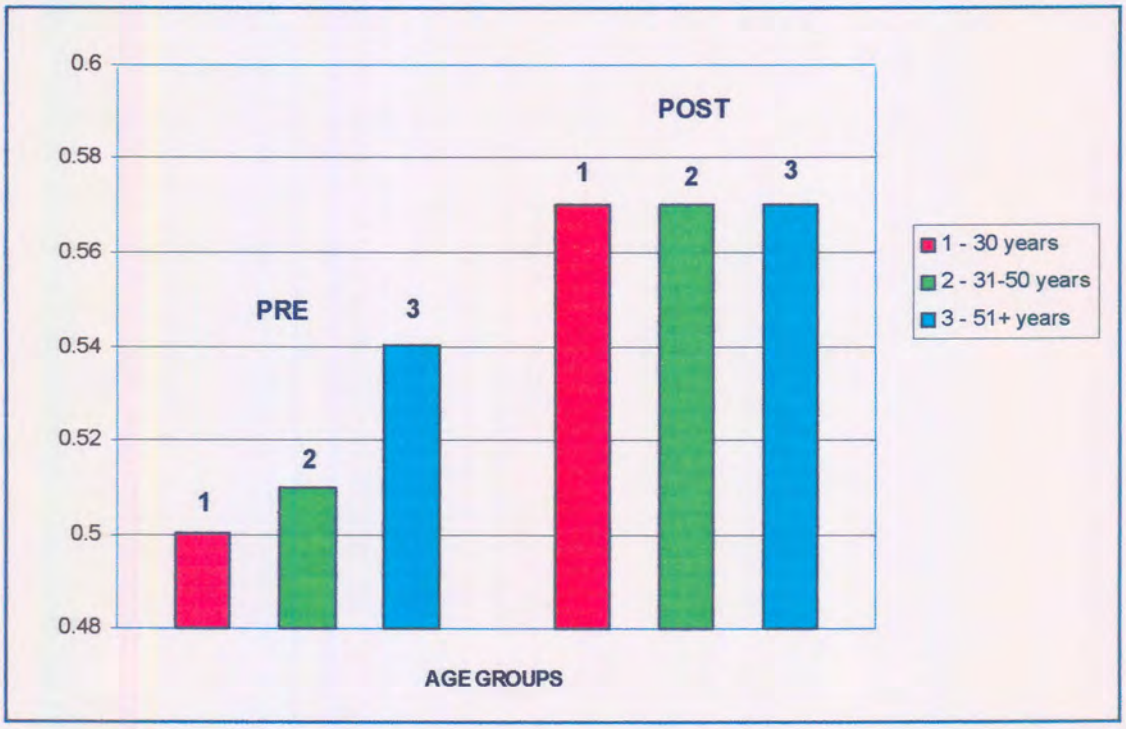


Figure 5.2a : The influence of age on the pre and post scores

Table 5.3b : The influence of language on the pre and post scores

LANGUAGE GROUP	N	PRE	POST	DIFF	P-VALUE
1					
English	25	0.51	0.56	0.04	0.0491 *
2					
Afrikaans	16	0.51	0.59	0.08	0.0010 *
3					
Eng / Afrik	4	0.56	0.58	0.02	0.6250

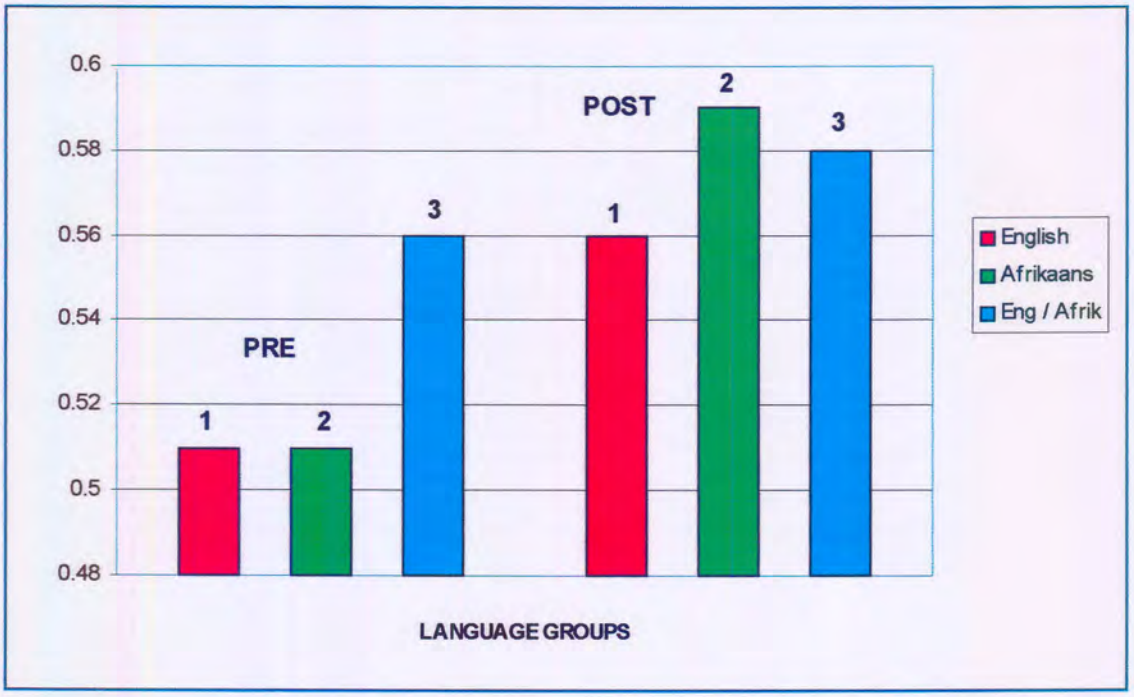


Figure 5.2b : The influence of language on the pre and post scores

Table 5.3c : The influence of qualifications on the pre and post scores

QUALIFICATION GROUP	N	PRE	POST	DIFF	P-VALUE
1					
Teaching	12	0.51	0.55	0.04	0.1748
2					
Teaching +	24	0.52	0.57	0.05	0.0082 *
3					
Professional	9	0.53	0.60	0.07	0.0391 *

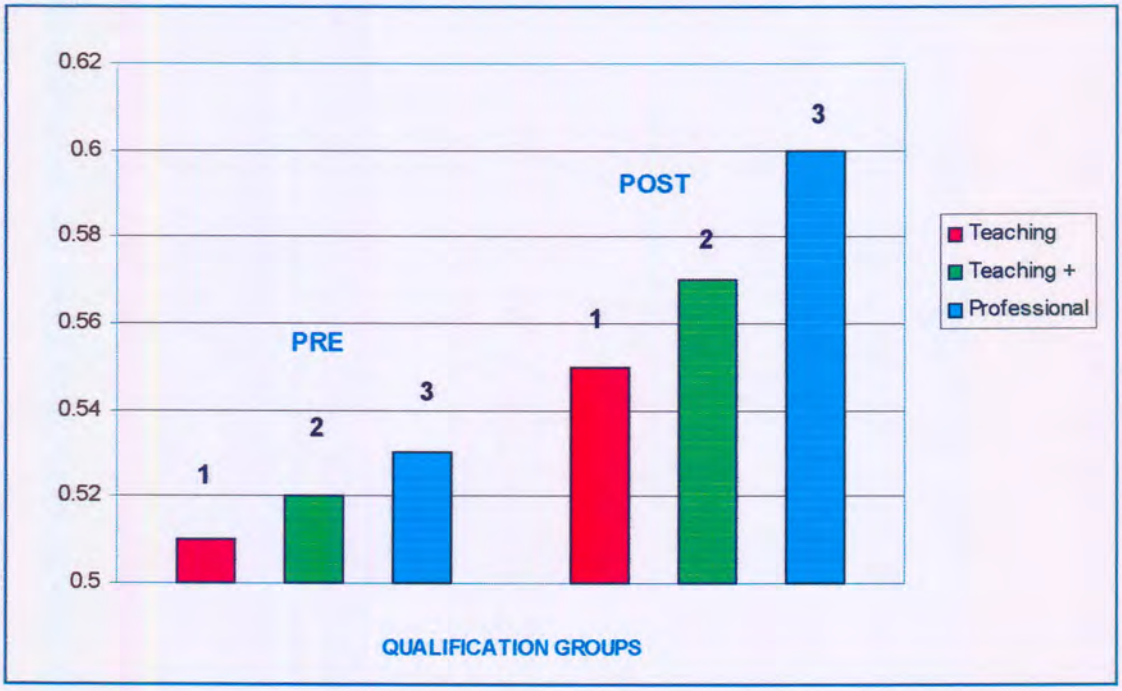


Figure 5.2c : The influence of qualifications on the pre and post scores

The respondents were also categorised into three groups with respect to language (Table 5.3b), namely English speaking (25); Afrikaans speaking (16) and bilingual (English and Afrikaans speaking) (4). In terms of qualifications (Table 5.5a) the respondents were categorised as those with a teaching qualification only (12); those with a teaching qualification plus an additional qualification such as remedial or special education (24); and the other "professional" group (speech-language therapists, psychologists, and remedial teachers (9).

The third sub-aim was to determine the influence of the variables of age, language and qualifications on the change in the teachers' and therapists' knowledge, attitude and skills regarding the geodesic principles of the MMA training programme.

5.2.3.1. The influence of age

The teachers and therapists was categorised into three groups with regard to age, namely:

- Group 1 - less than or equal to 30 years (n = 8)
- Group 2 - 31 to 50 years (n = 20)
- Group 3 - older than 50 years (n = 17).

Statistical analysis (see Table 5.3a and Figure 5.2a) revealed that group 2 showed the most significant improvement across all six categories on the questionnaire, indicating that this group responded the best to the MMA training. In group 1, the improvement was not significant on the 5% significance level, but was significant on the 10% significance level. This may be due to the small sample size. Although group 3 did not show a significant improvement on either significance level, a positive trend was identified indicating that improvement did occur.

An in-depth analysis of the results of each of the age groups (1, 2 and 3) in each of the six categories on the questionnaire now follows; these results are shown in Table 5.4a and Figure 5.3a.

In group 1, the youngest age group, only one of the six questionnaire categories, Skills Neuropsychology (SN) showed a significant improvement. The trend in the Attitude Metacognition category (AM) was slightly negative, but not significantly so, indicating that either no change took place or that the attitude to metacognitive concepts was slightly poorer after training than before.

Table 5.4a : The influence of age on the pre and post scores by learning categories

	KNOWLEDGE						ATTITUDE						SKILLS					
AGE GROUPS	KN			KM			AN			AM			SN			SM		
	PRE	POST	P-VAL	PRE	POST	P-VAL	PRE	POST	P-VAL	PRE	POST	P-VAL	PRE	POST	P-VAL	PRE	POST	P-VAL
1 ≤ 30 yrs n = 8	0.60	0.64	0.1484	0.45	0.54	0.1094	0.71	0.81	0.391	0.50	0.46	0.3125	0.23	0.38	* 0.0078	0.48	0.56	0.1484
2 ≤ 31-50 yrs n = 20	0.59	0.62	0.2753	0.44	0.52	* 0.0010	0.74	0.78	* 0.0400	0.57	0.56	0.7285	0.27	0.4	* 0.0021	0.47	0.54	* 0.0044
3 ≥ 51 yrs n = 17	0.62	0.63	0.7173	0.47	0.56	* 0.0089	0.73	0.77	0.6575	0.54	0.52	0.5245	0.36	0.39	0.6353	0.49	0.56	* 0.0133

KEY:

KN	=	Knowledge Neuropsychology
KM	=	Knowledge Metacognition
AN	=	Attitude Neuropsycholgoy
AM	=	Attitude Metacognition
SN	=	Skills Neuropsychology
SM	=	Skills Metacognition

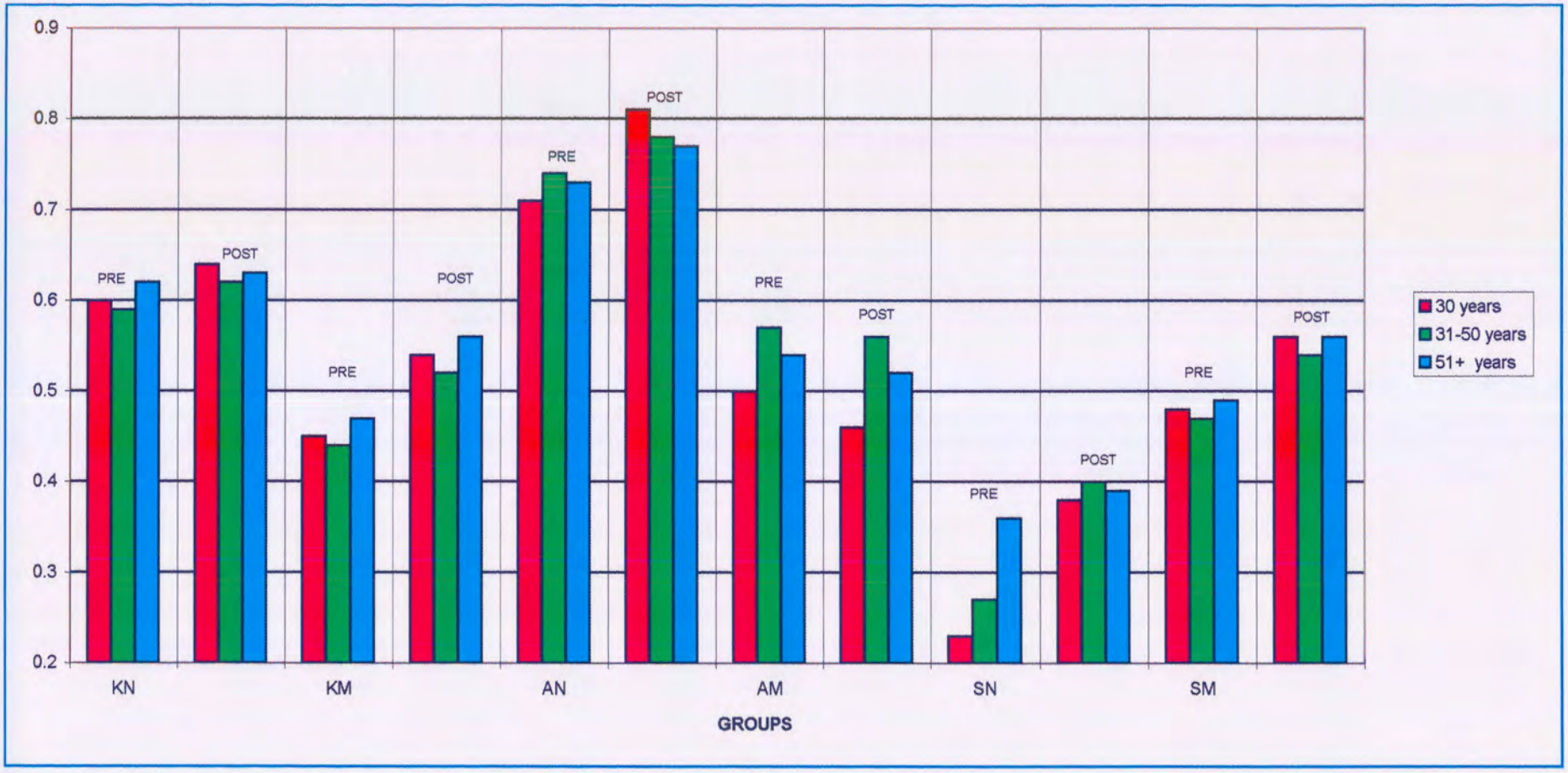


Figure 5.3a : The influence of age on the pre and post scores by learning category

KEY		
KN	=	Knowledge Neuropsychology
KM	=	Knowledge Metacognition
AN	=	Attitude Neuropsychology
AM	=	Attitude Metacognition
SN	=	Skills Neuropsychology
SM	=	Skills Metacognition

The other four categories (Knowledge Neuropsychology, Knowledge Metacognition, Attitude Metacognition and Skills Metacognition) all showed positive trends, indicating that improvement did occur, even though the changes were not significant.

In group 2, the middle age group, four of the six categories showed significant improvement, namely Knowledge Metacognition, Attitude Neuropsychology, Skill Neuropsychology and Skill Metacognition. Knowledge Neuropsychology showed a positive trend, although not significant. Attitude Metacognition showed a negative trend, as for group 1.

In group 3, the older age group, Knowledge Metacognition and Skills Metacognition demonstrated a significant improvement. Knowledge Neuropsychology, Knowledge Metacognition, Attitude Neuropsychology and Skills Neuropsychology all showed positive trends, although not significant. Once again Attitude Metacognition showed a negative trend.

In summary, group 2, the 31 to 50 year old category, showed the most improvement, that is, they responded the best to training, followed by the younger group (30 and under), then the older (over 50). In all age groups all the categories, except Attitude Metacognition, showed positive trends.

5.2.3.2. The influence of language

The teachers and therapists were categorised into three groups as to language, namely:

- Group 1 - English speaking
- Group 2 - Afrikaans speaking
- Group 3 - English and Afrikaans speaking.

Statistical analysis (see Table 5.3b and Figure 5.2b) revealed that groups 1 and 2 showed a statistically significant improvement overall. However, group 2's result was more significant than group 1 indicating that the Afrikaans group demonstrated the most improvement after training. Group 3 showed no significant improvement but the trend was positive. The lack of significance was probably due to the small sample size in comparison to the other two groups.

A detailed analysis of the results of each of the language groups in each of the six categories of the questionnaire follows; these results appear in Table 5.4b and Figure 5.3b.

In group 1, the English-speaking group, the categories Knowledge Metacognition and Skills Metacognition showed a statistically significant improvement. The categories Knowledge Neuropsychology, Knowledge Metacognition and Skills Neuropsychology showed improvement, although not significant. The trend in the Attitude Metacognition category was once again negative, although not significantly.

In group 2, the Afrikaans-speaking group, four of the six categories, Knowledge Metacognition, Knowledge Metacognition, Skills Metacognition and Skills Neuropsychology, showed significant improvement. In the category Knowledge Neuropsychology, the trend was positive, although not significantly. The trend in the Attitude Metacognition category was once again negative, but not significantly.

In group 3, English and Afrikaans speaking, no categories showed significant improvement. However, Knowledge Neuropsychology, Knowledge Metacognition, Skills Neuropsychology, and Skills Metacognition had positive trends. Both attitude categories, Knowledge Metacognition and Attitude Metacognition, were negative but not significantly so.

In summary, all trends for all the groups were positive except the Attitude Metacognition category and in one instance, the Knowledge Metacognition category. The Afrikaans group showed the most improvement as the positive trend was significant in more categories.

5.2.3.3. The influence of qualifications

Teachers and therapists were divided into three groups with regard to qualifications, namely:-

- Group 1 - teaching qualification
- Group 2 - teaching qualification plus another qualification, e.g. remedial, special education
- Group 3 – "professional" e.g. speech-language therapist, occupational therapist, psychologist, remedial teacher.

Table 5.4b : The influence of language on the pre and post scores by learning category

	KNOWLEDGE						ATTITUDE						SKILLS					
LANGUAGE GROUPS	KN			KM			AN			AM			SN			SM		
	PRE	POST	P-VAL	PRE	POST	P-VAL	PRE	POST	P-VAL	PRE	POST	P-VAL	PRE	POST	P-VAL	PRE	POST	P-VAL
1 English n = 25	0.60	0.61	0.7246	0.45	0.53	* 0.0016	0.71	0.77	0.1310	0.52	0.50	0.3263	0.33	0.37	0.2610	0.47	0.55	* 0.0021
2 Afrikaans n = 16	0.62	0.65	0.3910	0.45	0.54	* 0.0067	0.74	0.80	* 0.0052	0.57	0.57	0.9399	0.24	0.42	* 0.0002	0.47	0.55	* 0.0084
3 Eng / Afrik n = 4	0.58	0.63	0.3750	0.51	0.55	0.2500	0.81	0.81	1.000	0.64	0.55	0.2500	0.28	0.38	0.5000	0.55	0.56	1.000

KEY:

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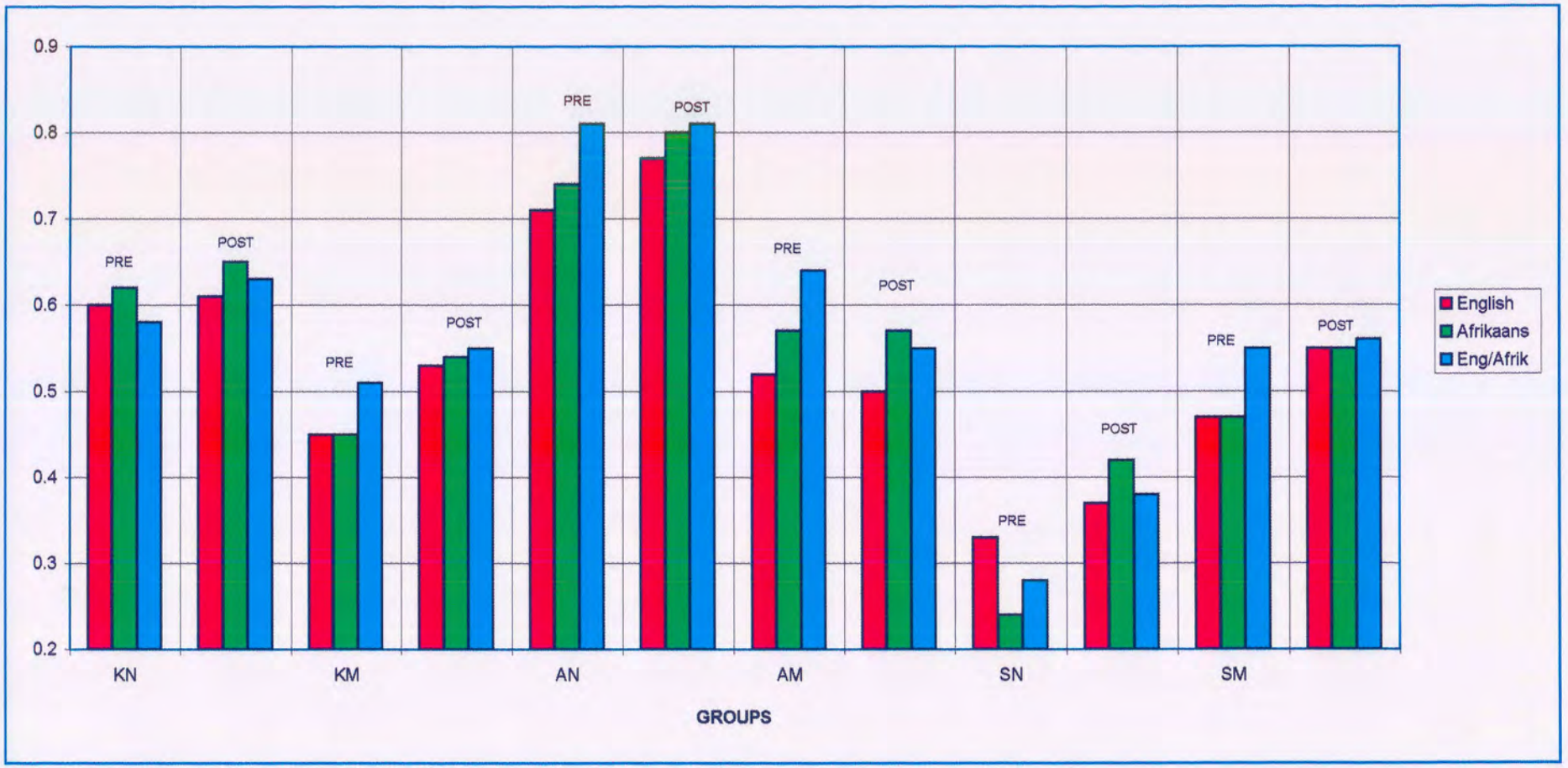

Figure 5.3b : The influence of language on the pre and post scores by learning category

KEY

KN	=	Knowledge Neuropsychology
KM	=	Knowledge Metacognition
AN	=	Attitude Neuropsychology
AM	=	Attitude Metacognition
SN	=	Skills Neuropsychology
SM	=	Skills Metacognition

Statistical analysis (see Table 5.3c. and Figure 5.2c.) revealed that groups 2 and 3 showed significant improvement after training. In group 1 the trend was positive indicating improvement had occurred; however, this trend was not significant. This lack of significance was not due to the sample size as group 3 had a smaller sample size but the results were significant.

A detailed analysis of the results according to qualification group on the six categories of the questionnaire is now presented; these results may be found in Tables 5.4c and Figures 5.3c.

In group 1, only the Knowledge Metacognition showed significant improvement. The Knowledge Neuropsychology, Knowledge Metacognition, Skills Neuropsychology and Skills Metacognition categories all showed positive trends, although these were not significant. The Attitude Metacognition category was once again negative, although not significantly so.

In group 2, Knowledge Metacognition, Skills Neuropsychology and Skills Metacognition showed significant improvement. The categories Knowledge Neuropsychology and Knowledge Metacognition showed positive trends, although these were not significant. The Attitude Metacognition category showed a negative insignificant trend.

In group 3, "professional", the improvement in Knowledge Metacognition, Knowledge Metacognition and Skills Metacognition was significant on a 5% significance level, and in Skills Metacognition it was significant on a 10% significance level. The categories Knowledge Neuropsychology and Skills Neuropsychology showed positive trends, but these were not significant on either the 5% or 10% levels. The trend in the Attitude Metacognition category was once again negative, but not significantly so.

In summary, group 2 (those with teaching plus an extra qualification) showed the most significant improvement, followed by group 3 (those with professional qualifications). The group with a teaching qualification only did not show as much improvement as the other two groups. The results of the Attitude Metacognition category were negative in all three groups. Moreover, this category showed negative results for all the groups for each of the variables - age, language and qualification. This would appear to indicate a confusion in the attitude of the teachers and therapists towards the importance of metacognitive concepts in education and therapy.

Table 5.4c : The influence of qualifications on the pre and post scores by learning category

	KNOWLEDGE						ATTITUDE						SKILLS					
Qualification Groups	**KN**			**KM**			**AN**			**AM**			**SN**			**SM**		
	PRE	**POST**	**P-VAL**	**PRE**	**POST**	**P-VAL**	**PRE**	**POST**	**P-VAL**	**PRE**	**POST**	**P-VAL**	**PRE**	**POST**	**P-VAL**	**PRE**	**POST**	**P-VAL**
Teaching n = 12	0.57	0.63	0.1289	0.47	0.52	* 0.0371	0.73	0.75	0.7695	0.53	0.51	0.8311	0.28	0.34	0.3828	0.48	0.52	0.1309
Teaching + n = 24	0.61	0.62	0.7689	0.44	0.53	* 0.0005	0.73	0.79	0.1255	0.55	0.54	0.3264	0.3	0.4	* 0.0118	0.47	0.55	* 0.0009
Professional n = 9	0.64	0.66	0.4688	0.45	0.57	* 0.0547	0.73	0.82	* 0.0039	0.56	0.53	0.4258	0.31	0.44	* 0.0156	0.49	0.58	0.0742

KEY:

KN	=	Knowledge Neuropsychology
KM	=	Knowledge Metacognition
AN	=	Attitude Neuropsycholgoy
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SN	=	Skills Neuropsychology
SM	=	Skills Metacognition

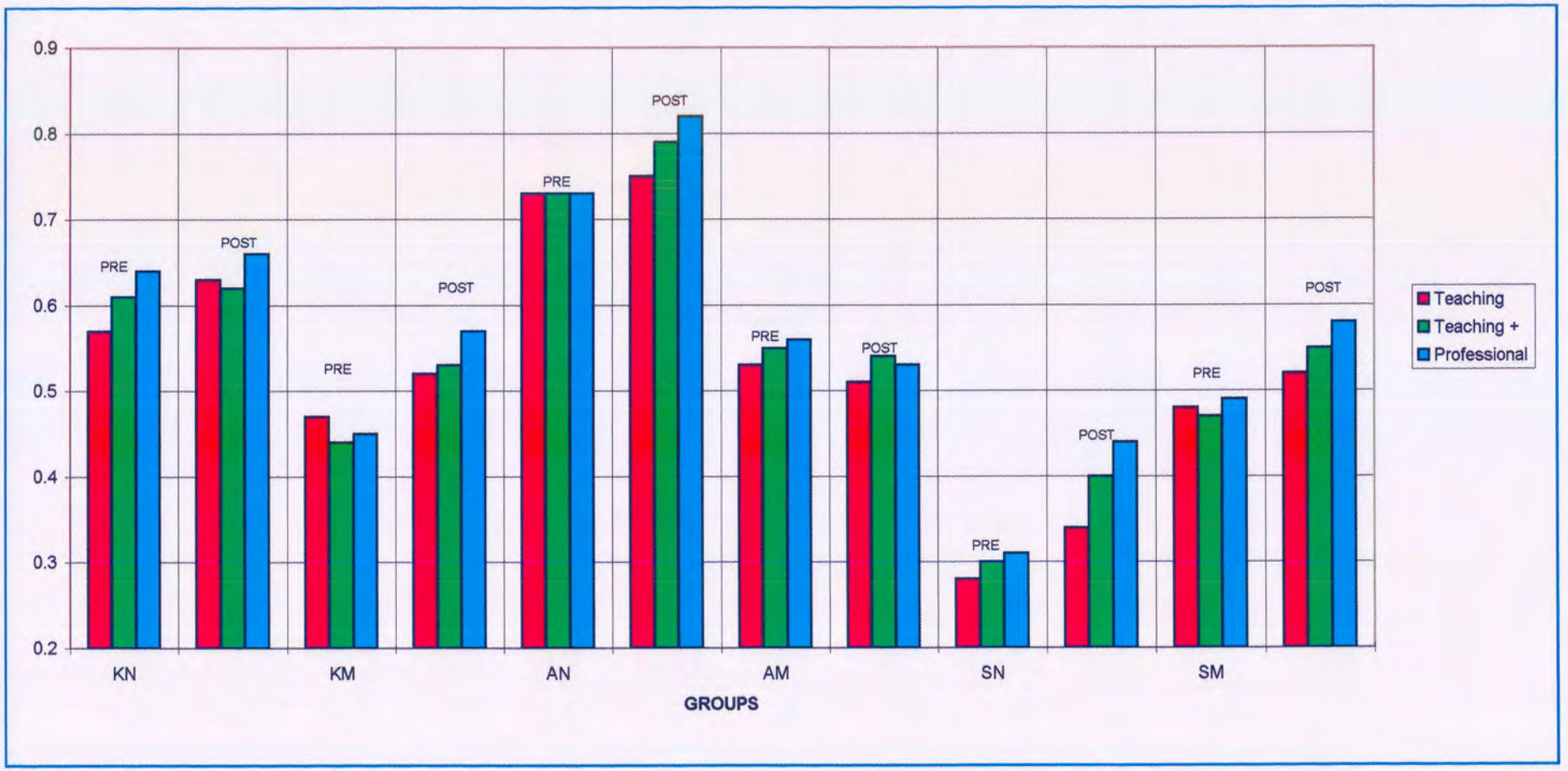

Figure 5.3c : The influence of qualifications on the pre and post scores by learning category

KEY		
KN	=	Knowledge Neuropsychology
KM	=	Knowledge Metacognition
AN	=	Attitude Neuropsychology
AM	=	Attitude Metacognition
SN	=	Skills Neuropsychology
SM	=	Skills Metacognition

5.2.4. ANALYSIS OF SECTION F OF THE POST QUESTIONNAIRE

The teachers and therapists had to fill in an extra section on the post questionnaire which provided them with the opportunity to explain how they had used the principles of the MMA and whether they had experienced any difficulty. Table 5.5 provides the statistical results obtained. Appendix III provides the categories of possible answers.

Question F1 asked whether the teachers and therapists managed to implement the concepts in their daily curricula, and if so, how. From the results it can be seen that 24,4% of the respondents experienced difficulty using the techniques daily. With regard to use of the techniques to teach specific subjects, 33,3% reported using the techniques to teach English but only 11,1% reported using them to teach Afrikaans. Only 2,2% actively used the techniques in Maths lessons. For other subjects, 22% used the techniques for the subjects of Biology and Science, which are taught in the higher standards. In the lower standards these subjects are taught as Environmental Studies, and it can be seen that the techniques were used by 40% of the respondents in this subject. Overall, approximately 75% of the teachers reported using the MMA method for cultural subjects. All the therapists who took part in the research reported using the methods in some form in therapy. Music was used in teaching and therapy by 62,2% of the teachers and therapists; 20% used the relaxation exercises, and 48,9% used the MMA methods as a study method for themselves as well as teaching the pupils.

In Question F2, respondents had to indicate whether they had experienced any difficulty in utilising the concepts of the MMA, and if so, which elements. Less than half the group, 37,8%, indicated that they had no problems with the application of the methods. The most difficulty was experienced with teaching the technique as a study method and getting the students to use the method as a study method independently, as 35,6% indicated problems in this area. Difficulty in teaching key concepts as opposed to key words was reported by 13,3% of the respondents. Only 8,9% indicated experiencing problems with organisation within the pupils' Mind-Maps. Lastly, 8,9% reported experiencing difficulty with using the method as a complementary teaching tool.

In Question F3, the respondents had to indicate whether they felt their clients had benefited from their use of the MMA geodesic principles. Twenty per cent of the teachers and therapists answered "no", but qualified it by saying that they had not really applied the principles.

Table 5.5 : Results of Section F of the post questionnaire

QUESTION	FREQUENCY % PER ELEMENT OF QUESTION															
F1	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
	24.4%	33.3%	11.1%	2.2%	13.3%	8.9%	2.2%	0%	2.2%	2.2%	40%	13.3%	24.4%	62.2%	20%	48.9%
F2	0	1			2			3			4			5		
	37.8%	8.9%			2.2%			13.3%			2.2%			35.6%		
F3	0	1			2			3			4			5		
	20%	8.9%			0%			13.3%			2.2%			55.6%		
F4	0	1			2			3			4			5		
	60%	6.7%			2.2%			4.4%			0%			26.7%		

55,6% of the teachers and therapists indicated that their pupils had benefited from the study method application and appeared to be more organised, and to demonstrate improved memory and improved problem-solving skills. 13,3% of the teachers and therapists felt that the pupils' ability to summarise and identify key concepts had improved. Only 8,9% felt the MMA principles were a complementary teaching tool.

In Question F4, the respondents had the opportunity to provide any extra comments. Sixty per cent of the respondents made no extra comment. The benefits of the study method application were stressed by 26,7% of the respondents. Only 6,7% indicated that there would be benefits in using a completely new geodesic approach in therapy and teaching; 2,2% stressed the benefits of the techniques in improving organisational and problem-solving skills; while only 4,4% indicated the benefits of using the method in developing the ability to identify the main concepts.

In conclusion, it appears that the principles and methods of the MMA were most used to teach English and cultural subjects. The main areas of difficulty appear to be in teaching the pupils to create Mind-Maps independently, to use the Mind-Map as a study method independently, and to select concepts. It appeared that teachers and therapists were creating Mind-Maps and the pupils were copying them. Finally, the teachers and therapists felt that the most benefit was derived from using the MMA techniques as a study method and for improving the pupils' memory and problem-solving skills.

5.2.5. GENERAL CONCLUSIONS REGARDING THE RESPONSE OF THE TEACHERS AND THERAPISTS

Of the six categories, four (Knowledge Metacognition, Knowledge Metacognition, Skills Neuropsychology and Attitude Metacognition) were found to have changed significantly. This change was positive indicating that the teachers and therapists knowledge, attitude and skills improved after the MMA training. However, the non-significant, although positive Knowledge Neuropsychology category, and the negative Attitude Metacognition category and the general low improvement percentages indicates that even though change occurred, it was not to the extent predicted. The knowledge and skill categories showed larger improvements than the attitude categories indicating a possible correlation between knowledge, attitude and skills. That is, in order to effect major changes, it would appear that the attitude category is the most important and most difficult area to influence and change, but without this change, no amount

of knowledge or skill is really going to work (Byron, 1986). The results are consistent with findings in section 5.1 in that the means of knowledge and attitude to neuropsychology concepts is higher than that of metacognitive concepts; their confidence in their skills is low pre and post training.

This appears to be corroborated by the results of the F section of the questionnaire which really examines changes in the classroom and therapy room. The results obtained from the F section indicate that the teachers and therapists felt that the geodesic principles of the MMA are primarily providing an alternative way of studying and improving memory, and not as providing an alternative approach to learning and educating. The teachers and therapists did indicate that the method was useful in cultural subjects and that the music had a relaxing effect on the pupils. Finally the biographical variables of age, language and qualifications were found to influence the overall results in that the middle age group, the Afrikaans-speaking group and the group with a teaching qualification and an extra qualification, demonstrated the most significant improvement after the MMA training course.

5.3. RESPONSES OF THE PUPILS TO THE MMA GEODESIC PRINCIPLES: THE SECOND MAIN AIM

This section deals with the changes in academic performance of the pupils after exposure to the MMA geodesic principles by the teachers and therapists who acted as respondents to the questionnaire. Therefore, this section not only examines the natural trends that occur as a pupil progresses through the standards, and how these may or may not change with introduction of geodesic frameworks such as the MMA, but also examines the effectiveness of the MMA programme as a consultative framework and a vehicle of change for therapists and teachers. This necessitates a statistical as well as descriptive analysis of the results in order to draw conclusions.

All the results presented below are those of the third data set. As discussed in the methodology, data set one was not organised to account for the dependency factor making the results of this data set inaccurate. Data set two, created to establish a longitudinal historical trend, was a subset drawn from data set one. This data set was purer than data set one, but the small sample size (75), as well as the uneven weighting of the sample across standards, affected the accuracy of the results. Results of these two data sets are therefore not presented in full. However, reference

(75), as well as the uneven weighting of the sample across standards, affected the accuracy of the results. Results of these two data sets are therefore not presented in full. However, reference is made to the results of the first and second data sets, in relation to the results of data set three, in the general conclusion at the end of this section.

5.3.1. GENERAL TRENDS

The results obtained indicate that in general the academic trend in the three primary remedial schools was altered with the introduction of the MMA methods in 1993. Furthermore, it appears that the most positive response occurred in phase one (grades 1 and 2, and standard 1). A positive response also occurred in phase two (standards 2-4), but this change was just outside the significance level. Phase three (standard 5), by contrast, experienced negative effects with the introduction of the MMA methods. In terms of school subjects, it appears that the MMA methods worked most efficiently for English, followed by cultural subjects, then Afrikaans, then Maths.

5.3.2. THE LONGITUDINAL TRENDS OF ACADEMIC RESULTS

The trend of academic results over the baseline years and the experimental year is now examined in general, then per phase, then per standard and finally per subject.

5.3.2.1. The overall longitudinal trend in general

The overall longitudinal trend across all three phases and across all subjects (Table 5.6. and Figure 5.4) was determined to be significantly positive. However, the change between 1992 and 1993 was more significant than between 1991 and 1992 ($p = 0{,}00034$ versus $0{,}02581$). Therefore, it appears that the introduction of the MMA principles in the experimental year made the trend significantly more positive.

5.3.2.2. The overall longitudinal trend per phase

In phase one the overall longitudinal trend (Table 5.7 and Figure 5.5) was significantly positive. However, the change between 1992 and 1993 had a higher positive significance ($p = 0{,}0000$) than between 1991 to 1992 ($p = 0{,}00888$). Thus, the trend was significantly altered in 1993.

In phase two (Table 5.7. and Figure 5.5.), the trend was significantly positive between 1991 and 1992. Between 1992 and 1993, the trend was not significant but remained positive.

Table 5.6 : The overall longitudinal trend of academic results: Results of Mixture Test of Wilcoxon Sum Ranks & Signed Ranks

1991 MEAN	1992 MEAN	P-VALUE 1991 - 1992	1993 MEAN	P-VALUE 1992 - 1993	STD. DEV.
53.93	55.69	0.02581 *	57.88	0.00034 *	1991 = 7.03 1992 = 7.81 1993 = 7.80

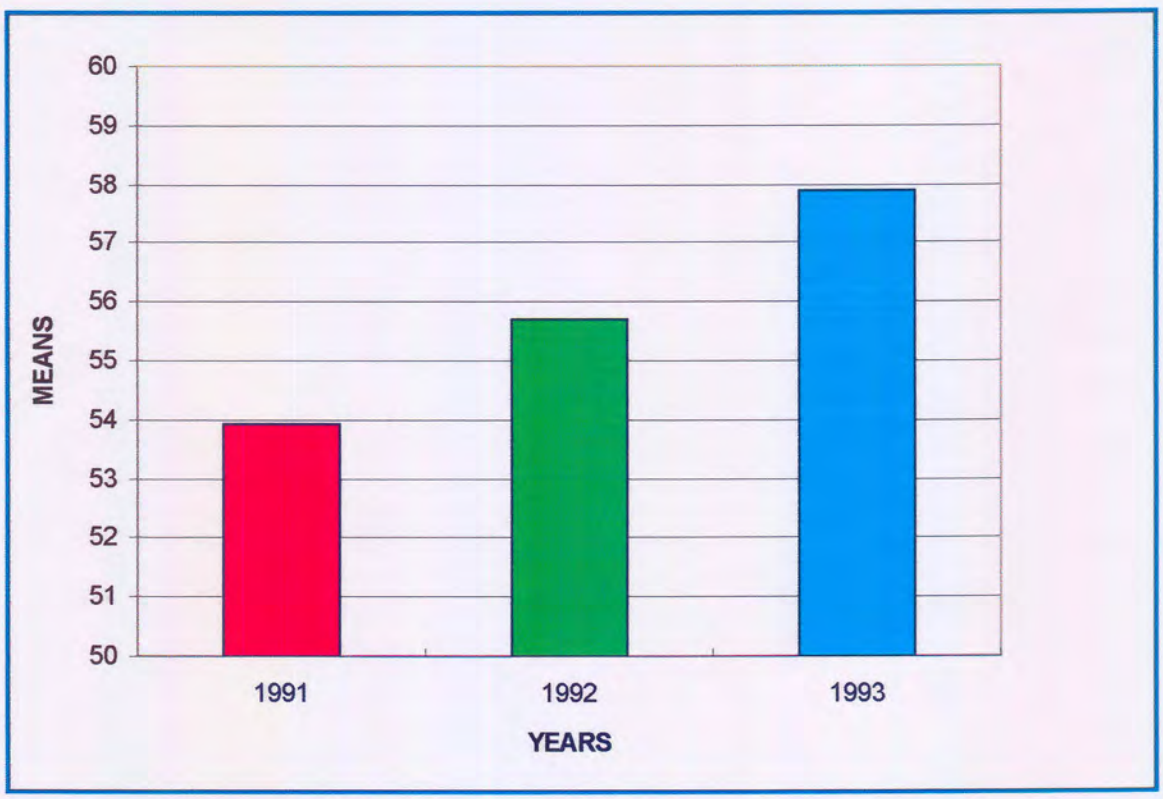

Figure 5.4 : The overall longitudinal trend of academic results

Table 5.7 : A comparison of the overall longitudinal trend of academic results of each phase: Results of Mixture Test of Wilcoxon Sum Ranks & Signed Ranks

PHASE	1991 MEAN	1992 MEAN	P-VALUE 1991-1992	1993 MEAN	P-VALUE 1992-1993	STD. DEVIATION 1991	1992	1993
1 Grade 1 - Std 1 n = 333	52.33	54.96	0.00888 *	59.68	0.000000 *	6.09	6.13	5.23
2 Std 2 -4 n = 388	55.14	57.48	0.03546 *	58.69	0.17423	8.39	7.98	7.37
3 Std 5 n = 260	53.83	54.08	0.16056	52.97	0.00031 *	8.24	8.81	7.17

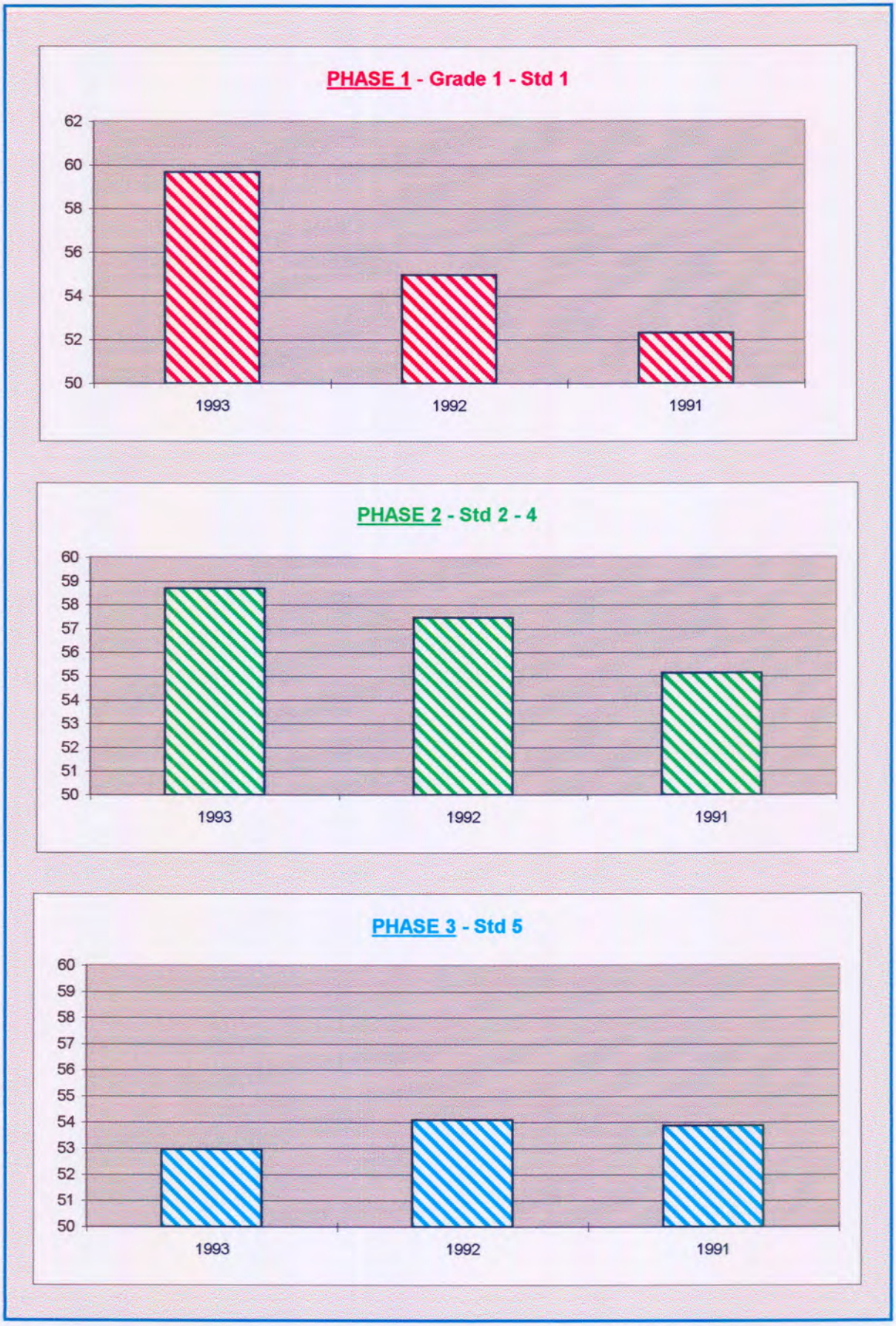

Figure 5.5 : The overall longitudinal trend of each phase of academic results

It can thus be intimated that the introduction of the MMA principles maintained the positive trend in phase two, but did not alter it.

In phase three (Table 5.7 and Figure 5.5), the trend was significantly positive between 1991 and 1992, but was significantly negative between 1992 and 1993. Thus, it appears that the trend worsened with the introduction of the MMA principles in 1993 in phase three. In summary, phase one responded the best.

5.3.2.3. The overall longitudinal trend per standard

The results of the overall longitudinal trend per standard can be found in Table 5.8 and Figure 5.6.

The academic results in grades one and two, standard one and standard three showed positive trends which were significantly altered in 1993 with the introduction of the MMA methods. In standard two the academic results for all the subjects demonstrated a positive trend that was maintained in 1993. In standard four the academic results for all the subjects demonstrated a positive trend that was altered negatively but not significantly in 1993. In standard five the academic results for all the subjects demonstrated a positive trend that was altered significantly in a negative way in 1993.

In summary, the overall trends for the academic results for all the standards were positive, but the MMA methods had a more positive effect on the subjects in the lower standards than the subjects in the higher standards.

5.3.2.4. The overall longitudinal trend per subject

The overall longitudinal trends per subject can be seen in Table 5.9 and Figure 5.7. The overall trend for English between 1991 and 1992 was positive, but not significant ($p = 0,62865$). However, between 1992 and 1993 there is a significantly positive change ($p = 0,00000$). Therefore it can be said that the use of the MMA methods in the subject of English significantly altered the trend.

In Afrikaans the trend was positive but it appears that it was not altered by the MMA methods in 1993 because the differences between 1991 and 1992 and between 1992 and 1993 were both very similar non-significant changes.

Table 5.8 : A comparison of the overall trend of academic results per standard : Results of Mixture Test of Wilcoxon Sum Ranks & Signed Ranks Test

STANDARD	1991 MEAN	1992 MEAN	P-VALUE 1991 - 1992	1993 MEAN	P-VALUE 1992 - 1993	STD. DEVIATION 1991	1992	1993
Gr I (n = 80)	60.55	53.88	0.23720	51.05	0.00136 *	4.73	6.25	6.00
Gr ii (n = 73)	58.55	54.15	0.03148 *	50.76	0.00043 *	6.42	6.41	5.14
Std 1 (n = 92)	60.27	57.13	0.07459	54.08	0.00253 *	5.44	5.78	5.55
Std 2 (n = 92)	60.12	58.49	0.46323	56.02	0.24466	7.75	7.99	7.73
Std 3 (n = 92)	59.39	56.78	0.22501	54.56	0.02534 *	7.72	7.38	6.68
Std 4 (n = 93)	54.58	55.00	0.64484	54.82	0.36200	10.23	9.80	6.70
Std 5 (n = 145)	53.88	54.40	0.33364	52.97	0.00031 *	8.33	8.86	7.17

Figure 5.6 : The overall trend of academic results per standard

...erall trend of academic results per subject : Results of Mixture ...Sum Ranks & Signed Ranks

SUBJECTS	1991 MEAN	1992 MEAN	P-VALUE 1991 - 1992	1993 MEAN	P-VALUE 1992 - 1993	STD. DEVIATION 1991	1992	1993
ENGLISH	53.73	54.44	0.62865	57.7	0.00000 *	8.54	8.63	7.54
AFRIKAANS	52.89	54.13	0.13288	55.44	0.18301	8.63	8.68	9.22
MATHS	53.80	56.26	0.07667	58.09	0.02373 *	12.95	12.95	11.88
CULTURALS	55.31	57.92	0.00614 *	60.29	0.00183 *	10.11	10.03	9.20

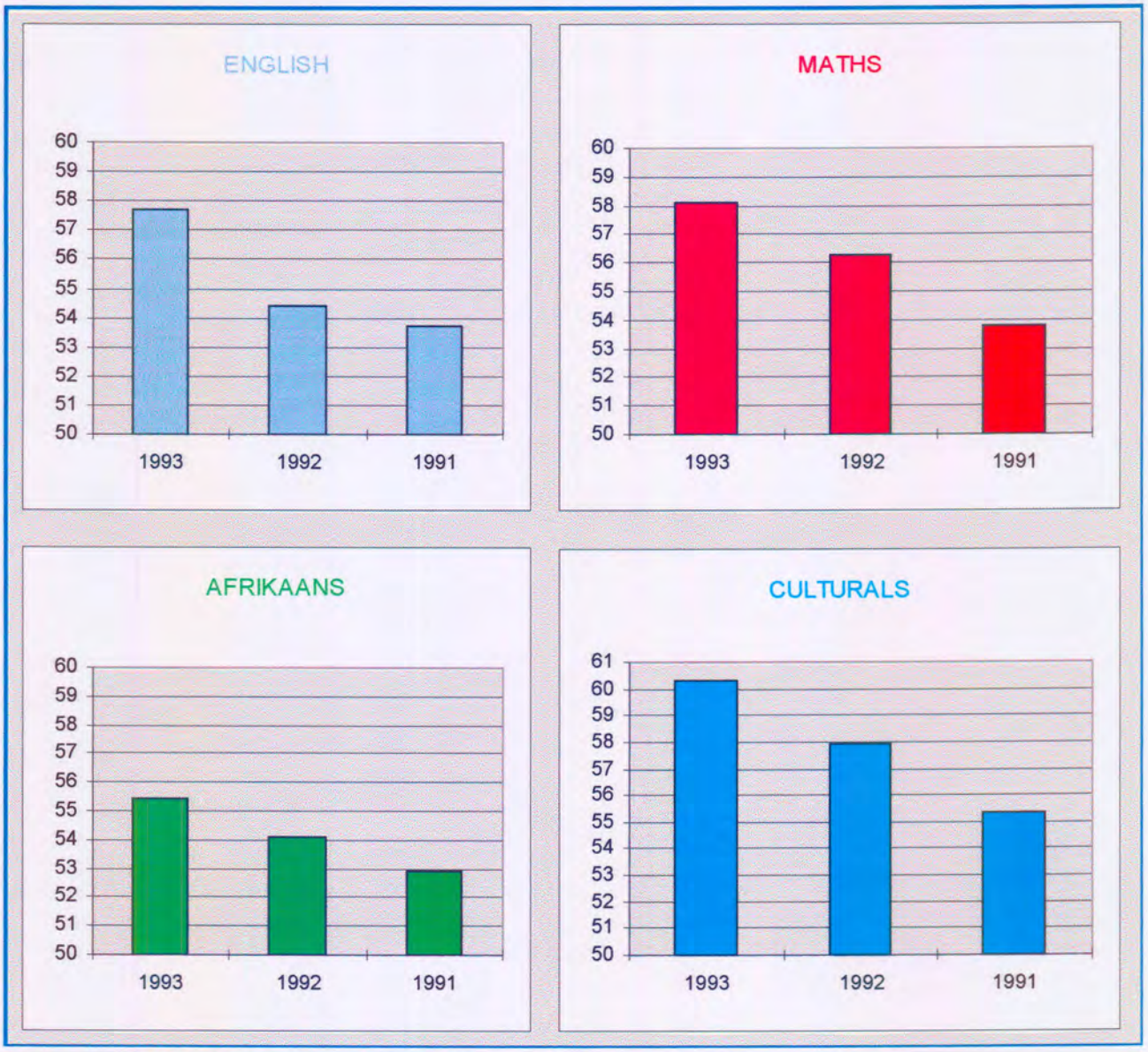

Figure 5.7 : The overall trend of academic results per school subject

The trend for Maths appears to have been altered in 1993 by the introduction of the MMA methods because the difference between 1992 and 1993 was significantly positive (p = 0,02373), whereas between 1991 and 1992 there was no significant change (p = 0,07667).

For cultural subjects the trend was significantly positive. Moreover, the trend appears to have been altered by the MMA methods because, although the difference between 1991 and 1992 was significantly positive (p = 0,00614), the improvement between 1992 and 1993 was increasingly significant (p = 0,00183).

In summary, if differences between the means for 1992 and 1993 are compared for each subject, it can be seen that the greatest difference occurred in English (difference = 3), and the least difference occurred in Afrikaans (difference = 2). Cultural subjects and Maths were in second and third place respectively.

5.3.3. THE INDIVIDUAL TRENDS PER SUBJECT

In this section how each of the school subjects, English, Afrikaans, Maths and cultural subjects, responded to the introduction of the MMA principles is evaluated. This is done by examination of the trends of each subject per phase and per standard.

5.3.3.1. The trend of each subject per phase

The trend of the academic results for each school subject per phase can be seen in Table 5.10 and Figure 5.8.

The academic results for **English** between 1991 and 1992 showed positive non-significant trends in phases one and two, but in phase three the trend was non-significantly negative. Between 1992 and 1993 the trend in phase one and two demonstrated significant positive changes (p = 0,00005 and 0,03685 respectively). In phase three, the negative trend of academic results was altered but non significantly so in 1993.

The trends of the academic results for **Afrikaans** between 1991 and 1992 were significantly positive in phase one, and non-significantly positive in phases two and three. In phase one the positive trend had a higher significance in 1993. In phase two, the difference between 1992 and 1993 (0,41053) was slightly closer to significance than between 1991 and 1992 (0,76312). However this result indicates that the trend did not change significantly, but was maintained with the introduction of the MMA principles in 1993. Moreover in phase three, the trend became significantly negative in 1993.

Table 5.10 : A Comparison of the trend of academic results per subject per phase : Results of Mixture of Wilcoxon Sum Ranks and Signed Ranks Test

SUBJECT	YEAR	PHASE 1		PHASE 2		PHASE 3	
		MEAN	STD. DEV	MEAN	STD. DEV	MEAN	STD. DEV
ENGLISH	1991	52.58	7.50	54.51	8.50	53.79	9.47
	1992	54.3	7.40	55.96	8.55	52.55	9.65
	P-Value 1991-1992	0.21301		0.52044		0.16056	
	1993	59.04	6.79	58.06	7.05	54.49	8.83
	P-Value 1992-1993	0.0005 *		0.03685 *		0.91298	
AFRIKAANS	1991	51.29	7.05	53.3	9.60	53.63	8.53
	1992	54.78	7.54	53.75	9.48	53.9	8.81
	P-Value 1991-1992	0.00468 *		0.76312		0.89199	
	1993	59.12	7.27	54.92	9.16	49.49	9.40
	P-Value 1992-1993	0.00472 *		0.41053		0.01401 *	
MATHS	1991	52.75	9.38	55.04	13.48	53.13	15.05
	1992	55.26	8.99	59.09	12.97	53.55	15.82
	P-Value 1992-1993	0.8383		0.04282 *		0.42122	
	1993	59.69	8.53	59.34	12.65	52.75	14.23
	P-Value 1992-1993	0.00092 *		0.72845		0.12603	
CULTURALS	1991	52.7	7.15	57.52	10.85	54.89	10.95
	1992	55.48	6.56	61.14	10.09	55.14	11.98
	P-Value 1992-1993	0.02229 *		0.01669 *		0.066380	
	1993	60.88	5.55	64.44	10.57	56.31	10.07
	P-Value 1992-1993	0.00000 *		0.21229		0.09361	

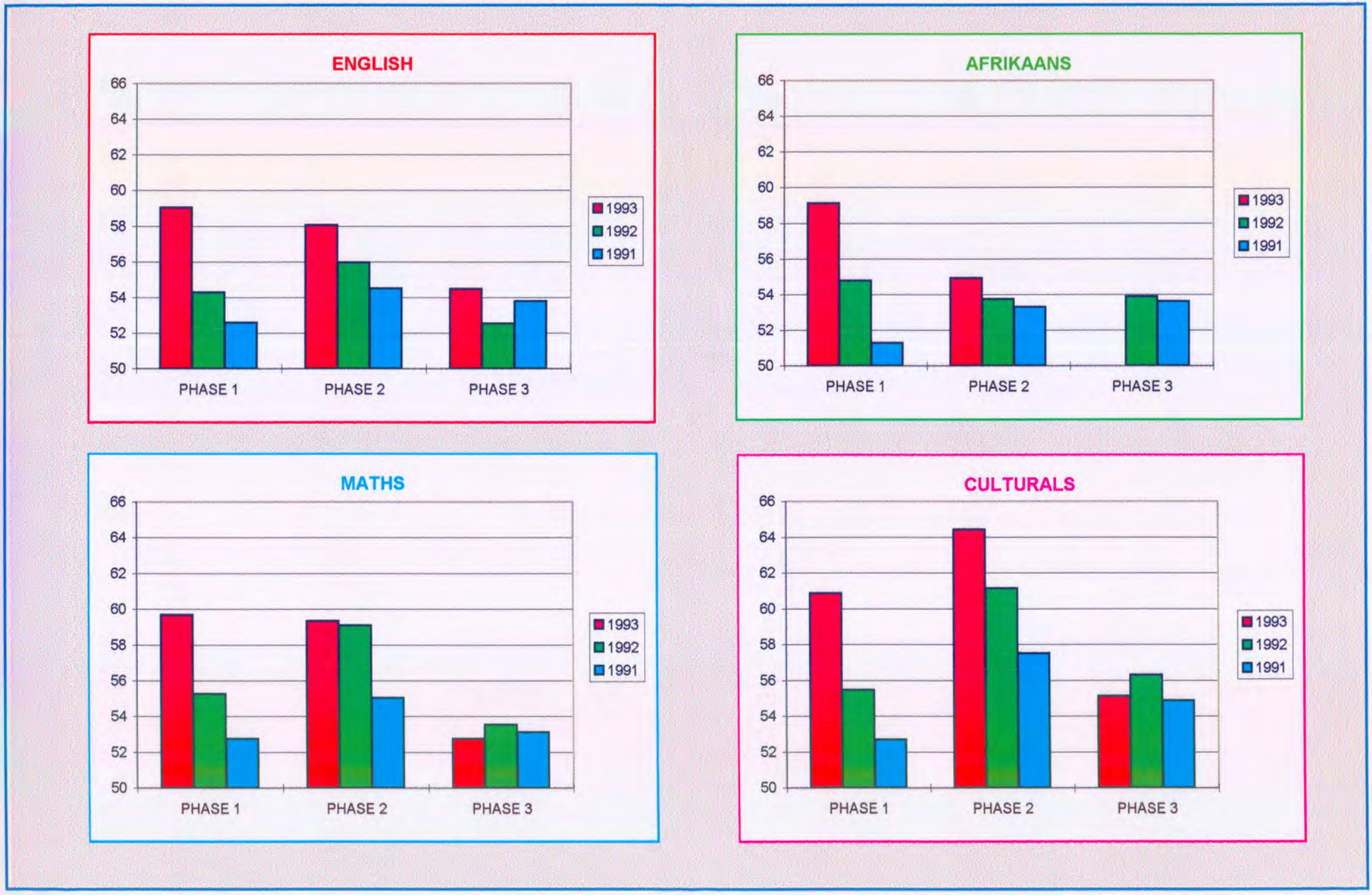

Figure 5.8: The trend of academic results per subject per phase

The trends of the academic results for **Maths** between 1991 and 1992 were non-significantly positive in phases one and three, and significantly positive in phase two. In phase one the trend demonstrated a significantly positive improvement in 1993. In phase two the trend was maintained, whilst in phase three the trend worsened but not significantly so.

The academic results for the **cultural subjects** between 1991 and 1992 demonstrated significantly positive trends in phases one and two, and a non-significant positive trend in phase three. In phase one the positive change between 1992 and 1993 (0,00000) was more significant than between 1991 and 1992 (0,02229). It can therefore be said that the trend was altered. In phases two and three, the non-significant positive trend was maintained in 1993.

In summary, it appears that all subjects responded equally well in phase one, significant changes being experienced for all subjects. In phase two, only English demonstrated a significant positive change, with Afrikaans, Maths and cultural subjects maintaining their positive trends, but without significant alteration. In phase three, the positive trend was maintained in English and cultural subjects but the trends in Maths and Afrikaans worsened.

The analysis of all the phase patterns confirms the results obtained from the overall longitudinal trends per subject reported in the previous section: it appears that performance in English benefited the most from the MMA methods, followed by cultural subjects then Maths, with Afrikaans showing the least benefit. However in phase one, all four subjects showed benefit indicating that the lower standards benefited more than the higher standards. These results are also consistent with the results identified under the general trends.

5.3.3.2. The trend of each subject per standard

The trends of each subject per standard can be seen in Table 5.11 and Figure 5.9.

In grade one, the academic results in all four subjects demonstrated positive trends between 1991 and 1992. These trends were altered in significantly positive way for English, cultural subjects and Maths in 1993, but not for Afrikaans. In grade two the pattern was almost identical to grade one.

Table 5.11 : A comparison of the trend of academic results of each subject per standard : Results of Mixture Test of Wilcoxov Sum Ranks and Signed Ranks Test

SUBJECT	YEAR	MEANS / STD'S							STD DEVIATION / STDS						
		i	ii	1	2	3	4	5	i	ii	1	2	3	4	5
ENGLISH	91	52.00	50.43	54.20	54.09	54.19	55.00	53.81	7.77	7.67	6.73	8.37	8.38	9.25	9.71
	92	53.68	54.12	56.08	56.25	55.08	53.83	52.96	7.51	7.43	8.02	8.97	7.74	9.62	9.70
	P-Value 1991-1992	0.73916	0.22249	0.52268	0.74346	0.51355	0.39669	0.34740							
	93	58.82	58.70	59.57	57.40	58.57	58.39	54.49	7.29	6.13	7.21	6.45	8.23	5.94	8.83
	P-Value 1992-1993	0.00925 *	0.00899 *	0.00510 *	0.59028	0.09774	0.24763	0.91298							
	91	49.40	50.00	53.20	54.32	53.11	52.31	53.99	5.83	6.03	7.41	8.32	9.60	11.69	8.49
	92	53.29	55.00	55.20	56.02	53.39	50.67	54.19	7.56	8.44	7.14	10.92	8.17	8.78	8.95
AFRIK.	P-Value 1991-1992	0.9932	0.11064	0.26514	0.91910	0.85192	0.49399	0.95665							
	93	58.24	57.50	61.52	56.63	54.69	52.14	49.49	7.58	6.17	7.66	9.27	8.68	9.37	9.40
	P-Value 1992-1993	0.40959	0.11367	0.00102 *	0.59028	0.72188	0.85883	0.01401 *							
	91	51.00	51.74	54.40	56.36	54.05	54.49	52.98	9.57	10.72	8.12	11.93	11.29	17.95	15.13
	92	54.21	53.24	57.94	61.48	58.05	55.83	53.76	8.89	8.95	9.70	11.44	12.93	16.25	15.70
MATHS	P-Value 1991-1992	0.57137	0.55229	0.11998	0.19826	0.09096	0.48465	0.58139							
	93	63.24	58.40	58.48	62.40	60.10	52.32	52.75	6.14	9.17	8.75	13.59	10.48	11.98	14.23
	P-Value 1992-1993	0.00041 *	0.02007 *	0.39009	0.58366	0.49592	0.24763	0.12603							
	91	51.80	50.87	54.50	59.32	56.89	56.54	54.76	7.48	7.33	6.41	10.98	9.16	13.09	10.95
	92	52.00	54.26	59.31	60.23	60.59	59.67	56.68	7.77	6.53	8.55	8.95	9.87	12.31	12.07
CULT.	P-Value 1991-1992	0.23060	0.18892	0.06452	0.08700	0.15843	0.59245	0.64404							
	93	54.34	59.60	61.52	64.04	64.18	56.43	55.14	4.27	5.88	5.86	11.07	9.70	9.11	10.07
	P-Value 1992-1993	0.00009 *	0.00753 *	0.01083 *	0.66804	0.12173	0.14227	0.02217 *							

Figure 5.9 : A comparison of the trend of academic results per subject per standard : Results of mixture test of Wilcoxon Sum Ranks & Signed Ranks test

In standard one, the trends of all the academic results were positive between 1991 and 1992, with significantly positive changes being experienced in English, Afrikaans and cultural subjects in 1993. For Maths the positive trend was maintained but not improved in 1993.

The baseline trends of academic results in standard two were positive for all subjects and this positive trend was maintained in 1993. However, the difference between 1992 and 1993 was closer to significance than between 1991 and 1992. It can therefore be said that there was a slight improvement in 1993.

The trends of academic results in standard three were again positive, but it appears that the MMA methods only maintained as opposed to improving the natural trend.

In standard four, the positive trend in English was maintained in 1993. For Afrikaans the negative trend was reversed but not significantly. In Maths and cultural subjects the positive trend became non-significantly negative in 1993.

In standard five the negative trend in English was reversed in 1993, but not significantly. In Afrikaans and cultural subjects the positive trend became significantly negative in 1993. In Maths the positive trend became negative, but not significantly.

In summary, it can be seen that in grade one, grade two and standard one all the subjects showed positive trends that were improved significantly for all subjects - except for Afrikaans in grade one and two and Maths in standard one, where the positive trends were maintained. This confirms the results of the previous sections, which showed that the pupils in phase one consistently responded the best to the MMA methods.

The standard two and three the trends of the academic results were maintained for all subjects in 1993. However, in standards four and five, the trends worsened for all subjects except English, and Afrikaans in standard four. Therefore the subject of English consistently demonstrates the most favourable response to the MMA methods, and the subject of Afrikaans the least favourable.

5.3.4. GENERAL CONCLUSIONS REGARDING THE RESPONSE OF THE PUPILS

In evaluating the response of the pupils to the exposure to the MMA methods by the teachers and therapists, trends were initially identified and then compared to the performance in the experimental year. The overall result indicates a positive change in the pupils' performance, that is, the academic results improved in a statistically significant way in the experimental year with the introduction of the MMA methods.

The trends identified were the overall trend for the pupils of three learning disabled primary schools; the trend per phase; the trend per standard and the trend per subject. The overall trend for the pupils of three learning disabled primary schools was found to be positive implying that in general, the pupils' proficiency improves as they move through the standards. The introduction of the MMA methods resulted in a significant positive alteration of this trend implying that the positive trend can be enhanced.

Regarding the trend per phase, phase one and two had significant positive trends but phase three's trend was non-significantly positive. Phase one experienced a significant positive change in 1993, phase two's trend was maintained but not changed in 1993, and phase three's trend became significantly negative. Therefore, the academic results in phase one improved the most in response to the MMA methods, and phase three's academic results actually deteriorated.

Regarding the standards, grades one and two and standards one and three had positive trends that were significantly altered in 1993 in a positive way. Standard two had a positive trend that was maintained in 1993, and standard five had a positive trend which was significantly altered in a negative way in 1993.

All the general trends for the subjects were positive except for the subject of English in phase three which was negative. Examination of the trends of each subject per standard reveals a more realistic idea of the trends. All the subjects in grade's one, two and standards one had positive trends that were significantly altered in a positive way; the positive trends for standards two and three were maintained; the positive trends were altered negatively in standards four and five. This reflects the same patterns identified in the phase analyses.

The MMA methods appeared to influence the academic proficiency in the subject of English the most, but had the least effect on the subject of Afrikaans. Cultural subjects and the subject of Maths followed in second and third place respectively.

The results discussed above are based on the results obtained from dataset three which was a combination of datasets one and two, but with the dependency factor accounted for. However, a brief evaluation of the results of datasets one and two appears to confirm the findings of dataset three, and thus strengthen the conclusions reached. The ensuing paragraph provides a brief analysis of the results of dataset one and two.

It was realised that the general results of dataset one, which, as discussed earlier, were not accurate due to the dependency factor not being accounted for, would result in too many false positives. Evaluated in this light, however, the results confirm the findings for dataset three, in that they appear to reflect the same patterns, but are slightly more positive, as expected. The general results of dataset two, the longitudinal historical trend where the weighting was inaccurate, tend to indicate that the overall trend for learning disabled primary schools is negative. As an overall result, however, this is not accurate as 57% of this dataset were the results of pupils in phase three, which as seen above did experience negative effects. These negative effects outweighed the positive effects in the other phases. However, the phase analyses of this dataset appear to confirm that phase one responded the most effectively to the introduction of the MMA methods, and phase three the worst, and that phase two did not alter much, which results are consistent with dataset three.

It therefore appears that, overall, the MMA methods positively influenced the academic proficiency of pupils in a learning disabled primary school acting as subjects. This influence seems to be greater with younger pupils.

5.4. CONCLUSION

In synthesising and discussing the results of the current study, certain conclusions were reached: Firstly, it was found that the teachers' and therapists' knowledge, attitude and skills regarding the geodesic principles of the MMA did improve, but not to the extent predicted. It was felt that this was due to a "maintenance" effect resulting in the conditioning of attitudes towards

learning. Secondly, the biographical variables of age, language and qualifications had a definite influence on the change experienced by the teachers and therapists. It was found that the younger age group, the English-speaking group and the other "professional" group experienced the most significant positive changes. Thirdly, a significant improvement in the academic results of the pupils was demonstrated after their exposure to the MMA methods, but also not to the extent predicted. Finally the MMA methods appeared to have the greatest effect on the subject of English.

5.5. SUMMARY

In this chapter, the results of the empirical study are presented. The results are organised into firstly, the responses of the teachers and therapists to the MMA geodesic methods, and then the responses of the pupils to the MMA methods introduced by the teachers and therapists subsequent to the training. The quantitative and qualitative analyses of the results are presented according to the aims of the study. The results form the basis upon which the interpretations and conclusions of the research are formulated in Chapter Six.

IF WE LEARNED TO USE OUR BRAIN
THE WAY IT WAS NATURALLY DESIGNED TO WORK,
WE WOULD ASTONISH OURSELVES EVERYDAY.

Jensen, 1995