Differential diagnosis of psycholinguistic disabilities of poor readers and some remedial procedures

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DIFFERENTIAL DIAGNOSIS OF PSYCHOLINGUISTIC DISABILITIES OF POOR READERS AND SOME REMEDIAL PROCEDURES.

BY

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J.G.N.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>SECTION</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>1-12</td>
</tr>
<tr>
<td>II</td>
<td>13-20</td>
</tr>
<tr>
<td>III</td>
<td>21-23</td>
</tr>
<tr>
<td>IV</td>
<td>24-39</td>
</tr>
<tr>
<td>V</td>
<td>40-62</td>
</tr>
<tr>
<td>VI</td>
<td>63-81</td>
</tr>
<tr>
<td>VII</td>
<td>82-125</td>
</tr>
<tr>
<td>VIII</td>
<td>126-165</td>
</tr>
<tr>
<td>IX</td>
<td>166-168</td>
</tr>
<tr>
<td>X</td>
<td>169-175</td>
</tr>
<tr>
<td>XI</td>
<td>176-192</td>
</tr>
<tr>
<td>XII</td>
<td>193-194</td>
</tr>
<tr>
<td>XIII</td>
<td>195-195</td>
</tr>
<tr>
<td>XIV</td>
<td>196-207</td>
</tr>
<tr>
<td>XV</td>
<td>208-213</td>
</tr>
</tbody>
</table>
SECTION VII

Statement of Results - Part II of the Study

Introduction ............................................... 214 - 215
(ii) Results of Statistical Analyses ..................... 215 - 237
(iii) Examination of Inter- and Intraindividual Differences for Experimental Group .................. 238 - 273
(iii) Effects of Remedial Work on Psycholinguistic Abilities, Reading Skills and Non-Verbal Intelligence 273 - 276

SECTION VIII

Interpretation and Discussion of Results - Part II
Comparison of the Input from the Kirk and Peabody Programmes 278 - 284
Comparison of the Effectiveness of the Kirk and Peabody Programmes ......................................... 284 - 294
Comparison of Children on Language Programmes with Controls 294 - 298
Effectiveness of Remedial Teaching ................................. 298 - 308
The Effects of Remedial Work on Psycholinguistic Abilities, Reading Skills and Non-Verbal Intelligence 309 - 320
Evaluation of the ITPA ..................................... 320 - 323
Limitation of the Research ................................. 323 - 327

SECTION IX

Summary of Conclusions ..................................... 328 - 332

SECTION X

Appendices
Appendix A - Analysis of Variance Data Sheets .............. 334 - 404
Appendix B - Rationale of PLDK .................................. 405 - 408
Appendix C - Rationale of ITPA .................................. 409 - 431
Appendix D - Score Data on Criterion Tests ................. 432 - 441
Appendix E - Nature of Input from Kirk and Peabody Programmes .................................... 442 - 446
Appendix F - Attendance Records of Experimental Group ...... 447 - 450

SECTION XI

Bibliography ............................................... 451 - 473
<table>
<thead>
<tr>
<th>TABLE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Performance patterns on the ITPA</td>
</tr>
<tr>
<td>2</td>
<td>Results of studies investigating the diagnostic value of the ITPA for reading</td>
</tr>
<tr>
<td>3</td>
<td>Results of studies which attempted to train psycholinguistic processes</td>
</tr>
<tr>
<td>4</td>
<td>The percentage of analyses, by subgroup, which found psycholinguistic training to be successful</td>
</tr>
<tr>
<td>5</td>
<td>Comparisons of means and standard deviations of PLAs on ITPA subtests for the normative and experimental groups</td>
</tr>
<tr>
<td>6</td>
<td>Comparison of ITPA mean scaled scores between experimental and normative groups</td>
</tr>
<tr>
<td>7</td>
<td>ITPA scaled score comparisons between normative and experimental groups across three studies</td>
</tr>
<tr>
<td>8</td>
<td>Mean scaled scores on ITPA subtests for experimental group</td>
</tr>
<tr>
<td>9</td>
<td>ITPA subtest mean scaled scores and deviation scores for children in schools B1 and B2</td>
</tr>
<tr>
<td>10</td>
<td>ITPA subtest mean scaled scores and deviation scores for children in schools B3 and B4</td>
</tr>
<tr>
<td>11</td>
<td>Patterns of psycholinguistic disabilities exhibited by the experimental group</td>
</tr>
<tr>
<td>12</td>
<td>Patterns of psycholinguistic abilities exhibited by the experimental group</td>
</tr>
<tr>
<td>13</td>
<td>Comparison of pre-test and post-test scaled scores on ITPA and other criterion tests obtained by Kirk Group</td>
</tr>
<tr>
<td>14</td>
<td>Mean language age gains on ITPA subtests by Kirk Group</td>
</tr>
<tr>
<td>15</td>
<td>Comparison of ITPA subtest mean scaled scores with composite mean scaled score, obtained on final test by the Kirk Group</td>
</tr>
<tr>
<td>16</td>
<td>Comparison of ITPA subtest final language ages of the Kirk and normative groups</td>
</tr>
<tr>
<td>17</td>
<td>Comparison of pre-test and post-test scaled scores on ITPA and other criterion tests obtained by Peabody Group</td>
</tr>
<tr>
<td>18</td>
<td>Mean language age gains on ITPA subtests by Peabody Group</td>
</tr>
<tr>
<td>19</td>
<td>Comparison of ITPA subtest mean scaled scores with composite mean scaled score, obtained on final test by the Peabody Group</td>
</tr>
<tr>
<td>TABLE</td>
<td>PAGE</td>
</tr>
<tr>
<td>-------</td>
<td>------</td>
</tr>
<tr>
<td>20 -</td>
<td>Comparison of ITPA subtest final language ages of the Peabody and normative groups</td>
</tr>
<tr>
<td>21 -</td>
<td>Comparison of pre-test and post-test scaled scores on ITPA and other criterion tests by the Control Group</td>
</tr>
<tr>
<td>22 -</td>
<td>Mean language age gains on ITPA subtests by Control Group</td>
</tr>
<tr>
<td>23 -</td>
<td>Comparison of ITPA subtest mean scaled scores with composite mean scaled score, obtained on final test by the Control Group</td>
</tr>
<tr>
<td>24 -</td>
<td>Comparison of ITPA subtest final language ages of the Control and normative groups</td>
</tr>
<tr>
<td>25 -</td>
<td>Reading ages and non-verbal IQ on three occasions for the three experimental groups</td>
</tr>
<tr>
<td>26 -</td>
<td>Comparison of gains made by the Kirk, Peabody and Control Groups</td>
</tr>
<tr>
<td>27 -</td>
<td>Comparison of final language ages achieved by Kirk, Peabody, and Control Groups with those of the normative group</td>
</tr>
<tr>
<td>28 -</td>
<td>Distribution of sexes within the treatment groups</td>
</tr>
<tr>
<td>29 -</td>
<td>Activities incorporated in the Visual Sequential Memory Programme</td>
</tr>
<tr>
<td>30 -</td>
<td>Activities incorporated in the Auditory Closure Programme</td>
</tr>
<tr>
<td>31 -</td>
<td>Kirk Programmes - Classification of activities under four dimensions</td>
</tr>
<tr>
<td>32 -</td>
<td>Peabody Programmes - Classification of activities under four dimensions</td>
</tr>
<tr>
<td>33 -</td>
<td>Classification of Peabody activities according to ITPA subtests which are sampled</td>
</tr>
<tr>
<td>34 -</td>
<td>Attendance record of Kirk Group during treatment</td>
</tr>
<tr>
<td>35 -</td>
<td>Attendance record of Peabody Group during treatment</td>
</tr>
<tr>
<td>36 -</td>
<td>Attendance record of Control Group during treatment</td>
</tr>
<tr>
<td>37 -</td>
<td>Comparison of the attendances of the children in the three treatment groups</td>
</tr>
</tbody>
</table>
LIST OF FIGURES

Profile of scaled scores for two experimental sub-groups ........ 184

Comparison of profiles for three experimental groups drawn from the same population and investigated in 1972, 1973 & 1980. 189

Profile of scaled scores for children on Kirk Programmes on three occasions ........................................ 247

Profile of scaled scores for children on Peabody Programmes on three occasions ........................................ 260

Profile of scaled scores for children on Control Programmes on three occasions ........................................ 271

ITPA profiles showing mean scaled scores for the experimental groups at the beginning of the experiment ............ 290

ITPA profiles showing mean scaled scores for the experimental groups at the end of the experiment .................. 291

Experimental group mean scaled scores taken on three occasions .......... 307
ABSTRACT

The aims of the study were (a) to investigate the use of the Illinois Test of Psycholinguistic Abilities in the diagnosis of psycholinguistic deficit in first year junior schoolchildren having reading difficulties, and (b) to examine the effects of three educational programmes on the modification of the children's psycholinguistic abilities and reading attainments. From a population of over 1,000 children considered to be at educational risk because of poor reading attainment, a sample of 60 children was identified from four junior schools (i.e. 15 children in each school), selected at random from those schools having a high incidence of poor readers. The 60 children were tested on the ITPA, after which their scores were subjected to a profile analysis. This revealed marked deficits in the areas of Auditory Closure and Visual Sequential Memory. Three intervention programmes were constructed. The first was designed to ameliorate the specific disabilities in the two areas specified above. The second was a diffuse approach to language development which stressed the general training of oral language and verbal intelligence rather than specific training in psycholinguistic processes. A third group of children acting as a control group received a number programme. The children were retested on the ITPA and on various measures of reading attainment at the end of a twelve week treatment period and again ten months later. At the end of the experiment both groups receiving language training obtained higher composite psycholinguistic ages on the ITPA than the control group, but the pattern of psycholinguistic deficits was modified only in the group receiving specific training. Both language groups scored significantly higher than the control group on the tests of reading attainment. The results are interpreted as giving qualified support for the use of the ITPA as a test of differential diagnosis and in providing suggestions for remedial programmes.
OUTLINE OF THE RESEARCH
Outline of The Research

The research was designed with the following aims in mind:

1. To utilize the ITPA as a test of differential diagnosis to determine the psycholinguistic characteristics of a group of Junior school children, aged 7 – 8 years old, deemed to be at educational risk because of reading failure.

2. To construct remedial programmes, as advocated by Kirk and Kirk (1971), to alleviate any specific disability or disabilities in psycholinguistic functioning revealed in (1) above. These programmes to be designated, "Kirk" Programmes.

3. To construct remedial programmes drawn from a representative sample of activities from the Peabody Language Development Kits (Manual - Level II), the primary aim of the programmes being to stimulate oral language development and verbal intelligence, rather than the training of isolated processes. These programmes to be designated, "Peabody" Programmes.

4. To conduct a methodological experiment to investigate the effectiveness of the above two programmes on the alleviation of psycholinguistic disabilities, (a) in the short term, and (b) in the long term.

5. To determine the effects of the remedial work on psycholinguistic abilities, non-verbal intelligence, and on related aspects of language such as articulation and reading skills.
The Sample

Sixty children, aged 7-8 years old, were involved in the study. These children were attending four Junior Schools B1, B2, B3 and B4 (i.e. 15 children in each school), and were considered to be at educational risk because of poor reading attainment.

The mean IQ of the children, as measured on the Raven's Matrices Test, was found to be 97.3, SD = 9.45, and their mean RA was 4.5 years on the Burt-Vernon Reading Test.

Method

The research programme was divided into three stages:

Stage I (Occasion C1)

This section of the programme was completed in two parts as follows:

Part I

This section of the research was completed during the period September 1975 - December 1975. It involved testing the children as follows:

(i) Group testing of half the sample of poor readers (N = 30), in two schools B1 and B2, on the Young's Group Reading Test.

(ii) Individual testing of children (N = 30, oldest children tested first) on, the revised Illinois Test of Psycholinguistic Ability, Raven's Coloured Progressive Matrices, and Burt-Vernon Reading Test.
The results obtained from the above testing programme were then subjected to an analysis in order to determine whether there were any discrepancies in psycholinguistic functioning. After an examination of deviation scores it was found that a substantial disability existed in Auditory Closure ($p < .01$) and a borderline disability in the Visual Sequential Memory ($p < .01$). Remedial Programmes were therefore constructed as follows:

Programmes A1 (Kirk)

These were constructed by the writer and were designed to ameliorate the specific deficits in Auditory Closure and Visual Sequential Memory. They were designated 'Kirk' Programmes because they follow the training of isolated processes as advocated by Kirk and Kirk (1971).

Programmes A2 (Peabody)

These were constructed by taking a representative sample of activities from the Peabody Language Development Kits (PDLK). The PDLK contrasts with the Kirk approach, because it is a global approach to remediation, whose primary aim is to stimulate oral language development.

Programmes A3 (Controls)

This was a Number Programme consisting of very simple exercises, whose aim was to offset the Hawthorne effect.
Part II

This part of the research was completed during the period September 1976-December 1976. It was a repeat of the activities outlined in Part I above, involving the second sub-group of poor readers \((N = 30)\) attending schools B3 and B4. At the end of the testing programme the subtest deficits of the second experimental sub-group was identical with that exhibited by the first experimental sub-group. Once again, the analyses indicated that the basic disabilities in the psycholinguistic growth of the poor readers were in the areas of Auditory Closure, and Visual Sequential Memory. No revision of the remedial programmes described in Part I above was, therefore, necessary.

Stage II (Occasion C2)

This section of the research was carried out during the period January 1976-July 1977.

(1) Taking the 15 poor readers in each of the four schools B1, B2, B3 and B4, they were randomly assigned to programmes as shown in the matrix below:

<table>
<thead>
<tr>
<th>Programme A1</th>
<th>School B1</th>
<th>School B2</th>
<th>School B3</th>
<th>School B4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Programme A2</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Programme A3</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>
(ii) Remedial teaching commenced in schools B1 and B2 in January 1976 and continued until July 1976. Children on each programme received 2 x 45 minute sessions of remedial teaching per week. The remedial sessions were supervised by a teacher from within each school.

(iii) Remedial teaching sessions in Schools B3 and B4 began in January 1977 and continued until July 1977. The organization and supervision of the remedial programmes was a repeat of the procedure as in (ii) above.

(iv) At the end of the remedial teaching programme in (ii) and (iii) above, all the children were retested for the second occasion (C2) on all the criterion tests.

Stage III (Occasion C3)

Ten months after the cessation of remedial teaching the children were retested for the third occasion on all the criterion tests. This testing on the third occasion was in two parts:

(i) The final testing of 30 children in schools B1 and B2 was begun in January 1977.

(ii) The final testing of 30 children in schools B3 and B4 was begun in January 1978.
Statistical Treatment of Results

These were analysed using an Anova design as follows:

(i) Three way analysis of variance
Programmes A (3) x Schools B (4) x Occasions C (3)

(ii) All significant main order effects found above were then subjected to a breakdown analysis, in order to detect differences among the respective group means.

The following 24 analyses were carried out:

(i) 12 ITPA subtests, Mean Scaled Score, Composite PLA

(ii) Automatic and Representational Level of ITPA; Auditory-Vocal and Visual-Motor Channels; Reception, Association, and Expression Processes.

(iii) Burt-Vernon Reading Test, Young's Group Reading Test, Raven's Matrices Test.

Empirical Findings

A. Comparison of Kirk and Peabody Programmes

1. Children exposed to Kirk Programmes performed significantly better than children exposed to Peabody Programmes in respect of:

   (a) Grammatic Closure (p<.05), and Burt-Vernon Reading Test (p<.05). These findings being independent of schools and occasions.

   (b) Visual Sequential Memory (p<.05), Auditory Closure (p<.01), Automatic Level of ITPA (p<.01), Auditory-Vocal Channel (p<.01), and Young's Group Reading Test (p<.05).
The above effects whilst independent of schools, were not independent of occasions. An examination of the significant programmes x occasions interaction showed that they were only valid over occasions C1 - C2 (i.e. gains as a result of remediation).

2. No significant differences were found between the performance of the two groups in respect of:


B. Comparison of Kirk and Peabody Programmes combined (i.e. Language Programmes) with Control Group

1. Children on the Language Programmes performed significantly better than the Control Group in respect of:

(a) Visual Sequential Memory (p<.05).

This finding being independent of schools and occasions.

(b) Auditory Reception (p<.01), Visual Reception (p<.05)

Auditory Association (p<.01), Visual Association (p<.01), Verbal Expression (p<.01), Grammatic Closure (p<.01),

Visual Closure (p<.05), Auditory Closure (p<.01),
Composite PLA ($p<.01$), Mean Scaled Score ($p<.01$),
Automatic Level ($p<.01$), Representational Level ($p<.01$),
Reception Process ($p<.01$), Association Process ($p=.01$),
Expression Process ($p<.01$), Auditory-Vocal Channel ($p<.01$),
Visual-Motor Channel ($p<.01$), Burt-Vernon Reading Test ($p<.01$),
and Young's Group Reading Test ($p<.01$).

The above effects, whilst independent of schools, were not independent of occasions. An examination of the Programmes x Occasion interaction showed that they were only valid over occasions C1 - C2 (i.e. gains as a result of remediation); the differences between C2 - C3 (post-remedial period) were clearly not significant.

2. No significant differences were recorded between the performance of the two groups on the following:

C. Effectiveness of Remedial Teaching

(i) Comparison of Post-Test Means combined with Pre-Test Means

The findings comparing post-test means for occasions C2 and C3 combined with pre-test means for occasion C1 were as follows:

1. Post-test means combined were significantly greater than pre-test means in respect of:
(a) Auditory Sequential Memory (p<.01), Sound Blending (p<.01), and Raven's Matrices (p<.05).

The above effects were independent of schools and programmes.

(b) Auditory Association (p<.01), Verbal Expression (p<.01), Visual Closure (p<.01), Visual Sequential Memory (p<.01), Auditory Closure (p<.01), Composite PLA (p<.01), Mean Scaled Score (p<.05), Automatic Level (p<.01), Association Process (p<.01), Expression Process (p<.01), Auditory-Vocal Channel (p<.01), Visual-Motor Channel (p<.01), Burt-Vernon Reading Test (p<.01), and Young's Group Reading Test (p<.01).

The significant effects on (b) above, though independent of schools, were not independent of programmes as a significant programmes x occasions interaction occurred for all. On examination of this interaction it was shown that:

(i) Significant differences between post-test and pre-test means, were valid for the Kirk Group on all subtests in (b) above

(ii) Significant differences, between post test and pre-test means were valid for the Peabody Group on all the above subtests on (b) above, excepting Visual Sequential Memory, Auditory Closure, and the Automatic Level.

(iii) The differences between post-test and pre-test means for the Control Group did not reach significance on any of the subtests in (b) above and regressions were recorded in 11 instances.
2. No significant differences between post-test means combined and pre-test means were found in respect of:

(ii) Examination of Post-Remedial Progress

This was investigated by comparing the final post-test means (occasion C3) with those at the end of remediation (occasion C2). The findings relating to the post-remedial period (approximately 10 months after remediation ended) were as follows:

1. Post remedial gains were significant in respect of:
   (a) Composite PLA (p<.01), and Burt-Vernon Reading Test (p<.01).
       These findings being independent of schools and programmes.

   (b) Young's Group Reading Test (p<.01).
       The above effect was independent of schools but not of Programmes. An examination of the programmes x occasions interaction showed that it was only valid for the Kirk and Peabody Programmes.

2. Post-remedial regressions in mean score were significant in respect of:
   (a) Auditory Association (p<.05), Verbal Expression (p<.05), Association Process (p<.01), Expression Process (p<.05), and the Auditory-Vocal Channel (p<.01).
       These findings being independent of schools and programmes.
(b) Grammatic Closure \((p<.05)\)

The above effect was independent of schools but not of programmes. An examination of the programmes \(\times\) occasions interaction showed that it was only valid for the Control Programme.

3. There were no significant post-remedial differences recorded on any of the remaining criterion tests.

D. Comparison of Performance in the four schools

The findings comparing the performance of the children in the four schools B1, B2, B3 and B4 are set out below:

1. The performance of the children in the four schools differed significantly in respect of:
   - Auditory Association \((p<.05)\),
   - Visual Association \((p<.05)\),
   - Composite PLA \((p<.05)\).

   The above findings were independent of programmes and occasions.

2. No significant differences between the performance of the children in the four schools were found for any of the remaining twenty-one criterion tests.

3. No significant lower-order interactions (i.e. \(A \times B\), \(B \times C\)) were found on any of the criterion tests.
Conclusions

Some of the main conclusions are summarised briefly below:

1. The study provided considerable support for the diagnostic validity of the ITPA. In particular Auditory Closure and Visual Sequential Memory appear to have diagnostic validity for reading.

2. It was concluded that the Kirk Method was superior to the Peabody Method, both in ameliorating psycholinguistic disabilities and promoting superior language performance. However, because of the complex nature of the Kirk schedule, which integrated both process and task training in the same remedial procedure it was difficult to evaluate the outcomes of the Kirk approach. The superior treatment effects could not be attributed to the training of isolated processes and no definitive conclusions could be drawn.

3. The clear superiority of the children receiving language training, over the untrained Control subjects, was considered experimental verification for the effectiveness of psycholinguistic training procedures.

4. The results of the study were largely independent of schools. For each experimental group, the trend of results across the schools was extremely similar over the experiment.
STATEMENT OF THE PROBLEM
The Problem

(1) The Scope of Children's Reading Difficulties

It is widely recognized that a large number of children experience difficulty in acquiring satisfactory reading skills. Estimates of the proportion of normal children who encounter reading difficulties vary from as low as 5 per cent to as high as 25 per cent. This disagreement in estimates appears to arise from differences in the criteria used to define a reading problem (Moseley, 1975). These children have reading problems ranging from mild to severe and present a challenge to teachers involved in the remedial teaching of reading. Whilst some reading problems are undoubtedly caused by poor teaching methods, innate dullness, sensory defects, or excessive absences of the child from school, most reading problems defy such simple diagnoses and are enigmas to teachers and parents alike. Various studies have shown that reading is the most frequent cause of school failure. In particular failures at the Junior stage are almost wholly due to reading difficulties. This has resulted in a number of surveys being carried out to assess the magnitude of reading difficulties in schools (Morris, 1953, 1966; Clarke, 1970; Start and Wells, 1972).

In 1953 Morris carried out her classic survey of reading standards in Kent. This survey of 3,000 children in their first year of junior school found that 19.2 per cent of such children could scarcely read at all and that 45 per cent of the sample needed the kind of teaching associated with the infant school. In her view these children would be unable to employ reading as a useful tool.

In a following study Morris (1966) selected ten schools for intensive study and makes some comments on the reading standards of
second year juniors. She notes that only 9 per cent of these children were reading books of a standard commensurate with or above their chronological ages. Twenty-five per cent of the children were retarded by one year and 16 per cent were having serious difficulties, being still at the infant primary stage of reading after two years in junior classes.

A later study by Clarke (1970) suggests that the above evidence reflects a national trend. Her investigation involved 1,544 children comprising the whole of the 7 year age group in the county of Dunbarton. Clarke reported that even though these children had been taught to read for two years, 14.9 per cent had reading quotients below 85.

A more recent N.F.E.R. survey into the trend of reading standards in England, concluded that reading standards today are no better than they were a decade ago (Start and Wells, 1972).

The above findings are of critical importance for as Southgate (1971) has pointed out, after the age of eight reading rarely appears as a regular subject in the timetable for all pupils. The Bullock Committee of Enquiry into Reading also usefully comments on this point in their conclusions concerning children with reading difficulties.

"Delay beyond the age of seven in beginning to read puts a child at educational risk. There is evidence to show that many children who have made little progress in reading on entering the junior school are even further behind at eleven and that this deficiency continues to the end of their statutory school life."

(D.E.S., 1975, p 539.)

That this problem is not confined to this country alone is evident from studies carried out in America and elsewhere. Attempts made recently, by Downing (1973), to compare reading standards objectively between the developed nations, have shown that the
differences among the developed countries are of rather modest dimension. In the United States the "Right to Read" has become a national goal for the 1970's, replacing the moon landings as the focus of a monstrous national effort. This organized effort has been initiated because it has been estimated that one in four American pupils have significant reading difficulties and that over 18 million people in the United States are unable to read effectively. It is hoped that by 1980, 99 per cent of all Americans under sixteen years of age and 90 per cent over sixteen, would achieve functional literacy.

Fundamental to this problem is our lack of knowledge about the causal factors of reading disability. We know a great deal about the conditions associated with backwardness of children, but we do not know which of these conditions play the greatest part in affecting progress in any particular academic field, nor to what extent they vary in any individual case; nor do we know, in relating reading disability to one of these conditions, which is the cause or which is the effect. The vast literature on reading indicates that there is no single cause or simple explanation of reading disability. Indeed, no theory lends itself as a basis for all cases, and no remedial programme works infallibly or with economy in all cases.

(ii) The Development of Diagnostic Psychological Tests

Since the beginning of the century psychologists have been engaged in developing psychometric instruments to assess intelligence, interests, personality and achievement. A noteworthy development was the creation of the intelligence scale early in the century by Binet and Simon. The Binet-Simon scales were later adapted and restandardized on
an American population by Terman in 1916 (Terman, 1916) and with its later revisions (1937, 1960) became the major instrument for psychological evaluation. The central concept underlying the construction of the early scales in the United States was that intelligence was unidimensional, fixed by inheritance and unmodifiable by experience. This unitary characteristic was reflected in global scores expressed in the form of an MA, IQ, or percentile rank indicating general intellectual functioning. The fixed nature of intelligence was reflected in the assumption of the constancy of the IQ. Such psychometric instruments are linked with the concept of inter-individual variability. Our current normative psychometric and attainment tests are used, primarily, to classify children into gross categories for placement purposes. Whilst they are useful to schools and administrators in the grouping of children according to the level of intellectual development and educational achievement, they provide little information in terms of instructional programmes.

Factor analytic studies by Thurstone (1938) and Guilford (1956), however, have expanded the definition of intelligence to include different psychological processes operating on different contents and yielding different products. This has given rise to the feeling that the classification and placement of children in nominal categories is of limited value. This has led to the development of tests for specific functions that give clues to remediation. This is linked with the concept of intra-individual differences which directs attention not only to the comparison of one child with another, but to differences of ability within a single child. In other words the concept of intra-individual differences led logically to psychometric tests that could measure a number of specific and discrete areas of psychoeducational development. These areas could then be compared to
determine discrepancies in growth and developmental imbalances within the child himself. In this way the deficient areas needing remediation could be identified. The Illinois Test of Psycholinguistic Abilities, among others, represents an effort along these lines. Kirk and McCarthy (1961, 1968) used the model of communication processes proposed by Osgood (1957), to devise a diagnostic test battery, the ITPA, the purpose of which is to delineate specific intra-individual abilities and disabilities within the field of communication enabling one to plan and implement remediation. As the ITPA is predicated upon communication theory it will be used in this investigation for studying reading.

(iii) The Remediation of Learning Disabilities

The view has been put forward by Jensen (1970) that the new hope for educational psychology is the possibility of capitalizing on the interaction of abilities and methods of instruction. If the aim of the remedial teacher, in the field of reading, is to help the child to improve his reading attainment, it may well be that different pupils make this intellectual journey most efficiently by taking quite different instructional routes. Taking the same route might lead to greater differences in progress among pupils and even to inordinate frustration and final defeat for some. Reading methodology in general and the remedial teaching of reading in particular would appear important sources of hypotheses concerning aptitude x instruction interactions.

Although reading disability has been the subject of much research, a comprehensive theory has not appeared in the literature. There are (1) those researchers, primarily neurologists and physiologists, who seek to link inability to read with a primary cause, such as
specific brain dysfunction; (2) those who view reading disability from the comfortable position of multifactored causation; and (3) those who minimize causation and seek to discover psychological correlates of reading disability. The investigator has chosen to follow the latter alternative.

Prognosis for children with reading problems varies with the particular theory and many controversies have arisen. Pertinent to this study is whether it is more beneficial to utilize a child's assets in psycholinguistic development or train his deficits; or whether to use a multisensory stimulation strategy in contrast to a unisensory presentation.

The Peabody Language Development Kit (Dunn and Smith, 1965) draws on Osgood's linguistic theory, which also formed the base for the ITPA. The PLDK adopts a multisensory approach and stresses the training of global oral language and verbal intelligence, rather than specific training in psycholinguistic processes. Emphasized is: (1) reception, (2) expression, and especially (3) conceptualization (Manual - Level 1, p VIII).

Kirk and Kirk, however, favour a unisensory approach and recommend the training of isolated processes. They recognise that a child's psycholinguistic strengths have an important function in the process of remediation of deficits, but they emphasize the remediation of specific deficits first:

"Compensating for disabilities by utilizing assets has definite advantages. By bypassing activities in which the child does poorly and providing activities in which he does well, the child's discrepancies between abilities become exaggerated. Weak areas remain weak while strong areas become stronger.... Remedial programmes aim, therefore, to stimulate the functioning of those abilities in which the child is below par."

Thus the effects of using the Kirk and Kirk approach to the alleviation of psycholinguistic deficit and the improvement of reading attainments may be compared with those of the PLDK, in groups from a specified population under prescribed conditions, in search for significant interactions between patterns of psycholinguistic abilities and teaching programmes in the modification of children's skills.

The Aims of the Study

The purpose of this study was to explore some of the issues raised in the discussion above. More specifically the following problems were considered in the investigation:

1. To utilize the ITPA as a test of differential diagnosis to determine the psycholinguistic characteristics of a group of junior school children, aged 7-8 years old, deemed to be at educational risk because of reading failure.

2. To construct remedial programmes, as advocated by Kirk and Kirk, to alleviate any specific disability or disabilities in psycholinguistic functioning revealed in (1) above. These programmes to be designated "Kirk" Programmes.

3. To construct remedial programmes drawn from a representative sample of activities from the Peabody Language Development Kits (Manual - Level II), the primary aim of the programmes being to stimulate oral language development and verbal intelligence, rather than the training of isolated processes. These programmes to be designated, "Peabody" Programmes.

4. To conduct a method's experiment to investigate the effectiveness of the above two programmes in the alleviation of psycholinguistic disabilities, (a) in the short term, and (b) in the long term.
5. To determine the effect of the remedial work on psycholinguistic abilities, non-verbal intelligence, and on related aspects of language such as articulation and reading skills.
REVIEW OF THE LITERATURE
Introduction

The main purpose of this study is to use the ITPA to assess the language abilities of children and implement instructional programmes on their behalf. In the following review, the literature pertinent to this study has been presented in five sections:

Section I - Major Psycholinguistic Theories

During recent years there has been a rapid growth in the study of psycholinguistics. As a relatively new discipline it combines ideas from the fields of psychology and linguistics. A number of models of language have been proposed from both the psychological and linguistic point of view. Much of the early input were attempts by behavioural psychologists, such as Skinner and Osgood, to incorporate language acquisition within the framework of S-R learning theory. These early theories were later refuted by Chomsky who offered an alternate model for language development in the form of transformational grammar. Whilst the ideas of Chomsky and his associates have had more impact on psycholinguistics, their concepts have not been represented to a significant degree in educational programming. On the other hand, although the language models of Skinner and Osgood are not given as much credibility within the discipline of psycholinguistics, their formulations have attracted considerable attention amongst educators. Osgood's theory of communication has had a considerable impact on schools and clinics because of its clinical applicability for diagnostic purposes. Thus, Osgood's concepts constitute the foundation of the
ITPA and also provide the basis for instructional programmes such as the Peabody Language Development Kits. The main purpose of the review will be to present some of the major psycholinguistic theories and to focus discussion on Osgood's Theoretical contributions.

Section II - Reading in a Language Context

The psycholinguistic nature of the reading process will be briefly discussed. As the children in the study have been drawn from E.P.A. schools, the relationship between unfavourable environmental conditions and language learning will then be discussed.

Section III - The Diagnostic Process

The problems of diagnosis arising from the complexity of the reading process will be put forward, and the principles underlying the diagnosis of reading difficulties will be outlined. The emphasis will then be directed towards instruments of differential diagnosis such as the ITPA, and Kirk's views on diagnosis will be presented.

Section IV - Interventions

In a field as complex as remedial education, there are many divergent points of view regarding pertinent issues and practices. In general, remedial intervention programmes can be broadly classified into two categories:

(a) Highly Specialised Methods of Remediation
(b) Global Methods of Training
Since children with learning disabilities generally exhibit a wide range of problems, many highly focussed remedial techniques have been developed each with its own parochial interest in some specific problem area. The highly specialised methods of Strauss, Kephart, Fernald, Myklebust, and Frostig have been briefly examined culminating in a detailed account of the 'Kirk' approach.

The second remedial strategy has been adopted by a prolific number of compensatory programmes recently tried out in America. Here the emphasis has been on the training of global oral language and verbal intelligence, rather than the specific training of selected deficits. Some of the more substantial intervention studies will be reviewed culminating in the Peabody Language Development Kits.

Section V - The ITPA in Current Research

As the revised ITPA is the main criterion measure used in this study, the related research studies have been assembled and presented together in one section. The review has been organised in two parts as below:

I  Statistical Characteristics of the ITPA
II  Educational Significance of the ITPA

In the first part the reliability and validity information of the revised ITPA will be reviewed.

Implicit in the ITPA rationale are the assumptions that language behaviour is composed of discrete components; the components are prerequisite for learning, and they are amenable to remedial training. This last assumption has precipitated considerable debate over the efficacy of process training, particularly the effectiveness of psycholinguistic training using the ITPA as criterion. These issues will be examined in the second part.
Section 1

Major Psycholinguistic Theories

Introduction

The study of psycholinguistics is a relatively new discipline. It was as recently as 1954 when C E Osgood, a psychologist, focused attention on the manner in which children learn language. He and Sebook edited a book, "Psycholinguistics: A Survey of Theory and Research Problems", which for all practical purposes gave birth to psycholinguistics as an independent discipline.

Psycholinguistics as its name implies is an interdisciplinary study that lies at the intersection of two broader disciplines, psychology and linguistics. Most of the contributions in the field of psycholinguistics have come from these two major sources: the schools of psychology and linguistics.

Linguistics in general is concerned with the abstract study of language. Such aspects of language as their sounds, syntax, and lexicon are analysed and compared. Linguistics examine similarities and differences among languages, and try to trace their evolutionary development. They are concerned with the nature of language as a system that is available to its users, rather than with the way in which language is acquired, produced, and comprehended by individuals.

Psychology, on the other hand, is concerned with the knowledge of mental processes which make learning possible. Cognitive psychologists focus on the manner in which humans acquire, interpret, organize, store, retrieve and use information. In psychological theory all variables which affect linguistic competence are important to the understanding of language development.
As psycholinguistics is interdisciplinary, differences in interpretation of theoretical issues have arisen, depending on whether one views issues from the psychological, or linguistic frame of reference.

During the early years of psycholinguistics most of the input was primarily psychological in emphasis, the concern being to explain language phenomena in a nonmentalistic stimulus—response framework. The publication of Skinner's, "Verbal Behaviour" in 1957, marked the first attempt of behaviourists to state the whole problem of human language. Skinner calls his behavioural analysis 'functional'. A functional analysis explains behaviour by specifying the conditions which are relevant to the occurrence of the behaviour. Skinner's system does not account for the contribution of the organism to verbal behaviour. His analysis avoids the use of such terms as 'ideas', 'meaning', 'images' and so on. Such terms are considered unscientific as they refer to interior states of the organism that are inaccessible to scientific observation. For Skinner, verbal behaviour is that behaviour we observe in everyday life. All the facts are known but they require ordering.

But another line of approach was proposed that was boldly mentalistic and which offered a degree of insight into the processes of speech and language substantially greater than any previously available to psychology. The major impetus for this cognitive approach to psycholinguistics came from the school of generative transformational linguistics associated primarily with the name of Noam Chomsky. Chomsky (1959) in a review of Skinner's book gave a number of compelling reasons why an associationistic viewpoint was inadequate to explain both the structure of language and its acquisition by children. In Chomsky's view children learned to talk because they were biologically prepared for it and linguistically preprogrammed to do so.
The atmosphere in the 1960s, then, was pervaded by the conflict between the more traditional behaviourist view that language is learned and shaped by forces in the environment, and those who held that language is innate and its acquisition is the product of maturation. The major issues and summaries of research in language acquisition are usefully reviewed by Lyons and Wales (1966), Brown (1973), Slobin (1971, 1974), Kess (1976), and Bloom and Lahey (1978), amongst others.

The purpose of this review is not to assess the many models that have been proposed to explain language acquisition, but to focus discussion on Osgood's theoretical position in the psycholinguistic field. However, Osgood's theory cannot be examined, meaningfully, in isolation, and to clarify the logic behind his point of view, a brief overview of other psycholinguistic theories is necessary. Insofar as Osgood's position represents an extension of Skinner's account of language behaviour, Skinner's theory is presented first. A brief synopsis of Chomsky's work will also be outlined, as his theoretical ideas are at variance with those of the S-R theorists, and he presents an alternative method of explaining language acquisition and development.

**Behaviourist Models**

In the late fifties and early sixties, there were several attempts to incorporate the major aspects of linguistic behaviour within a behaviourist framework. In applying the principles of behaviourist learning theory to language, some theorists argued that language learning occurs in the same way as other types of learning, i.e. from the formation of S-R associations. Words are used in sentences because they are conditioned responses. The application of behaviourist principles to language has been discussed by Dollard and Miller (1950), Skinner (1957, 1966, 1969), Mowrer (1960), Bandura and Walters (1963), and Staats (1971).
In his book *Verbal Behaviour* (1957), Skinner explains language development in terms of a selective reinforcement model. Since speech is a motor response, the learning model that seems most appropriate for explaining it is the operant conditioning paradigm. In the case of speech, the reinforcement is always social, i.e. it is provided by other persons in the individual's environment. Skinner outlines several ways in which a speech response may arise:

It may be heard as an 'echoic' response, that is, as an imitation of a heard stimulus which the parent may reward if it approximates to the stimulus. For example, an infant's "baba" may be close enough to "mama" to surprise and please his mother, and her excitement may be transmitted to the infant in the form of affectionate and spirited attention. This attention provides the reinforcement for the child.

Or it may be learned as a 'mand' - as a response which starts out as a random speech utterance, but which is adequate to cause the parent to provide a stimulus that happens to satisfy some need of the child. For example, the mother might take a random utterance of the child "milk" or something close enough to be understood as "milk", to make her think that the child is asking for (manding) "milk". Milk is then given to the child, thus satisfying the desire that (one may suppose) he happens to have for milk. In this way, it is argued, the child learns to be a 'demander', if he consistently gets what he asks for, i.e. if he is reinforced for demanding.

Still another way, in which a verbal response can be acquired, is as a 'tact'. A child who for any reason makes a particular verbal response in the presence of (in contact with) a given objective stimulus, and is rewarded in some way for doing so, may learn to make this response, or some variant of it, whenever he experiences the relevant stimulus.
In this way Skinner argues that a baby exposed to a wide range of human speech sounds, learns to associate recurring patterns with perceptual or other situations. Thus comprehension is classically conditioned by repeated associations and expression is acquired by operant conditioning. The probability of emitting a particular verbal response is dependent on the strength of the dependency relation between the response and the antecedent stimulus developed through differential reinforcements. For example, as the infant babbles, he sometimes makes noises that approximate adult vocalisations. These noise approximations are reinforcing to the infant and thus increase the probability of the motor responses that produced them. The more closely the infant vocalisation approximates the adult vocalisation the greater the probability of its recurrence (Jenkins and Palermo, 1964; Staats 1971; Braine, 1974). As he grows older the child's responses are 'shaped', i.e. closer and closer approximations to adult pronunciation and grammar are reinforced. Later, his speech is rewarded when the hearer complies with his requests, or comments on his statements, answers his questions, and so forth.

Skinner's analysis is basically an empirical functional approach and it has been criticised on the grounds of its narrowness. For Skinner the organism is hollow and his description of behaviour is always in terms of observable behavioural responses. Any theorising about internal mental or neurological processes is not embarked upon. Meaning is considered a mentalistic concept and, for this reason, his theory makes no reference to it. The fact that meaning, in Skinner's analysis, does not play the central role, which it plays in other theories, has been criticised by many.
Mediational Models

Skinner's obvious reluctance to deal with meaning or any other sort of intangible, but nevertheless necessary, mental construct in accounting for language, has led to the rejection of his model by many psychologists. Other behaviourists, have, however attempted to deal with the problem of meaning (Mowrer, 1960; Staats and Staats, 1963; Staats, 1968; Osgood, 1957, 1969).

Osgood was critical of Skinner's single stage S-R paradigm, which explains meaning as derived from simple conditioning - the direct pairing of word and object. According to this S-R view, the child acquires meaning when he properly associates the word and the object that the word signifies. Words in this way, become conditional stimuli. The chief pitfall of the behaviourist position, according to Osgood, is that words frequently elicit responses that vary considerably from those elicited by the objects themselves. Words cannot be assumed to be faithful copies of the physical objects to which they refer. Meaning does not adhere in the direct word-object relation, but is instead "imputed". Faced with such difficulties Osgood acknowledged the necessity of abandoning the simpler S-R account of language. In its place Osgood (1957, 1969) has developed a mediation hypothesis to explain language acquisition and meaning.

In contrast to the behaviourist theories of language, mediational models postulate a mediating step that intervenes between the stimulus the human organism is responding to and its response. Thus, a mediational theory of language behaviour would look for a stimulus-response sequence within the organism itself as a mediating stage between the external, observable stimulus and response. As such, the mediational approach is not entirely unlike the behaviouristic model; some have characterised
the former as a two-stage learning theory model and the latter as a one-stage learning model. Moreover, mediational theorists believe that some version of conditioning theory will prove adequate to explain the characteristic features of verbal behaviour, and in particular the referential functions of language.

**Osgood's Representational Mediation Hypothesis**

Osgood points out that there are at least as many meanings of 'meaning' as there are disciplines which deal with language, and of course, many more than this because the exponents within disciplines do not always agree with one another. Osgood draws on the views of Ogden and Richards (1923) presented in 'The Meaning of Meaning', and also the writings of Morris, particularly his 'Signs, Language and Behaviour' (1946), as a basis for his model. According to these writers psychologists are typically interested in semantical meaning - the relation of signs to their significates. This requires the psychologist to define the distinctive mediational process or state, which occurs in the organism, whenever a sign is received (decoded) or produced (encoded). Osgood illustrates the problem for the meaning theorist with the following self-evident fact:

"The pattern of stimulation which is the sign is never identical with the pattern of stimulation which is the significate."

(Osgood et al, 1964, p 3)

Thus the word "hammer" (sign) is not the same stimulus as the object hammer (significate). The former is a pattern of sound waves; the latter is a complex of visual, tactual and proprioceptive stimulations. Nevertheless the sign ("hammer") does come to elicit behaviours which are in some manner relevant to the significate (hammer), a capacity not shared by an infinite number of other stimulus patterns that are not signs of this object. Put in simplest terms the problem for the meaning theorist is to specify:
"Under what conditions does a stimulus which is not the significate become a sign of that significate?"
(Osgood et al, 1964, p 4)

Osgood points out that as signs almost never evoke the same overt responses as their significates, then single stage theories based on classical conditioning are clearly inadequate to explain meaning.

With the above in mind, Osgood put forward a two stage Representational Mediation Hypothesis to explain semantical meaning. This is essentially a S-rm-sm-R paradigm and is illustrated by reference to the figure below:

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S -- A --> RT
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Symbolic account of the development of sign processes.

Take for illustration the connotative meaning of the word snake. The stimulus-object (S), the visual pattern of the animal often encountered in a threat context, elicits a complex pattern of behaviour (RT), which would probably include a heavy loading of automatic fear-shuddering etc. Let us assume that the object snake (S) is presented in close association with the heard word, "snake" [snake], then part of this complex pattern of behaviour becomes conditioned to the heard word. On other occasions when the word "snake" is encountered it will now become a representative of the animal (primary stimulus) and will evoke a fraction of the original response, i.e. automatic fear, shuddering etc. Thus the mediating reaction (rm) produces a distinctive pattern of self stimulation (sm) which may elicit a variety of overt behaviours (Rx) - fear, shivering etc.
Thus, according to Osgood, a word elicits only a part of the response which the associated object elicits. This word response, the mediating reaction ($rm$) in turn produces a mediating stimulus ($sm$) that, in turn, may result in a variety of overt responses ($Rx$). It is the implicit ($rm-sm$) which constitutes the representational process and denotes what the stimulus means. The associations that a stimulus causes in the brain constitute its meaning and evoke cognitive operations, such as abstract reasoning and problem solving. Osgood refers to the symbolic or meaningful aspects of learning as the representational level of mental organization.

Although Osgood's conceptualization of the representational (symbolic) level of language is his key construct, two other levels of mental organization, the integrative level and the projective level, are included in his theory. The integrative level deals with the processing of nonmeaningful information. This level accounts for a lower form of language behaviour – the associations of response patterns with stimuli which require no thought and are automatic. Because overlearned response patterns are handled at this level it is called the automatic sequential level. Examples of this type of language integration might be a short-term sequential memory task such as repeating the alphabet, or a familiar poem or prayer. Osgood's third level of organization, the projective level, accounts for physiological or reflex behaviours which are of little importance in language acquisition. It is acknowledged in the model, however, because it has a very primary effect on learning. A schematic form of Osgood's model is shown overleaf.
Osgood's Model of Communication

Osgood's depiction of intervening variables permits him to delineate the processes involved in language behaviour as decoding or reception (the $S - r_m$ relationship), association (the $r_m - s_m$ relationship), and encoding or expression (the $s_m - R$ relationship). He believed these neural processes to be distinct constructs and hypothesized that language disability might relate to specific process deficiency. In this way, a child might be normal in his ability to receive and associate linguistic stimuli but be deficient in expressive ability (the $s_m - R$ relationship).

Because the model enables one to delineate the breakdown of mental processes, his theory became closely associated with clinical research into language disorders, in particular aphasia. Furthermore, in the mainstream of education, teachers and educational psychologists recognized that Osgood's model provided a new approach in studying the relationship between learning disabilities in children and specific areas of psychoeducational development. This was, in some way, due to
the fact that Kirk used a modification of Osgood's model to provide
the theoretical foundations for both the 1961 and 1968 versions of the
ITPA, one of the most popular psychometric instruments currently being
used in schools.

Critique of Behaviourist Models

The review has shown that within the behaviourist tradition
exponents have advanced different models to explain language behaviour.
These differ from the kind of theorizing, typified by Skinner, which
stress objectivity and view the organism as hollow, to mediational
theorists who have been willing to utilize intervening organismic
variables to explain observable S-R relations. There are, however, a
large number of critics who hold that the behaviourist theories present
an over-simplified view of language and are quite inadequate to deal
with the important problems of language and thought. The most
devastating criticisms have come from Chomsky (1959) presented in his
"Review of Skinner's Verbal Behaviour". His criticisms reiterate earlier
arguments from "Syntactic Structures" (1957).

Chomsky's chief objection to Skinner's thesis is that he attempts
to explain verbal behaviour in a functional way, without considering
the neurological make-up of the speaker and what the speaker contributes
to learning and performance. As Chomsky remarks:

"One would naturally expect that prediction of
behaviour of a complex organism (or machine) would
require, in addition to information about external
stimulation, knowledge of the internal structure of
the organism, the ways in which it processes input
information and organizes its own behaviour."
(Chomsky, 1959, p 29)

Chomsky objects that Skinner applies the technical language of the
laboratory, derived from studies conducted on lower organisms, and
extends them to complex human behaviour. In his view the laboratory
terms of 'stimulus', 'response' and 'reinforcement' are rendered meaningless when used as analogies in real-life situations. Chomsky considers that reinforcement theory is inadequate to explain language acquisition:

"It seems that Skinner's claim that all verbal behaviour is acquired and maintained in 'strength' through reinforcement is quite empty, because his notion of reinforcement has no clear content, functioning only as a cover term for any factor, detectable or not, related to the acquisition or maintenance of verbal behaviour ... I have been able to find no support whatsoever that slow and careful shaping of verbal behaviour through differential reinforcement is an absolute necessity. If reinforcement theory really requires the assumption that there be such meticulous care, it seems best to regard this simply as a reductio ad absurdum argument against this approach."

(Chomsky, 1959, p 48)

Chomsky is particularly critical of Skinner's refusal to study the child's own contribution to language learning. As Chomsky put it:

"... a refusal to study the contribution of the child to language learning permits only a superficial account of language acquisition, with a vast and unanalyzed contribution attributed to a step called 'generalization' which in fact includes just about everything of interest in this process. If the study of language is limited in these ways, it seems inevitable that major aspects of verbal behaviour will remain a mystery."

(Chomsky, 1959, p 58)

Chomsky's own view of linguistic ability is that it develops independently. The speaker makes his own contribution which he does not have to learn from others. Chomsky notes that all normal children acquire essentially comparable grammars of great complexity with remarkable rapidity. This suggests that human beings are specially designed to carry out complex data-handling and hypothesis formulating functions. Chomsky, therefore, argues for the existence of an innate language acquisition device (IAD), a sort of biological preprogramming which means that a young child merely has to hear fragments of adult speech for the linguistic universals of language to be activated. Thus little external control or shaping becomes necessary. Chomsky
further distinguishes between "competence" which relates to the child's knowledge and "performance" which refers to the actual use made of language. Chomsky substitutes for S-R theory a model derived from generative or transformational grammar. He makes a distinction between two aspects or levels of language: "a surface structure" - its physical manifestation; and "a deep or underlying structure" - its meaning. Thus, Chomsky equates competence with Generative Theory (deep structure and the transformational operations which lead to surface structure).

Chomsky's concern with the nature of language has led to a shift from the rigidly empirical approach to a rationalistic orientation in language analysis. Basically, the linguists' position is that the behaviourist models are simply incapable of accounting for the known facts of language development. By viewing language as a fixed, bounded set of data to be acquired by conditioning and reinforcement, the behavioural approach leaves no room for the infinite, dynamic character of language and the importance of linguistic creativity.

Behaviourists, in turn, maintain that

"integrated learning theory is fully capable of indicating in a credible manner how language behaviours mediate such cognitive behaviours as reasoning, problem solving, intelligence, perception and so on."

(Staats, 1968, p 158)

They remind one that it cannot be denied that interaction with the family and the social environment is the major influence on the exact form of language which the child achieves: after all, a child learns English, French, or Russian depending on where he grows up, and that cannot be explained as a result of pre-programming. By exaggerating the innatist argument, Chomsky and his followers lost sight of that fact.

Likewise, Broadbent (1973) has written, "In Defence of Empirical Psychology", in which he refutes Chomsky's attack on empiricism.
MacCorquodale (1969, 1970), also, has dismissed Chomsky's review as irrelevant to Skinner's account of verbal behaviour.

**Summary**

Some of the major psycholinguistic theories that have been proposed to explain language acquisition have been surveyed in the literature review.

From the behaviourist point of view, the model which has had the most impact in the field of psycholinguistics is the hybrid represented, most obviously, by combining the views of Skinner and Osgood.

From the linguistic frame of reference the most important input has been Chomsky's theory of generative transformational grammar.

Currently the views of Chomsky and his followers enjoy considerable popularity in the study of psycholinguistics. Much of modern psycholinguistics reflects Chomsky's theorizing about the structure of language, and the nature of a theory of language. Chomsky's ideas have initiated entirely new perspectives on language for many, and opened up new avenues for research. However, even though Chomsky's theorizing has stimulated such interest within the discipline of psycholinguistics, his concepts do not appear to have made much impact in the mainstream of education. There is little evidence to show that the views of Chomsky and his associates have been incorporated to any significant degree in educational programming. Furthermore, no comprehensive test of linguistic abilities has been developed, as yet, based on Chomsky's tenets.

On the other hand, the empirical approach, as presented by Skinner and Osgood has been subjected to considerable criticism. Many critics have argued that learning theory, with emphasis on conditioning and
reinforcement, cannot satisfactorily account for language behaviour. Despite this, however, their concepts have had a tremendous influence in education. Skinner's operant conditioning theory has been the basis of programmed instruction, which has provided a platform for many new techniques. Skinner's methodology for modifying behaviour has great popularity. The control of contingencies, i.e. "to reinforce or not to reinforce", has become one of the questions often asked in schools.

Osgood's mediational theory has, also, proved equally influential both in the school and the clinic. In many ways his model appears more attractive than Skinner's functional analysis, because it admits some internal processes into the account of language behaviour. Osgood perceived these processes to be distinct, and hypothesized that language disability might relate to specific process deficiency. In this way, Osgood's theory became closely associated with clinical manifestations of communication disorders. It was perhaps due, in part, to the clinical applicability of Osgood's theory for diagnostic purposes that his ideas have attracted considerable attention amongst educators. Osgood's concepts underlie the curricula of many teacher training programmes in special education, provide the basis for numerous instructional strategies (e.g. the Peabody Language Development Kits), and constitute the foundations for the ITPA, one of the most widely used tests in the field of language development.

Language is, at its simplest, a hugely complicated affair and theories to deal with it have proliferated in the various disciplines. This review has examined two alternative psycholinguistic theories that have attempted to explain the origin of the child's linguistic competence. These two theories are not mutually exclusive theories of language acquisition, rather, they are parts of a single, complex picture. In our present state of knowledge in psycholinguistics no one
model can satisfactorily explain language development. Recent writers, however, emphasize that a moderate position is emerging, which, while granting primary importance to man's biological disposition to learn language, regards the actual process of first language acquisition as a delicate cooperation of nature and nurture (Fowler, 1974; Kess, 1976; Bloom and Lahey, 1978; Lee, 1979).
(i) The Psycholinguistic Nature of the Reading Process

Reading has received more attention than any other aspect of education. There is no one method, medium, approach, device, or philosophy that holds the key to the process of learning to read (DES, 1975, p.77).

Of fundamental importance in discussing the linguistic foundations for reading is an understanding of the reading process. Otto (1970), also, points out the lack of agreement on the nature of reading:

"Conceptions of 'reading', then, range from extremely narrow to extremely broad; they are confined to the decoding of printed symbols and basic oral responses at one extreme and they move through the grasping of literal meaning and the interpretation of ideas to the inclusion of changes in behaviour that result from decoding at the other extreme." (Otto, 1970, p.224).

Children, it is often asserted, are linguistically mature by the time they start to learn to read. They have mastered the phonological system of their language, except perhaps for a few hard-to-articulate sounds. They can say and understand all of the sentences which the grammar of their language allows, except for rare and complicated sentences. They are able to communicate and to extract meanings, although their vocabularies will continue to grow and there will be refinements of word meanings. The assumption of linguistic maturity at age six implies a theory about the acquisition of reading skills. Learning to read is said to entail only one unique process, decoding or translating text to sound. Once the child can do this, so goes the line of speculation, reading simply involves hitching the consequences
of decoding to the language the child already has (Gibson, 1975, p.109).

Thus, Fries (1962) writes:

"The process of learning to read in one's native language is the process of transfer from the auditory signs for language signals, which the child has already learned, to the new visual signs for the same signals." (Fries, 1962, p.120).

A more moderate expression of what is still a decoding view is found in Venezky (1972):

"Reading is the translation from writing to a form of language from which the reader is already able to derive meaning." (Venezky, 1972, p.1)

To many, the conception of reading as a decoding process is an over simplification, since it focuses on the surface structure of language and ignores the meaningful nature of language - its deep structure. Smith (1971, 1973) and Goodman (1967, 1969, 1972) show the influence of Chomskian linguistics, and emphasise the language context and its importance in the reading process. They base their premises upon generative grammar and see reading as syntax or discourse processing of meaningful units, not the one-to-one decoding of sound units.

Smith (1973) argues that reading is not primarily a visual process. Two kinds of information are involved in reading, visual information that comes from in front of the eyeball, and non-visual information that derives from behind the eyeball, from the brain. Non-visual information is what we already know about reading, about language, and about the world in general. Smith writes that there is a trade-off between visual and non-visual information in reading. The more that is already known "behind the eyeball", the less visual information is
required to identify a letter, a word, or a meaning from the text. Conversely, the less non-visual information that can be drawn upon, because the text is not easy to comprehend, the slower reading tends to be. More visual information is needed (Smith, 1973, p.7).

In Goodman's theory of the reading process, reading is seen as information processing. The reader, a user of language, interacts with the graphic input as he seeks to reconstruct a message encoded by the writer. He concentrates his total prior experience and learning on the task, drawing on his experiences and the concepts he has attained as well as the language competence he has achieved (Goodman, 1973, p.162).

Goodman argues that reading is a holistic process. The most basic reason why the reading process cannot be fragmented is that the reader does not use all the information available to him. Reading is a process in which the reader picks up and chooses from the available information only enough to select a language structure which is decodable. It is not in any sense a precise perceptual process. It is not a process of sequential word recognition. A proficient reader is one so efficient in sampling and predicting that he uses the least (not the most) available information necessary (Goodman, 1973, p.164).

All the information must be available for the process to operate in the reader and for the sampling strategies it requires to develop in the beginner. Goodman has identified three cue systems:

1. Grapho-phonetic information. This is the information from the graphic system, and the phonological system of oral language.
2. Syntactic information. This is the information implicit in the grammatical structures of language. The language user knows these and, therefore, is able to use this information before he learns to read his native language. Reading, like all language processes, involves a syntactic context.

3. Semantic information. As he strives to re-create the message, the reader utilizes his experiential conceptual background to create a meaning context. If the reader lacks relevant knowledge, he cannot supply this semantic component and he cannot read. In this sense, all readers regardless of their general reading proficiency, are incapable of reading some material in their native language.

Samuels (1976) points out that, at the present time, a heated controversy exists about whether reading should be taught as a holistic process or through a subskill approach. Those who advocate a holistic approach (Goodman, 1972; Smith 1973) claim that by fractionating the reading process into subskills, the essential meaning deriving aspect of reading is destroyed. On the other hand, those who favour the subskill approach point to the accumulated evidence on complex human learning which strongly suggests that prior to mastering a complex, higher-order skill, numerous subskills must first be acquired (Gagné, 1977; Hilgard and Marquis, 1961).

Recent research by Guthrie (1973) has provided perhaps the strongest evidence to support the subskill approach in reading. Thus Guthrie compared the intercorrelations among subskills for good and poor readers. He found that for poor readers, the intercorrelations were low, whereas for good readers they were substantially higher. Guthrie's research implies that poor readers had neither mastered nor integrated subskills used on his tests, while the good readers had. Thus, reading appears to be a holistic process only when these subskills are mastered and unitized. Guthrie concluded that in the process of
becoming a skilled reader, the subskills must be integrated in such a way that they become unified into a single process we call "reading". Thus it appears that what happens in the learning-to-read process is that, at the onset of reading, the more behavioural processes tend to dominate; but, as the reader learns more and more about reading, he calls more and more on cognitive strategies, especially those which involve processing larger and larger language accesses (Shuy, 1979, p. viii). Thus decoding skills are crucial at the onset of learning to read, then decreasingly important as the learning to read process develops. As the learner continues to progress, however, he calls less and less on the word to subword level accesses and more and more on the language accesses that are larger than word level.
(ii) The Relationship between Reading and deficiencies of Speech and Language.

The period 1960-1970 was characterized by a concern for equality of educational opportunity and, consequently, for compensatory education in areas of underprivilege. In particular, reading research and practice, in the context of language and literacy, tended to be strongly influenced by the disciplines of sociology, social psychology and sociolinguistics (Morris, 1978).

The literature during this period abounds in instances of the natural consequences of these three social sciences concentrating on home and neighbourhood effects. Examples in Britain include the work of Bernstein (1971) and his followers on sociolinguistic codes, and the researches carried out by the Plowden Committee in the early 1960s, which according to Wiseman (1964) show that home and neighbourhood effects far outweigh school effects on the attainment of primary school children.

Many studies have been undertaken investigating the relationship between children's experiential backgrounds at home and reading progress (Hilliard & Troxell, 1937; Witty and Kopel, 1939; Sheldon & Carrillo, 1952; Schonell, 1948; Lovell & Wolsey, 1964; Douglas, 1964; Morris, 1966; and Goodacre, 1968).

The conclusion from these studies and others is that conditions in the social environment are related to reading but this is not a direct causal relationship. Furthermore, the studies show that when one examines the variation in reading achievement, it is higher in the upper socio-economic classes, and decreases steadily as social class declines. The research studies also show that certain beneficial
educative experiences are less likely to be available to individual children from poorer homes. Books and other forms of written language are less likely to be in evidence. Parental attitudes are less likely to be positive to intellectual activities such as reading. Parents are less likely to read to their children, or hold elaborate conversations with them. The emphasis should be on the phrase 'less likely' because there is considerable overlap between socio-economic classes in all these studies.

A number of investigations have been carried out into the relationship between unfavourable environmental conditions and language learning. As many writers have stressed, the development of language is central to the emergence of cognitive skills. Limited linguistic ability was identified as a characteristic of the disadvantaged population quite early since it seemed that this was the key to the problem. Many factors affect the growth of speech and language in the child, and it should be remembered that children in homes of all social levels can be deprived of adequate language experience because of such factors as lack of contact with the mother, poor speech models, an unsatisfactory emotional atmosphere in the home, or an over-close relationship with a twin. (Chazan et al, 1976, p.12).

However, children from lower working-class families are particularly handicapped by their linguistic background as Bernstein (1960, 1961, 1965) has shown in his studies of the relationship between social class and language structure. According to Bernstein, the measurable linguistic differences between British lower- and middle-class children indicate important qualitative differences in modes of speech. While middle-class speakers make full use of the structural possibilities of sentence
organisation, lower-class speech is characterized by rigidity of syntax and by a restricted use of structural possibilities in the construction of sentences. Bernstein thus postulated the existence of two markedly different modes or styles of speech:

(a) the formal or elaborate language prevalent among middle-class speakers,

and (b) the restricted or public language used by members of the lower class.

Bernstein asserts that middle-class children must have access to both codes of language which can be used according to the social context. This will lead to an appropriateness of behaviour in a wide range of contexts. Other children will have access to only the restricted code. Thus the working-class child may be considerably disadvantaged at school. This follows as the working-class child experiences cultural discontinuity when he enters school, stemming from two radically different systems of communication: the restricted code he has so far been exposed to at home, and the elaborated code he hears now from his middle-class teachers. Bernstein sees these divergent communication systems as leading to a general diminution of educability. Although he does not specifically mention reading, reading problems and reading failures may be a large component of educability diminution.

Other writers have stressed the verbal impoverishment of many children from poor home backgrounds. This gave rise to the 'verbal deficit model' of the disadvantaged child which has been elaborated by many researchers (Jensen, 1964; Deutsch, 1963, 1964, 1965; John, 1965; Arsubel, 1966; Bereiter and Engelmann, 1966; and John and Goldstein, 1967). Deficits included lack of variety and clarity of stimuli in the home
which were regarded as conducive to cognitive growth. Other lacks include stimulating adult-child interaction and verbalization, sufficient varieties of adult models, motivation and stimuli for intellectual behaviour, environmental requirements for perseverance, deferment of need gratification, and task orientation. Deficits are sometimes viewed as specific, such as poor auditory discrimination, and sometimes as more global, such as retardation in the development of representational and symbolic forms of cognition. Furthermore, the deficit model assumes that there may be critical periods in the young child's development when stimulus deprivation can be crucial and result in irreversible damage to normal development. Alternatively, while no period is critical, early development is a time for greater plasticity and opportunity for enrichment for optimum growth. In essence the deficit theory views problems of educability as arising out of interactions which are considered to be deficient, inadequate, or even pathological. A number of intervention programmes have been based on the deficit theory. Deficit theory language programmes aim to provide intensive training to develop 'missing skills' tend to be firmly structured, and sometimes aim to be 'teacher proof'. Some of the more notable of these programmes are examined in Section IV of this review.

An alternative explanation to the deficit model the "difference model", has been put forward by such workers as Labov (1970), Baratz and Baratz (1970) and Tough (1976). These writers dismiss the notion of deficit as both inadequate and misleading. They point out that working class children are not linguistically deprived or non-verbal
but have developed a functional language by the time they enter school. Thus, the child is not seen to be lacking in competence, but differing in the range and type of situations in which he applies it. Baratz and Baratz (1970) claim that most programmes aimed at assisting the culturally deprived, based on deficit theory, only result in destroying functionally viable processes. Labov (1970) asserts that the myth of verbal deprivation is particularly dangerous, because it diverts attention from real defects in our educational system to imaginary defects in the child (Labov, 1970, p. 198). Importantly, difference theory does not lead to different educational goals but to differences in viewpoint and focus. Difference theory programmes tend to be more loosely structured, the emphasis being on teacher-child dialogue (eg. Tough, 1976). Such programmes start with what the child already possesses rather than what he lacks.
(i) **Individual Differences: Discrepancies in Growth and Development**

Educationists have long recognized that grouping children in classes according to chronological age does not assure homogeneity of grouping in other characteristics. Children not only learn at different rates when compared with each other, but within themselves tend to exhibit different capabilities in various subject areas. These variations are present for several reasons. First, each individual is associated with a completely unique internal and external milieu. The behavioural patterns we exhibit are based primarily on the way in which we have been reared, the areas of environment in which emphasis has been placed, our perception of what is important to the groups with which we identify, and our own capabilities. The level of intrinsic and extrinsic motivation concerning the need to achieve and in goal striving are other areas in which wide differences exist between and within individuals.

Samuel A Kirk, the senior author of the ITPA, has continued to stress throughout his writings that the concept of individual differences between children is based on two components: (a) interindividual differences, and (b) intraindividual differences (Kirk, McCarthy, and Kirk, 1968; Kirk and Kirk, 1971; Kirk, Kliebhan and Lerner, 1978; Kirk and Gallagher, 1979).

Interindividual variability refers to the extent that one child is significantly different from another child. It is the basis upon which most tests are constructed, i.e., to determine children's relative abilities on a particular criterion — intelligence, reading ability, and so forth. Children who deviate from the average in one or more educationally significant areas can be considered exceptional.
The concept of intraindividual differences on the other hand, directs attention not to the comparison of one child with another, but to discrepancies of growth within the child himself. The individual's own ability level and performance are used as reference points. The child is compared with himself and a profile of relative strengths and weaknesses is determined. In this way the concept of intraindividual differences is used to organize an instructional programme for a particular child in conformity with his abilities and disabilities and without regard to how he compared with other children (Kirk et al, 1979, p 30).

(ii) Learning Disabilities

One of the areas in which intraindividual differences are most dramatic and most relevant is that of learning disabilities. Learning disabilities represent deficits or discrepancies in certain psychological processes based on intraindividual differences (Kirk, 1972, p 41).

The concept of learning disabilities was introduced by Kirk in 1963, and has recently evolved to encompass the heterogeneous group of children not fitting neatly into the traditional categories of handicapped children. There is a substantial number of children who show retardation in learning to talk, or who do not develop language facility, or who do not develop normal visual or auditory perception, or who have great difficulty in acquiring reading or numerical skills. Some of them are not receptive to language but are not deaf, some are not able to perceive visually but are not blind, and some cannot learn by ordinary methods of instruction but are not mentally retarded. Although these children form a heterogeneous group and fail to learn for diverse reasons, they have one thing in common: developmental discrepancies in abilities that require specific remediation. This group of children has been described as children with specific learning disabilities (Kirk et al, 1978, p 8).
Because of the heterogeneous nature of this group of children the concept of specific learning disability has been hard to define. Many definitive labels have been used such as minimal cerebral dysfunction, or central nervous system disorder. Specific disabilities have been labelled dyslexia for severe reading disability, or aphasia for children who have not yet acquired language. As the field of learning disabilities is of interest to different disciplines such as educationists, psychologists and medical specialists, the problem has been viewed from these various perspectives. In general, however, definitions fall into two broad categories: (a) those definitions which imply a neurological aetiology to explain the deviation in behaviour, and (b) those which lay stress on behavioural characteristics without reference to brain dysfunction or aetiology.

An example of the first type of definition is presented by Myklebust who writes:

"We use the term psychoneurological learning disorders to include deficits of learning, at any age, which are caused by deviations in the central nervous system and which are not due to mental deficiency, sensory impairment, or psychogenicity. The etiology might be disease or accident, or it might be developmental."

(Myklebust, 1963, p 27)

In the second category of definitions the emphasis is on behavioural characteristics without reference to aetiology. In a discussion of learning disabilities Kirk writes:

"A learning disability refers to a specific retardation or disorder in one or more of the processes of speech, language, perception, behaviour, reading, spelling, writing, or arithmetic."

(Kirk, 1968, p 398)

Learning disabilities are of such a varied kind that it is difficult to present a taxonomy or even a specific list of the different types of learning disabilities. Therefore, in 1968 the National Advisory Committee on Handicapped Children of the US Office of Education defined specific
learning disabilities. With only a few changed words, it was included in the 1975 Education for All Handicapped Children Act as follows:

"Children with special (specific) learning disabilities exhibit a disorder in one or more of the basic psychological processes involved in understanding or in using spoken or written language. These may be manifested in disorders of listening, thinking, talking, reading, writing spelling, or arithmetic. They include conditions which have been referred to as perceptual handicaps, brain injury, minimal brain dysfunction, dyslexia, developmental aphasia, etc. It does not include children who have learning problems which are primarily the result of visual, hearing, or motor handicaps, of mental retardation, of emotional disturbance, or of environmental, cultural, or economic disadvantage."

(Public Law 94-112, Section 5 (b) (4), 1975)

The concept of learning disabilities as used in education, and in this study, lays stress on the behavioural characteristics of the child without reference to brain dysfunction or aetiology. The labelling or classification of children into separate compartments may be helpful to some but not very helpful for the child. The major reason for the rejection of labels is that a label has little educational relevance. Telling a teacher that a child is dyslexic, or brain damaged, or mentally retarded does not help the teacher to organize an instructional programme. In commenting on this Kirk writes:

"Since all behaviour, normal or abnormal, is related to brain function, it is of no benefit educationally to infer brain dysfunction from behaviour. It is difficult to find the dysfunction in the brain, and even if it is found, seldom can anything be done about it."

(Kirk et al, 1979, p 283)

In the United States, the whole question of the labels and categories we use with children has been studied by a task force reported by Hobbs (1975).

The United States is not alone in its efforts to decrease the harmful effects of labelling. Writing about dyslexia, both the Tizard Report (DES, 1972) and the Bullock Report (DES, 1975) advise that the term serves little useful purpose and it would be better to adopt a more usefully descriptive term, "specific reading disability". The problem of
labels and categories also caused the Warnock Committee (DES, 1978) considerable concern. They preferred to describe handicapped children in terms of their educational needs but found this approach also difficult. In the end they accepted some form of categories (the blind, the deaf, the maladjusted) as a "serviceable form of description" (p 44), but they changed the label "educationally subnormal" to "children with learning difficulties." In this description they included other children who needed remedial services.

For the teacher, the major problem in identifying and diagnosing children with specific learning disabilities is to pinpoint the atypical behaviour, explain it, differentiate it from similar problems of other handicapped children (differential diagnosis), and determine the remedial programme best suited to ameliorate the disability (Kirk et al, 1979, p 299). The concept of learning disabilities is, therefore, an extension of the concept of intraindividual differences, since the task is psychoeducational diagnosis and educational remediation. This has promoted the development of diagnostic psychoeducational tests. Such diagnostic tools as the ITPA are directed away from medical categories and towards the determination of discrepancies within the child's own developmental areas.

(iii) Problems of Diagnosis arising from the complexity of the Reading Process

The Concise Oxford Dictionary defines diagnosis as: "The identification of a disease by means of a patient's symptoms". Dreyer (1964) extends this to: "The determination of the nature of an abnormality, disorder or disease".

If one accepts that the medical model is appropriate in education, diagnosis is the process through which information relative to a problem is gathered and analysed. After the analysis stage, the emphasis should
then shift to the prescription of procedures for remediation, the
modification stage. One must emphasize, however, that for the teacher
investigating children's reading difficulties, the analogy between
reading difficulty and disease is rarely fruitful. Although one may
detect some kind of cause for reading failure by examining a child's
long term case history, it is unlikely that any 'antibiotic' can be
administered. This is partly because of the complexity of the reading
process and also, when one examines the literature on reading failure,
the great variation in the types of difficulties and their causes. Not
only is the literature on the teaching of reading voluminous, but the
many authors hold a variety of theoretical positions, so that criteria
for diagnosis and remediation are presented from different vantage
points. However, it is the complexity of the reading process which makes
it possible for the child to accumulate a wide range of reading habits.
This presents the investigator, intent on the precise diagnosis of
patterns of disabilities, with his greatest problems.

In this connection the recent Bullock Report comments:

"The causes of reading failure are no less complex today
than they were when Sir Cyril Burt examined London children
some fifty years ago."

(DES, 1975, p 267)

Calfee (1978) also writes:

"There is a general awareness that (a) reading is a
complex concept capable of several definitions, (b)
little is known about the processes that underlie
the acquisition of reading and only a modest amount
about the process in skilled reading."

(Calfee, 1978, p 427)

Gibson and Levin (1975) apply the principles of cognitive psychology
to the understanding of reading. They describe the acquisition of initial
reading skills and the transition to skilled reading. They examine the
many models proposed to explain the reading process in the mature reader.
They argue that, as there is no single reading process but instead many
reading processes, there can be no single model for reading.
Vernon (1971), also, dismisses the tendency to regard reading as a single unitary capacity which all normal children should be able to acquire automatically as they learn to speak. She reports:

"However, a careful study of reading objectively and without bias, demonstrates that, the psychological processes involved are numerous and complex, and vary at different stages in learning to read ... Unfortunately there has been inadequate investigation of the stage of breakdown of reading failure, and far too little is known as to where it has occurred in any particular individual case. This is due in part to the difficulty of locating the failure; but also to the aforementioned tendency to regard reading as a single unitary element."

(Vernon, 1971, p 4)

In some cases a child's reading difficulty may be attributable to an abnormality, disorder or disease, for example, a defect in visual or auditory acuity, the nature of which can be diagnosed and then possibly treated so as to enable the child to overcome his reading difficulties. However, in the majority of cases highly specific causes cannot be identified. There are a whole complex of factors, or correlates, that inhibit learning to read. The correlates of reading failure refer to certain characteristics within the child or in the environment of children who are failing in reading. These correlates are not synonymous with causes, but rather are conditions that often accompany inability to read. The correlates that have been studied may be listed as: (a) physical correlates, (b) environmental correlates, and (c) psychological correlates.

It is difficult if not impossible for the teacher to change, remove, or ameliorate certain of these factors, particularly those classified as physical and environmental correlates. The psychological correlates, however, can often be affected by the teacher (Kirk et al, 1978, p 23). A comprehensive review of some psychological correlates of reading failure has been carried out by Samuels (1973).

There is general agreement among educationists that the most effective way of dealing with reading difficulties is through appropriate remedial education. The ability to diagnose should be part of the professional
competence of every primary school teacher so as to improve the teaching in relation to the needs of the individual child (DES, 1975, p 256).

Since diagnosis and remediation are part of the same process (Spache, 1976), it is necessary for the teacher to make an assessment of the children's reading skills, and an examination of the functions that underlie them.

(iv) Principles relating to the Diagnosis of Reading Difficulties

The professional literature is filled with discussions of the importance of reading diagnosis and with suggestions for performing the many diagnostic functions. Diagnosis is the foundation upon which effective corrective and remedial teaching is built. Appraisal, diagnosis, and evaluation have much in common. All involve (1) obtaining facts about the individual and his reading, (2) synthesizing and interpreting these facts, (3) arriving at hypotheses that are modified as new information is obtained, and (4) using the understanding to help children improve their reading.

Diagnosis is as complex as the reading process itself. The causes of reading difficulty are subtle and difficult to uncover. Often there is no clear line of demarcation between the causes and effects of reading deficiency (Strang, 1969, p 26).

Wilson (1967) points out that the diagnosis is not an esoteric exercise carried out solely by highly trained experts. The class teacher is constantly engaged in the informal diagnosis of children's reading difficulties and in making modifications to the experiences that the child encounters so as to facilitate higher competencies (Gagné, 1969).

Diagnosis may be made on different levels of comprehensiveness, psychological depth, and competence. On the first or symptom surface level, reading performance might be assessed on word recognition or contextual reading tests. A higher level might focus on the differential
The principles relating to educational diagnosis have been comprehensively reviewed by Strang (1969); Bond and Tinker (1970); Wedell (1970); Lerner (1976); Spache (1976); Pumfrey (1976); and Kirk, Kliebhan and Lerner (1976) amongst others. The following points underlying the diagnosis of reading difficulties are drawn from their writings:

1. Early diagnosis is of crucial importance.
2. Diagnosis is an integral part of effective teaching.
3. There is a reciprocal relationship between diagnosis and teaching.
4. Diagnosis underlies prevention as well as remediation of reading difficulties.
5. Diagnosis should have a developmental emphasis.
6. Diagnosis should be a continuous process of hypothesis verification.
7. Diagnosis recognizes the multiple causation of reading difficulties.
8. Diagnosis should involve the use of standardized test procedures, but the teacher needs to be aware of the limitations of currently available instruments in the field.
9. The heart of diagnosis is the intelligent interpretation of a series of observations coupled with the ability to relate the interpretation to a plan for remedial teaching.
10. Only by developing and refining diagnostic procedures can our understanding of the reading process be furthered and our ability to prevent and ameliorate reading difficulties be advanced.

(v) Relation of Diagnosis to Remediation

Many writers advocate that diagnosis and remediation should be continuous and that diagnosis has no merit in itself unless it leads to
action. Diagnosis should lead directly to the improvement of reading through the reinforcement of strengths and the correction of dis-
abilities. In this way remediation must be in direct response to diagnostic conclusions, necessitating the use of the most suitable techniques as solutions to diagnostic conclusions (Wilson, 1972, p 144).

Kirk and Kirk (1971) also emphasize this point:

"What is needed in the field of learning disabilities is a diagnostic remedial programme, beginning with an assessment of the child in terms of his abilities and disabilities and proceeding to an appropriate remedial programme." (Kirk and Kirk, 1971, p 53)

The importance of the diagnostic hypothesis in the organization of the remedial programme is underlined by: (Bateman, 1965; Strang, 1969; Kirk, 1971; Spache, 1976).

Thus Bateman (1965) maintains:

"On the basis of the information gathered a hypothesis is formulated which must be both precise and comprehensive. It must take into account all the relevant factors and yet be so precise that it leads to remedial planning." (Bateman, 1965, p 172)

Kirk and Kirk (1971) also consider that the diagnostic hypothesis is the most important factor of diagnosis. According to Kirk, diagnosis should lead to remediation and the remedial procedures should be developed in the light of the diagnostic hypothesis:

"In a sense the diagnostic hypothesis is one of the most important factors in diagnosis. This consists of a summary of the symptoms and the correlates that have inhibited the child's learning to talk, read, write, or spell. This requires experienced clinicians who can use the relevant tests, select the relevant facts, and put the pieces together in organized form so as to explain the child's inability to learn. The diagnostic hypothesis must select the relevant variables in the case and pinpoint the specific disability upon which the remedial programme can be organized." (Kirk and Kirk, 1971, pp 57-58)

The diagnostic process that leads to a programme of remediation generally follows five stages (Bateman, 1965, p 171).
1. Determining whether a learning problem exists.

2. Determining the behaviour manifestations and the specific problems encountered by the child.

3. Discovering the physical, environmental, and psychological correlates of the disability.

4. Evolving a diagnostic hypothesis on the basis of the behavioural analysis.

5. Organizing a systematic remedial programme based on the symptoms and deficits and diagnostic hypotheses determined during the previous stage.

(vi) Classification and Diagnostic Tests

The dualistic nature of the concept of individual differences has been discussed earlier in section (i). First, it can refer to the comparative differences between one child and another, for example, intelligence quotients, socioeconomic status, school attainment test scores, etc. These are actually interindividual differences and can be useful in classifying or labelling children. Second, the term can also refer to the differences of ability that exist within a single child, for example, his relative assets or deficits in linguistic or academic behaviour.

Kirk (1966) observed that unfortunately most of the testing carried out in schools seemed to be of the interindividual variety and was undertaken for the purpose of identifying (i.e. isolating) one group of children from others. The most commonly used individual general intelligence tests are the Wechsler Intelligence Scale for Children, and the Stanford Binet Intelligence Scale. The purpose of these tests is to assess the global aspects of intelligence, usually for classification or categorization. Similarly there are many global or general survey-type
tests of reading ability which usually yield a reading quotient and a reading age, indicating the level at which a child reads. Kirk suggests that the global nature of such tests limits their usefulness in analysing the characteristics of a child's learning problems and in designing suitable treatment procedures. In this connection Kirk comments:

"The concept of interindividual differences led to the development of testing programmes to determine relative abilities of children in a classroom. This has been found administratively helpful but educationally unproductive. The statement that a child has a low IQ or is at the 25th percentile in his reading class does not necessarily lead to educationally relevant hypotheses for remediation."

(Kirk and Kirk, 1971, p 11)

Dissatisfaction with classification instruments has led to the recent development of diagnostic tests that assess specific abilities, disabilities and achievements in a child in such a way that remediation of defects can logically follow. Diagnostic tests relate to the concept of intraindividual variability in which the individual's own ability level and performance are used as reference points (Smith, 1968).

The utility of intraindividual testing has long been recognized in the field of reading and a number of suitable diagnostic devices, such as Neale Analysis of Reading Ability, Frostig's Developmental Tests of Visual Perception, Wepman's Auditory Discrimination Test, and various formal reading inventories, have been designed. Therefore, the ITPA was developed to provide the field with another measure of intraindividual differences. Again, Kirk writes:

"The concept of intraindividual differences led logically to psychometric tests that could measure a number of specific and discrete areas of psychoeducational development. These areas could then be compared to determine discrepancies in growth and developmental imbalances within the child himself. Such an assessment is diagnostic rather than classificatory, since it pinpoints underlying areas of deficiency basic to the observable problem. It also delineates abilities that can be utilised to develop the deficient areas."

(Kirk and Kirk, 1971, p 12)
Therefore, recognizing the importance of certain psycholinguistic dimensions to learning, Kirk and his co-authors designed the ITPA, a diagnostic, intraindividual test of selected psychological and linguistic functions. The uniqueness of the ITPA is that it seeks to tap selected psycholinguistic processes that are assumed to be basic to academic achievement. With this instrument it became possible to profile the performance of children on different psycholinguistic abilities. In this way it was possible to pinpoint certain psycholinguistic correlates of learning disability. As a result, useful information pertaining to communication behaviour could then be utilized to plan individual remedial programmes for children who evidenced learning disabilities (Myers and Hammill, 1976).

The 1968 Revised Edition of the ITPA is, perhaps, the most comprehensive test of children's linguistic abilities available as yet. The ITPA consists of twelve discrete sub-tests standardized on approximately 1,000 children between the ages of 2 and 10 years. Normative data is provided enabling one to derive both psycholinguistic age equivalents and scaled scores, thereby giving an objective point of reference in judging the performance of a child in any of the twelve abilities tested.

Key to this approach is the assumption that these functions are identifiable in individual children, that deficits can be remediated through a planned programme, and that the constructs do in fact contribute appreciably to academic success.

As the ITPA is the principal diagnostic test around which this study is based a full description is included in Appendix C pages 392-414.
Interventions

(i) Introduction

In a field as complex as remedial education there are many divergent points of view regarding pertinent issues and practices. Many controversies have arisen in remedial teaching, such as whether to utilise a child's assets or train his deficits; or whether to use a multisensory stimulation technique in contrast to a unisensory presentation. In exploring the multiplicity of theories and approaches relating to remedial strategies it is obvious that there is no royal road to the solution of educational problems. Every teacher must have, however, the background to make wise choices from a wide range of approaches and techniques. In general, Remedial Intervention Programmes can be broadly classified into two categories:

(a) Highly Specialised Methods of Remediation
(b) Global Methods of Training.

Since children with learning disabilities generally exhibit linguistic, reading, or perceptual motor disabilities, many highly focussed remedial techniques have, therefore, been developed each with its own parochial interest in a specific problem area. The work by pioneers such as Strauss, Lehtinen, Kephart, Cruickshank, Fernald, Myklebust, Frostig and Kirk, among others, has provided a rich background of clinical experience in providing for individualisation of educational programming for the handicapped child. A brief review of some of the specific remedial approaches will be presented culminating in a detailed account of the Kirk approach.

The second remedial strategy, which differs markedly from such highly focussed techniques, is witnessed in the prolific number of compensatory programmes that have recently been tried out in the United
States. Here the emphasis has been on the training of global oral language and verbal intelligence rather than the specific training of selected deficits, recognizing that an adequate linguistic background is a prerequisite for reading and academic success. Some of the more substantial intervention studies will be reviewed culminating in the Peabody Language Development Kits.

(ii) Specialised Methods of Remediation

During the 1960s and 70s, the population of children who evidence specific deficits in their learning performance, and yet are sensorily intact and intellectually normal by psychometric standards, has attracted the interest of a wide variety of specialists within many disciplines including education, psychology, and medicine. In 1963 the term "learning disabilities" was introduced to describe the characteristics of this group of exceptional children. Since the mid 1960s, the field of learning disabilities has grown rapidly and continues to experience phenomenal growth (Mann and Sabatino, 1974, p 103). Despite this rapid growth, the field has been grappling with a confusion of terminology and a seeming conflict of ideas pervade current discussions found in the literature. Because learning disabilities is an interdisciplinary field it has not been built upon a common core of ideas and directions. Instead the concepts, ideas, and directions of this new field were, and continue to be, fostered within widely educational circles. The wide range of both degree and type of learning disability requires a diversity of approaches to remediation and treatment. As a consequence certain highly specialised methods have been developed for children who are failing in academic achievement. By and large these methods are remedial and emphasize specific modes of learning.
Recent comprehensive reviews of the pertinent issues in the field of learning disabilities can be found in Mann and Sabatino, 1974; Kauffman and Hallahan, 1976; Haring and Bateman, 1977; Hamill and Bartel, 1978; Lily, 1979; and Kirk and Gallagher, 1979. Only a few of the specific theories and techniques can be described in this review, and necessity demands that these are described briefly. To do justice to any single approach would require a complete volume.

Two of the early pioneers in the field of learning disabilities were Alfred A Strauss and Heinz Werner. Some of the major concepts of the latter two have greatly influenced later learning disability proponents. In essence, the bequests of Werner and Strauss to the fundamental principles of learning disability theory include maximum concern for: (a) specific individual disabilities and techniques to deal with them; (b) the importance of perceptual-motor training as a prerequisite for conceptual development; and (c) the attenuation of inessential stimuli and the accentuation of essential stimuli in the child's environment.

Kephart, Getman, Barsch, and, to a certain extent Frostig all share the Werner and Strauss orientation. But whereas Werner and Strauss were talking, for the most part, about the mentally retarded, Kephart, Getman, Barsch, and Frostig translated these concepts to the investigation of children with normal intelligence.

These investigators believe that the child's difficulty in academic achievement has its genesis in a perceptual-motor deficit, and sequential programming and training in the perceptual-motor areas is necessary if remediation is to take place. All four of these perceptual-motor theorists agree that motor development precedes and is necessary for perceptual development, (Getman, 1965; Barsch, 1967; Kephart, 1971; Frostig and Maslow, 1973).
Thus according to Kephart, the ability to generalize in the higher mental processes grows out of and has its foundations in the ability to form motor generalizations. As motor development progresses, more complex activities such as perception, symbolic manipulation, concept formation and others will develop. Barsch and Getman emphasize the visuo-motor processes of the learner, and Kephart is concerned with the perceptual-motor match. In the end, however, the basic sensory-motor orientation and the suggested remedial activities are similar for all three. The techniques emphasize training in spatial orientation, directionality, hand-eye coordination, and training in form perception. The continual emphasis is on the development of perceptual-motor skills as a precursor to adequate concept formation and language-communicative abilities.

Kephart, Getman, Barsch, and Frostig all believe that one needs to diagnose a child's particular problem before applying specific educational techniques, i.e. they advocate process-orientated rather than task-orientated procedures. They also share common ground in their de-emphasis of aetiology.

Myklebust (1957), Barry (1961) and McGinnis (1963) are associated primarily with communication problems of children diagnosed as aphasic. These three authors share a rather strong auditory orientation which is reflected in their training systems appropriate for use with children who exhibit auditory-vocal deficits.

The involvement of Myklebust with language problems is a natural outgrowth of his early extensive exploration of deafness and aphasia. Since deaf children have as their basic functional deficit the acquisition of language, Myklebust's interests also included language disorders and learning disorders in reading and writing and other school subjects.
Although his earlier publications were primarily in the field of the deaf, his later publications notably with Johnson (1967) dealt with learning disabilities.

According to Myklebust (1960) language develops in a hierarchical sequence. He states that a child first gains experience, then develops by stages through: (1) development of inner language or meaning; (2) comprehending the spoken word, or auditory receptive language; (3) speaking, or auditory expressive language; (4) reading, or visual receptive language; and (5) writing, or visual expressive language. For example, no child talks until he understands speech, nor does he learn to read unless he has acquired oral language. Further, since written language is the expressive side of reading language, the child who cannot read is unable to write. In teaching reading Myklebust argues that the printed word is associated with a spoken word, which is based on a concept. The major objective of training, therefore, is to promote the experience of the spoken word, and the printed word.

Myklebust believes that diagnostic study is the single most important factor in planning for learning disabled children. The effect of the disability on types of educational achievement (reading, arithmetic) is pinpointed; remedial programmes can then be meaningfully prescribed.

Johnson and Myklebust's training activities feature specific modes of remediation. As each child's problem is unique, each programme should be individually tailored. They caution against the indiscriminate use of multisensory techniques - Fernald's VAKT approach for instance. They argue that some children cannot process the stimulation of several modalities simultaneously. As a result, such teaching may confuse the child and prevent learning. They advocate modality-matching, i.e. methods of reading instruction should be matched with the child's
relative modality patterns (e.g. auditory learners should be taught by phonics). The Johnson-Myklebust approach is an eclectic approach rather than a unique diagnostic remedial system.

Frostig (1964) and Kirk (1966, 1971) have developed training systems directly related to the diagnostic assessment instruments associated with them, they are sometimes referred to as "test-related systems". It should be noted that Frostig, if being categorized, prefers to be known as a developmentalist rather than a perceptual-motor theorist.

Frostig's renown stems chiefly from her development of the Frostig Developmental Test of Visual Perception (Frostig, Lofevor, and Whittlesey, 1961; Frostig, Mantlow, Lofevor, and Whittlesey, 1964), and from her design of a training program (Frostig and Horno, 1964) to develop or remediate visual and visual-motor abilities assessed by the test. The test is composed of five subtests, each of which purportedly measures a discrete area of visual perception. These supposedly independent abilities are: (a) eye-motor coordination; (b) visual figure-ground discrimination; (c) form constancy; (d) position in space; and (e) spatial relations.

In formulating educational programs for learning disabled children, Frostig maintains a detailed analysis of the learner cannot be neglected; styles of learning, preferred sensory channels, and areas of perceptual and cognitive deficits or strengths must be determined if the child is to be taught effectively. In order to achieve this Frostig recommends the use of four basic tests: the Frostig Test, the Wechler Intelligence Scale, and the ITPA.
Samuel A Kirk has repeatedly expressed his concern about the limitations of most psychometric tests used in today's schools. He is dissatisfied with descriptive diagnosis that merely classifies children into categories, or is concerned with etiology and with the relationship between communication and possible cerebral dysfunction in children. In this connection Kirk comments:

"The knowledge of the etiology of the disability is not helpful to the organization of remedial procedures. Labelling a child as brain injured does not, with the exception of rare instances, alter the remedial procedure."

(Kirk and Kirk, 1971, p 15)

Kirk asserts that what is needed in the field of learning disabilities is a diagnostic-remedial programme beginning with an assessment of the child in terms of his abilities and disabilities and proceeding to an appropriate remedial programme. As Kirk saw the need to measure a child's intraindividual differences as opposed to his interindividual differences, the ITPA was designed as a test of differential diagnosis to isolate specific learning disabilities so that remediation can follow. Kirk used the Osgood model of language function upon which to base the 1961 and 1968 editions of the ITPA.

As the ITPA is predicated upon a communication model it has been used to study children with linguistic disabilities, reading disabilities, and perceptual problems. The work of Kirk and his colleagues in the development of the ITPA has generally been lauded by professions in the field of learning disabilities on two accounts: (a) it focuses on the relatively neglected psycholinguistic functioning of children with learning disabilities, and (b) it reflects a basic concern for diagnosis leading to remediation (Kauffman and Hallahan, 1976, p 34). Kirk's approach is sometimes referred to as process-orientated training as he emphasizes the assessment of specific
weaknesses and strengths in academic skills and remediation of each
deficit through direct teaching. In addition to developing the ITPA,
Kirk and his associates have compiled suggestions and guidelines for
the remediation of psycholinguistic disabilities (Kirk and Kirk, 1971;
Kirk and Lord, 1974; Kirk, Kliebhan and Lerner, 1978; Kirk and
Gallagher, 1979).

This research study found the undermentioned eight principles,
drawn from Kirk's writings, useful guidelines to follow (Kirk and

1. Differentiate testing from teaching: Testing and teaching are
two different types of operations. Testing seeks to determine
what a child can and cannot do. Teaching seeks to develop the
skills necessary to fulfill the goals of education. There is a
circular reaction between evaluation and teaching. Thus diagnosis
leads to remediation, and remediation leads to diagnosis.

2. Train the deficient areas: Kirk does not hold that deficits are
innate and unalterable ... "remedial programmes aim, therefore,
to stimulate the functioning of those abilities in which the child
is below par. Even among those whose disabilities are neuro-
logically related it is likely that the behavioural deficits
become exaggerated because of avoidance and can be improved
through remediation."

3. Utilise areas of strength: In effect to remediate deficits, the
teacher should not overlook a child's psycholinguistic assets.
Teaching tasks that couple strong and weak areas together should
be designed thereby facilitating the remedial effort.
4. Use multisensory presentations appropriately: After discussing the controversy concerning the merits and hazards of both multisensory and unisensory presentations, Kirk concludes that the judicious use of multisensory instruction and cross modality techniques are valuable in education.

5. Remediate prerequisite deficits first: In organizing a remedial programme it is necessary to decide whether one deficit is basic to another. The purpose of diagnosis is to look at the pattern of abilities and disabilities, to evaluate the correlates, and to evolve a diagnostic hypothesis. The diagnostic hypothesis should indicate where to start and what deficiency or deficiencies to remediate first. For example teach receptive processes before expressive processes, and automatic level process deficits before representational level process deficits.

6. Make provision for utilising feedback: The internal and external feedback in which the child monitors his own response is very important in teaching. In organizing a remedial programme provision should be made for vocal and/or motor response when appropriate so that the child will obtain internal and external feedback. For example, in teaching words use the Fernald VAKT reading method where the child sees a word, writes it from memory, checks his work against a model, and recycles it if it is done in error (external and internal feedback).

7. Develop abilities functionally: Put simply, train the skills the child has the most immediate need to learn in order to perform normally at home or at school. If, for example, a child is experiencing difficulty in learning to read and if he shows defective visual sequential memory, it is preferable to train visual sequential ability with letters, words, and phrases rather than with geometric shapes.
8. Start remedial programmes early: The best time to identify and remediate learning problems in children is at the earliest opportunity. It is indefensible to allow children to fail for years in school, and to attempt remediation only after their difficulties have compounded into serious academic and behavioural problems.

(iii) **Summary**

As the field of learning disabilities has emerged from a variegated heritage we have witnessed divergent approaches to teaching learning disabled children. The diversity in the kinds of disabilities found in children demand a wide range of diverse skills and approached in the teacher.

This review has focussed on the diagnostic-prescriptive approach of Kirk who emphasizes the remediation of those processing functions that appear to be deficient.

The present decade has been marked by controversy concerning the effectiveness of certain strategies. In particular the efficacy of psycholinguistic training has been questioned seriously in recent research studies (Mann, 1971; Hammill and Larsen, 1974; Newcomer and Hammill, 1976).

That this controversy has by no means been settled is indicated by a number of published rebuttals to the anti-process point of view (Frostig, 1969; Bush, 1976; McCarthy, 1976; McLeod, 1976; Lund, Foster, and McCall-Perez, 1978).

The available evidence concerning the effectiveness of psycholinguistic training will be examined in Section V of this review.
(iv) Introduction

In recent years there has been a growing concern for children whose educational progress is impeded by environmental handicaps such as poverty, membership of a minority group or a background offering little emotional stability or cultural stimulation. On the premise that the handicaps of these children usually referred to as "disadvantaged" or "deprived" can be removed or remediated by social and educational action, compensatory programmes on a wide scale have been put into operation in the United States of America designed to improve education from the pre-school to the high-school level (Little and Smith, 1971).

In this country, although both research studies and official reports have highlighted the adverse effects of an unfavourable home background on a child's progress at school, action to help disadvantaged children has been more limited (Chazan, 1973).

Some of the pertinent research findings, from the voluminous literature on the effects of deprivation of children, will now be reviewed. This is highly pertinent to the background of the present study which is concerned with children attending schools in disadvantaged areas.
Theoretical Origins of Compensatory Education

The importance of language in facilitating concept formation and thinking has been well attested by Vygotsky (1962) and Bruner (1964), whilst Luria (1961) has stressed its importance in helping the child to gain control of his overt behaviour. During the infant school years children develop basic concepts such as those of number and class which form the foundation for mathematical and logical thinking, and language plays an important part in this development. The growth of efficient reading skills depends upon a basis of an adequate vocabulary and command of grammatical structures that children are likely to encounter. Moreover, oral language is of exceptional importance during the infant school stage, not only because it enables the child to develop other basic educational skills but also because it is the main teaching medium, whereas in later years the written word assumes greater importance.

While children with adequate intellectual and cultural backgrounds acquire efficiency in language informally and often incidentally, the disadvantaged from less stimulating environments are not so fortunate. Bernstein (1971), Deutsch (1964), Ausubel (1964), among others, have pointed out the complex interaction between home and school, and although the types of deprivation experienced by children at different levels of society are probably quite different, the net results are frequently the same - disadvantage and subsequent educational deterioration. It is in the area of language development, and particularly with respect to the abstract dimension of verbal functioning, that the culturally deprived child manifests the greatest degree of intellectual retardation. Many factors contribute to this unfortunate developmental outcome.
Thus Deutsch (1964) in his examination of homes in depressed areas finds few educational objects and a general absence of parental stimulation appropriate for cognitive, perceptual, or verbal development. Further, Deutsch observes the tendency for disadvantaged children to fall farther behind as they proceed through school. Deutsch calls this the "cumulative deficit" in which small deficiencies at an early age lead to inferior learning which in turn increases the magnitude of the deficiency.

The culturally deprived child's entire orientation to language is also different from that of the middle-class child. He responds more to the concrete, tangible, immediate, and particularized properties of objects and situations rather than to their abstract, categorical and relational properties. In this way he uses language in a convergent or restrictive fashion rather than a divergent, elaborative fashion (Bernstein, 1960).

Writing about the effects of limited experiences in the disadvantaged, Ausubel (1964, 1965) asserts that a delay in learning certain language forms by the disadvantaged slows down their transition from concrete to abstract modes of thought. This transition normally occurs during the junior high-school period. As a result, pre-adolescent and adolescent children are able to understand and manipulate relationships directly, i.e. they are no longer limited to intuitive, concrete, and particularized thought processes, but can formulate precise, abstract, and universal concepts. In the disadvantaged group the transition is much slower, Ausubel feels, because deprived children lack the abstract terms to manipulate relationships and because they lack adequate practice in relating abstractions to each other with the benefit of concrete-empirical props. Since the use of concrete operations is much slower than
classifying in abstract categories, and since deprived children lack the facility with the formal language, they are slower in school and tend to be retarded in most verbal interaction situations.

Hunt (1961) and Bloom (1964) emphasize that early experience has a crucial effect on the development of cognitive skills. Bloom's (1964) analysis of a number of longitudinal studies of child development turned attention to the pre-school years where the most rapid rate of growth in intelligence appeared to take place. Thus educational experiences at the pre-school level could have great potential value for developing intellectual abilities in those children who lack such learning opportunities in their homes and thus may become an antidote for cultural deprivation.

Hunt's (1961) contributions, perhaps more than any other, have freed our conceptions of intelligence from the fetters of the fixed IQ. After reviewing all the evidence available, he concluded that the belief in the constancy of intellect is no longer tenable and that intelligence can be changed by experience. He concluded that with a sound scientific educational psychology it might become feasible to raise the average level of intelligence as now measured by a substantial degree.

In the light of the evidence from such research studies a proliferation of compensatory programmes were developed in the United States designed to eradicate the intellectual deficits of disadvantaged children.

In 1965, the Elementary and Secondary Act of the Federal Government of the US established "Project Head Start", a national effort directed at special educational intervention for disadvantaged children at pre-school level. This was followed by a growth of programmes by Gray and
Klaus (1966), Bereiter and Engelmann (1966), Deutsch (1967), Weikart (1967), Karnes (1968), and Blank (1968), to name some of the best known.

Summaries of these and other substantial intervention studies can be found in Hodges and Spicker (1967), Little and Smith (1971), Stanley (1972), and Smith and James (1975).

(vi) Classroom Approaches to Language Development

Corresponding with the increasing use in America of pre-school intervention programmes has been the introduction of language development programmes designed expressly for use in the classroom. However, both in Britain and the United States controversy surrounds the question of whether the teaching of language skills to children should take place in a fairly structured or relatively unstructured setting (Quigley, 1971; Chazan and Williams, 1978).

Some educationists feel that language skills should be developed informally and incidentally, in the context of the children's spontaneous activities. In contrast, others argue, particularly in the case of culturally disadvantaged children, for a more systematic approach in which situations or experiences designed to foster particular forms or uses of language are deliberately built into the children's learning environment. This distinction between what Cazden (1972) calls the "more didactic" and "less didactic" approaches has theoretical and practical importance in the field of teaching disadvantaged children.

Evidence based on observation and research seems to indicate that a clear statement of aims and objectives and conscious planning are necessary if the language performance of disadvantaged children is to be significantly improved (Bereiter and Engelmann, 1966; Bissell, 1966; Cazden, 1972; Thomas, 1973; Ruder and Smith, 1974). In a review of the effectiveness of compensatory education programmes carried out in
the United States, Hawkridge et al (1968) found that the following features clearly distinguished the relatively successful from the less successful programmes:

(i) careful planning and a clear statement of academic objectives;  
(ii) a high degree of individualisation of training through the use of small groups;  
(iii) relevant and instructional material closely linked to the programmes' objectives;  
(iv) high intensity treatment;  
(v) teacher training in the methods of the programme.

In Britain, because of the "child centred" learning orientation of the British infant school with its emphasis on flexibility and teacher guidance rather than direction, the "non-didactic" approach to language development is usually preferred. This approach was adopted for the PDU programme of the Schools Council Project in Compensatory Education (Chazan and Williams, 1978, pp 72-76).

In America, however, programmes usually incorporate the features set out by Hawkridge above, i.e. are highly structured with a strong instructional emphasis. Some of the better known classroom programmes of language development are the Karnes Programmes (1972, 1975, 1977), the MWM Programme (Minskoff, Wiseman and Minskoff, 1975), the Distar Language Programme (Engelmann and Osborne, 1970) and the Peabody Language Development Kits (Dunn and Smith, 1967).

The Peabody Language Development Kits

The PLDK, prepared by Dunn and Smith (1967, 1968, 1969), is a broadly-based total enrichment programme. The PLDK draws on Osgood's linguistic theory (1957) on which the ITPA is also based. There are four kits and they aim to provide a language development programme from three to ten
years of mental age. Each kit offers a complete programme which consists of 180 lessons of 20-30 minutes, and it is designed for use with groups of children rather than for a one-to-one situation. The programmes consist of a set of highly structured activities following a strict progression, together with a detailed script for the teacher to follow. The main aims of the programmes are (1) to stimulate the overall language facility of the disadvantaged and retarded, (2) to develop their verbal intelligence through training, and therefore, (3) to enhance their school progress. Much emphasis is, therefore, given to the development of oral language, the teaching of key patterns (syntax), and the use of language to serve a variety of functions ranging from logical and mathematical to social and emotional.

The teacher is supplied with a manual, picture cards, posters, tapes and puppets. At the lowest age level there are also toys and teaching aids for developing skills such as sorting and labelling. The authors emphasize that they are not bidding to replace the free creative environment of the children in school, merely to reinforce it. The activities are pupil centred, being primarily a talking time for children and not the teacher. The teacher's role is to encourage and involve all of the children, even the most retiring.

As activities drawn from the PLDK comprise one of the intervention programmes used in this study, a full description of the development and rationale of the PLDK, together with general guidelines for the teacher, is set out in Appendix B pages 388-391.

(vii) The Effects of Compensatory Education

Several attempts have been made to review the effectiveness of compensatory educational programmes for the benefit of disadvantaged children (Little and Smith, 1971; Jensen, 1972; Tizard, 1974; Smith and James, 1977).
From the mass of American material embodying a variety of ideas, theories, and programme designs, the difficulties of making any overall assessment are formidable. The high expectations that accompanied the setting up of the Head Start programme in 1964-1965, buoyed up with the early optimism of studies such as Hunt’s (1961) and Bloom’s (1964), reflected the optimistic climate of opinion at that time on the effects of early intervention. The Westinghouse Report of Head Start (Cicirelli et al, 1969) which investigated follow-up effects up to three years after pre-school, however, were very disappointing and discouraging. In this study comparison was made between children who had experienced Head Start in a national sample of Head Start centres and children in similar classes matched on a number of characteristics who had not been in the programme. The overall finding of the study suggested that the programmes had little sustained effects and that in general no difference could be distinguished between Head Start and non-Head Start children (Little and Smith, 1971). A common finding in most other compensatory programmes that have been evaluated is the subsequent "fade-out" or "levelling off" after children leave the programme. After six months to a year in regular classes their scholastic performance is generally indistinguishable from that of comparable children who had not been given compensatory education (Jensen, 1972). This evidence has prompted Jensen to reassert that as group differences in measured ability are genetically rather than environmentally determined, they are not open to remedial intervention.

The disappointing nature of the Westinghouse findings has brought a number of methodological criticisms of the study. The lack of a highly structured curriculum is an obvious reason to explain the relatively poor performance of Head Start centres. It is argued that dramatic changes in educational performances are not likely to result from broad based short-term pre-school programmes. While massive compensatory programmes such as Head Start have produced no appreciable gains in intelligence or achievement, the majority of specific small-scale
experiments, such as the ones cited in the review, have produced significant gains. The highly structured, "task-orientated" methods, such as the Bereiter-Engelmann (1966) programme, have shown that large gains in the short-term could be achieved. This seems to indicate that highly concentrated direct instruction is more effective than more diffuse cultural enrichment.

Few now believe that pro-school intervention could by itself produce the long-term changes needed if the gap in attainment between the different social groups is to be closed. The psychological developmental reasons for pre-school intervention were oversold, particularly the simple view of deprivation they assumed (Cohen and Garet, 1975). The arguments for early intervention, however, on both developmental and social grounds remain powerful. As Bruner (1975) writes,

"the staggering rate at which the pre-school child acquires skills, expectancies and notions about the world and about people; the degree to which culturally specialized attitudes shape the care of children during these years - these are the impressive matters that lend concreteness to the official manifestos about the early years."

Smith and James (1977) assert that pro-school intervention can make impact, and with the right support this can be maintained for considerable periods. They remind one that however we seek to explain away the gains made in experimental programmes, there have indeed been gains on a substantial scale, maintained for a period not so far achieved at other levels of education. That they were temporary does not necessarily prove them an illusion.
The Illinois Test of Psycholinguistic Abilities in Current Research

Introduction

For the convenience of the reader summaries of the research studies have been assembled and presented together in one section.

In 1961, the experimental edition of the ITPA was published. This edition resulted in a series of research studies which were summarized by Bateman (1965), but like most publications of this nature in an expanding field, the review became outdated almost as soon as it was off the press. The statistical characteristics and the validity information of the experimental edition were provided by McCarthy and Kirk (1963), and McCarthy and Olson (1964).

The revised edition of the ITPA was published in 1968. The development and psychometric characteristics of the revised edition was provided by Paraskevopoulos and Kirk (1969). Since then research studies using this edition have been reported in increasing numbers in the literature. The studies on the revised ITPA from 1970-1975 have been usefully located and summarized by Kirk and Elkins (1975). Newcomer and Hammill (1976) and Spache (1976a, 1976b) have, also, provided comprehensive summaries of studies. The writer is indebted to these authors for providing details of some of the studies carried out in the United States. Although the majority of investigations relating to the ITPA originate from America, the British studies up to 1979 have been included.

As the investigations conducted by the writer have always utilised the revised ITPA, the emphasis in the review that follows is on studies based on the 1968 edition rather than on the 1961 experimental edition.

The review has been organized by topics as below:
I Statistical Characteristics of the ITPA

Reliability of the ITPA

(i) Internal Consistency
(ii) Internal Stability
(iii) Standard Error of Measurement

Validity of the ITPA

(iv) Concurrent Validity
(v) Construct Validity
(vi) Diagnostic Validity

II Educational Significance of the ITPA

(i) Introduction
(ii) Predictive Validity – Review of Correlational Research
(iii) Psycholinguistic Characteristics of Poor Readers as identified by the ITPA
(iv) Effectiveness of Psycholinguistic Training
(v) Conclusion

I Statistical Characteristics of the ITPA

Reliability of the ITPA

Any test which is to be effective as a measure of the individual abilities of individual children must have a high reliability. This is especially important in tests of differential diagnosis like the ITPA used to pinpoint specific disabilities in children in order to organize specific remedial programmes.

Reliability data for the ITPA includes measures of internal consistency and stability. Extensive efforts to present adequate normative data for the test have been made by Paraskevopoulos and Kirk (1969).
(i) Internal Consistency

Internal consistency reflects the extent to which the items of the test represent a homogeneous set of measurements of some simple underlying trait, i.e., consistency in results obtained throughout the test in a single administration. Since each subtest of the ITPA battery is designed to assess a discrete psycholinguistic ability, it is relevant to inquire about the homogeneity of items within each subtest.

The internal consistency coefficients were calculated using the data of the 1962 children in the standardization sample. Because of the nature of the subtests' format, two different procedures were used - Kuder Richardson (1937) #20 formula, and Hoyt's analysis of variance technique. As the investigators stated, since the normative sample was homogeneous because of selection procedures, the reliability coefficients were likely to be lowered. Paraskevopoulos and Kirk therefore corrected for IQ but were unable to rectify many variables, e.g., achievement, age, and sensory-motor ability. Accepting .80 as the threshold criterion of adequate reliability for diagnostic tests, for the most parts the coefficients are quite adequate, occurring predominantly in the high .80s or .90s. ITPA test users can feel confident that most subtests have homogeneous items.

(ii) Internal Stability

Stability reliability is determined in order to evaluate the extent to which test scores are stable over time, i.e., how constant are the scores likely to be if the test is repeated after a specific time lapse. If test-retest scores in the absence of intervening remedial treatment are not relatively constant, such scores cannot be readily used to evaluate the effect of remedial teaching, since the change evidenced
by the test scores may be due to measurement error alone. For the ITPA stability study, therefore, a five to six month test-retest interval was selected on the assumption that a remedial programme usually lasts this length of time. Sampling from the age range at which the ITPA is most appropriate, three age levels were selected: 3-7/4-1, 5-7/6-1, and 7-7/8-1. Seventy-one children from the youngest age group, fifty-five from the middle, and seventy-two from the eldest, drawn from the standardization sample were retested.

The coefficients obtained were generally of a moderately high nature for all three age groups falling for the most part in the .60s+ and .70s. No age trend is discernible. Visual Sequential Memory and Sound Blending appear as the least stable of the subtests.

In the case of the stability coefficient the .80 threshold criterion for adequate stability is unduly rigorous. The six month time lapse between test and retest was too long, this being a considerable length of time in an educational sense. Owing to the developmental nature of psycholinguistic abilities, and to the influence of ongoing educational programmes, marked changes in test performance should therefore be expected. The result of this is to lower the size of the coefficient. In view of this the stability reliability of the ITPA appear to have adequate stability.

(iii) **Standard Error of Measurement**

The standard error of measurement reflects consistency of performance. It provides the magnitude of errors of measurement expressed in the same units in which the individual scores are expressed; in other words it establishes the zone within which the true score lies. The $SE_m$ is dependent upon the standard deviation of the distribution of obtained scores and upon the reliability coefficient of the test. The higher the reliability coefficient, the smaller the error of measurement.
The SEM is an important statistic for any test which attempts to compile a diagnostic profile based on comparisons of specific subtest performances. The larger the SEM band around each score, the greater the possibility that what appears to be a deficit in performance is simply a statistical artifact due to chance.

SEMs for raw scores, scaled scores, and psycholinguistic ages have been computed from the standardization sample and are presented in Paraskevopoulos and Kirk (1969). Subtest SEM's for scaled scores are generally low and there is a relative consistency across the age levels.

In a discussion about the interpretation of reliability data, Paraskevopoulos and Kirk provide guidelines on the use of SEM's in defining limits around the observed score, and also the use of the SEM in interpreting test score differences (Paraskevopoulos and Kirk, 1969, pp 127-136).

Validity Studies on the ITPA

In simple terms the validity of a test may be regarded as the extent to which it measures what it is intended to measure. A test cannot have a high validity without a correspondingly high reliability. On the other hand, a high reliability is not in itself a guarantee of high validity. Validity is essentially a matter of degree. There is no such thing as an absolutely valid or invalid test; there are simply more or less valid tests. Generally a measure of validity, in the form of a coefficient of validity, would be obtained by correlating the test scores with scores obtained from the same group of testees on some agreed criterion test. In a test which purports to measure twelve discrete psycholinguistic functions for the purpose of delineating a child's strengths and weaknesses, questions of validity assume extra importance. Of relevance is information on the concurrent, predictive, content, construct and diagnostic validities of the ITPA.
Concurrent validity is perhaps the most common index of a test's validity. Concurrent validity is the degree of correlation of the test with extant criterion tests of a similar qualitative nature. The ITPA purports to be basically a language test and should, therefore, be expected to correlate substantially with existing language tests and linguistic portions (reading, spelling) of achievement tests. Furthermore, correlations on which the assumptions of validity are based, should be stable over time, i.e. should exhibit predictive validity.

McCarthy and Olson (1964) performed a number of statistical operations in order to determine the concurrent and predictive validity of the 1961 ITPA. The criterion measures were already-extant language tests and language-based portions of various achievement tests. Each subtest was correlated with a criterion test preselected on the basis of its apparent similarity to the particular subtest, e.g., the Peabody Picture Vocabulary Test was selected as criterion for Auditory Reception, and Raven's Matrices for Visual Association. A restricted sample of 86 children was used whose chronological ages ranged from approximately 7-0 to 8-6 years, this validity sample being chosen to be as similar as possible to the original ITPA standardization group. Correlations all of which were significant ranged from .27 - .65. On analysis the following subtests appeared clearly to possess adequate concurrent and predictive validity: Visual Reception, Visual Association, and Auditory Sequential Memory. A second group of three subtests appeared to have a qualified validity, that is, they appeared to measure something in addition to those intended by the test authors: Auditory Reception, Auditory Association, and Visual Sequential Memory. A third group of subtests appeared to have questionable validity, these were Verbal Expression, Manual Expression, and Grammatic Closure. Although the validity studies of McCarthy and Olson appear inconclusive there is a
distinct possibility that the ITPA subtests are tapping skills which have not been measured by the criterion tests.

Horner (1967) studied the relationship between the ITPA and the Parsons Language Scales and found considerable support for all the subtests. Milgram (1967), Weaver and Weaver (1967), Washington and Teska (1970), amongst others, have investigated the relationship of the ITPA to various intellectual measures with generally supportive results.

(v) Construct Validity

Construct validity is the most important type of validity. According to Cronbach (1960), construct validity is an analysis of the meaning of test scores in terms of psychological concepts. Since the ITPA is based on theoretical constructs it is most important that its construct validity be demonstrated. This involves assessing the extent to which each ITPA subtest measures a discrete psycholinguistic construct as depicted on the Osgood test model. While subtests within the ITPA battery should be reasonably heterogeneous, there should, however, be some communality between the subtests based on the fact that they are on the same linguistic level, are in the same channel, or assess the same process.

Factor analysis is one method of investigation that has been extensively used to determine whether the subtests measure single and separate abilities. The majority of these analyses have, however, involved the experimental rather than the revised edition of the ITPA. The standardization procedures of the revised edition by Paraskevopoulos and Kirk (1969) did not include factor analysis.

Meyers (1969), Carroll (1972), and Newcomer et al (1976) are critical of many of the factor studies carried out on the experimental
edition of the ITPA. They point out that the majority of those studies failed to include in their analysis external criterion-referenced tests. One must, therefore, largely discount such analyses with little or no use of external referenced tests, for such studies would automatically fail to identify unique abilities in the separate ITPA subtests.

In this respect Semmel and Mueller, 1962; Loeffler, 1963; Center, 1963; Ryckman and Wiegerink, 1969; Mittler and Ward, 1970; and Burns and Watson, 1973; conducted factor analytic studies without using external criterion tests. This treatment maximised the subtest correlations and resulted in multiple subtest loadings on large general factors. In general, these studies report that the ITPA seems to measure between three and six separate abilities rather than the nine the tests purports to measure.

Despite these weaknesses some of the studies cited above have found partial although not definitive support for the clinical model of the ITPA (Meyers, 1969; Ryckman and Wiegerink, 1969; Burns and Watson, 1973).

Meyers (1969) attempted to synthesize thirteen analyses based on the experimental edition of the ITPA. He concluded that the ITPA appears to measure six separate and established abilities, and possibly a seventh. Meyers also discussed the extent to which the factor analytic results seem to provide confirmation of the postulated Osgood model. While separation into auditory-vocal and visual-motor channel does occur, the representational level is identified mainly with the well known verbal comprehension factor. The concept of the automatic level is not well supported and the notion of different processes is completely unsubstantiated, according to Meyers, who further states that the sequential tests are just tests of short-term memory.
Taking the correlation matrices from numerous studies on the experimental ITPA, Ryckman and Wiegerink (1969) submitted them to principal axis factor analysis. They found that as age level increased the test became more discriminatory in terms of measuring single abilities. At the 3 year old level, there appeared a general factor with strong auditory-vocal channel emphasis and a factor heavily weighted on the visual-motor channel. Three factors appeared at the 5½ year age level. The first of these was the general factor evident at the 3 year level, while the other two were an apparently indefinable factor and a visual-motor factor. At the 8 year level were found four factor not resembling any of those at the other two levels. These were a general language, an encoding, a memory, and a visual-decoding factor. When the data was analysed to ascertain whether the factor loadings would break down into channels, levels, and processes the three components of Osgood's model emerged as reasonably separate entities.

Burns and Watson (1973) carried out a factor analysis of the revised ITPA with underachieving children. The subjects were 90 children aged between 5-10 years, all of whom had learning difficulties; they were not associated with mental retardation or sensory impairment. Five factors emerged from the analysis. Two of the five factors were largely visual-motor, and three were auditory-vocal, giving considerable support to the dimensions of channels of communication. There was no support for the processes of reception and association, but expression was substantially upheld. Neither automatic nor representational levels of organization emerged as separate entities.

More recent studies based on the revised edition of ITPA have generally been more supportive of the construct validity of the ITPA model (Doughtie et al, 1974; Hare et al, 1973; Newcomer et al, 1975).
Doughtie et al (1974), carried out a factor analytic study on the six subtests of the representational level of the revised ITPA. Data from the eight age levels, comprising the standardization sample of the revised ITPA as presented by Paraskevopoulos and Kirk (1969, pp 202-209), was examined. This involved utilising data from eight matrices of ITPA subtest intercorrelations, through eight age groups for the 962 children of the normative group, i.e. from the 1st matrix which was obtained on a sample of 107 children aged 2 years 7 months - 3 years 1 months, through to the 8th matrix on a sample of 122 children aged 9 years 1 months - 10 years 1 month.

Doughtie et al concluded that the clinical model of the ITPA was reliably approximated by the representational level subtests on data obtained from the six oldest age groups treated by Paraskevopoulos and Kirk (1969), but not on data obtained from the two youngest age groups. The age group that ranged from 2 years 7 months - 3 years 1 month, and from 3 years 7 months - 4 years 1 month yielded patterns of the six representational level subtests which had no demonstrable relationship to the clinical model. The children in the six older groups near their sixth, seventh, eighth, ninth, or tenth birthdays, yielded subtest patterns that approximated the pattern of the representational level of the clinical model. Thus, according to Doughtie, interpretations based on the ITPA must be held suspect for children who are four or younger but however may be reasonably applied to children who are approaching or have passed their fifth birthday.

Newcomer and Hammill (1976) assert that in only two studies, Newcomer, Hammill, and McGettigan (1975) and Hare, Hammill, and Bartel (1973) has the construct validity of the ITPA been investigated using
criterion tests which were specifically designed to parallel the functions supposedly matched by the ITPA subtests.

Hare et al (1973) investigated the construct validity of six selected ITPA subtests. The subjects were 126 children who attended eight classes in four different communities. All the children came from English speaking families in middle class communities. The boy/girl ratio was 1:1, and 7% of the children were black. The mean CA was 103 months (range 95-112). Only children who were achieving at a rate and level considered normal by their teacher were included. The subjects were administered six ITPA subtests, Auditory Reception, Visual Reception, Verbal Expression, Manual Expression, Auditory and Visual Sequential Memory. A parallel task was designed to correspond with each of the selected subtests. The matched task differed from the corresponding subtest in only one dimension while it was identical or equivalent in the other aspects. (In one instance the level or organization, content, and process might be held constant while the input or output modality (channel) was changed.) In all 16 tests were administered (6 subtests and 10 parallel or reference tests).

The component analysis essentially confirmed the construct validity of the six subtests. The subtests were identified as separate traits consistent with the Osgood-Kirk model of communication.

In an extensive study by Newcomer et al (1976) the ITPA was factor analysed with matched criterion variables to determine its construct validity. The subjects were 167 children who were similar to the standardization sample of the revised ITPA, whose ages ranged from 105-118 months and whose intelligence was within normal range. All children were administered the ITPA plus 20 external criterion tests. Two types of criterion tests were provided for each ITPA subtest:

(a) tests which met each specification of the Osgood model but differed
in content and (b) tests in which content and the psycholinguistic dimensions of level and process were held constant while the channel was varied.

On the whole, the results of this study provide substantial support for the assumptions of Kirk, McCarthy, and Kirk that the ITPA measures discrete psycholinguistic abilities, at least when administered to normal fourth grade children. In addition, the subtests apparently do represent at least two of the three constructs which theoretically underlie the test, i.e., level of organization and process were largely substantiated. The channel concept had the least empirical substantiation. Except for the Visual Closure subtest, the visual modality as measured by the ITPA is completely without substantiation as a valid dimension. Both the Visual Association and Visual Reception subtests factored with auditory tasks and, therefore, could not be considered as valid for the channel. Further the Visual Sequential Memory subtest appears totally lacking in construct validity, i.e. not valid on all three dimensions. The auditory channel has greater credibility. Although the integrity of the auditory channel appears established for Auditory Association, Auditory Sequential Memory and Verbal Expression subtests, there is some question concerning Grammatic Closure, Auditory Reception, Sound Blending and Auditory Closure.

Newcomer et al conclude that with the exception of the channel dimension the ITPA can be regarded as a valid representative of the constructs of the test model and to some extent Osgood's model as well. For the most part the subtests are discrete measures and do not tap the same constructs. The dimensions of level were proved to be different, and the separation of the three processes were confirmed. Only the visual channel modality was questioned.
Summary of Construct Validity Studies

Most of the reported factor analytic studies have been performed on the experimental rather than the revised edition of the ITPA. On the whole, results of the studies completed on the experimental edition are frequently contradictory and inconclusive. The research to date does not support the notion that the nine subtests of the experimental edition measure single and separate psycholinguistic abilities. In general, the findings of the factor studies show that the test seems to measure between three and six separate abilities. The research cited does, however, lend some support to the construct validity of certain dimensions described by the model for the instrument. Channels of communication, psycholinguistic processes, and levels of organization were all supported to some degree as hypothetical constructs by the studies reviewed. There is, however, some disagreement among the studies regarding the degree and nature of the support of these dimensions. Many of the studies based on the experimental edition contained a serious methodological weakness in that the ITPA subtests were factor analysed without any criterion tests, a treatment which maximised their intercorrelations and resulted in multiple subtest loadings on large general factors. In the writer's opinion, the findings reported on the experimental edition are not applicable to the revised edition. The revised edition was introduced to take account of criticisms of the experimental edition previously noted by McCarthy and Olson (1964), Bateman (1964) and Kass (1962). The revision contains three additional subtests and one additional psycholinguistic ability. Along with new norms and an extended age range, there are changes in format, content and terminology. The two editions are, therefore, not equivalent.
Factor analytic studies based on the revised edition are consistent in their support of the ITPA model. For the most part, they report that the subtests represent discrete abilities and do not tap the same constructs. The dimensions of level were proved to be different and the separation of the three processes was established. There is some question about the lack of modality clustering, but this is at variance with some sound analyses (Meyers, 1969; Leong, 1974). The overall conclusion of these studies is that the construct validity of the revised ITPA is acceptable and the research worker can use the test with confidence.

(vi) Diagnostic Validity

Diagnostic validity is a special class of concurrent validity. As the ITPA is frequently employed in clinical diagnostic settings, it is important to determine the extent to which test results and clinical observations agree. A purpose for which the test is used and for which it must be shown valid is diagnosis—differential and educational. As has been noted, the psychometric characteristics of the ITPA are based on data obtained primarily from average children. It is important, therefore, to collect information on the differential performance of groups of children with whom the test is going to be used, such as retardates, learning disabilities, culturally disadvantaged, and other groups of exceptional children. The performance patterns of some selected studies are presented in Table 1, overleaf.

The performance patterns of two groups of children are most pertinent to this review: reading disability cases; and children of differing social classes.
<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Edition</th>
<th>No of Children</th>
<th>Types of Subjects</th>
<th>Performance Patterns on the ITPA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wiseman (1965)</td>
<td>Experimental</td>
<td>10</td>
<td>Generally lower scores on tests at automatic level than at representational level.</td>
<td></td>
</tr>
<tr>
<td>Brown &amp; Rice (1967)</td>
<td>&quot;</td>
<td>50</td>
<td>Mentally Handicapped</td>
<td></td>
</tr>
<tr>
<td>Smith (1970)</td>
<td>Revised</td>
<td>74</td>
<td>Deficits in Visual &amp; Auditory Memory and Grammatic Closure</td>
<td></td>
</tr>
<tr>
<td>McCarthy (1965)</td>
<td>Experimental</td>
<td>30</td>
<td>Mongoloid</td>
<td></td>
</tr>
<tr>
<td>Bilovsky &amp; Share (1965)</td>
<td>&quot;</td>
<td>30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kass (1962)</td>
<td>Experimental</td>
<td>21</td>
<td>Performance at the Automatic Level more deficient than at Representational Level</td>
<td></td>
</tr>
<tr>
<td>Macione (1969)</td>
<td>Revised</td>
<td>56</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ruhly (1970)</td>
<td>&quot;</td>
<td>128</td>
<td>Reading Disabled</td>
<td></td>
</tr>
<tr>
<td>Celebre (1971)</td>
<td>&quot;</td>
<td>104</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deese (1971)</td>
<td>&quot;</td>
<td>50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bannatyne &amp; Wichiarojet (1969)</td>
<td>Revised</td>
<td>50</td>
<td>Poor Spellers</td>
<td></td>
</tr>
<tr>
<td>Parasekevopoulos &amp; Kirk (1969)</td>
<td>Revised</td>
<td>245</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mittler &amp; Ward (1970)</td>
<td>Experimental</td>
<td>96</td>
<td>Social Class Differences</td>
<td></td>
</tr>
<tr>
<td>Butts (1971)</td>
<td>Revised</td>
<td>48</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stephenson &amp; Gay (1972)</td>
<td>&quot;</td>
<td>160</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cicerelli et al (1971)</td>
<td>Revised</td>
<td>1,495</td>
<td>Lower Class Blacks &amp; Whites &amp; Mexican Americans</td>
<td></td>
</tr>
<tr>
<td>Foster (1963)</td>
<td>Experimental</td>
<td>30</td>
<td>Articulation Disorders</td>
<td></td>
</tr>
<tr>
<td>Hallom (1964)</td>
<td>&quot;</td>
<td>25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ferrier (1966)</td>
<td>&quot;</td>
<td>40</td>
<td>Poor on Automatic Level Subtests</td>
<td></td>
</tr>
</tbody>
</table>
In the case of children experiencing reading failure, many authors have reported that poor readers tend to have superior abilities at the representational level as compared to abilities at the automatic level, such as Visual and Auditory Sequential Memory and Grammatic Closure (Kass, 1962; Macione, 1969; Ruhly, 1970; Celebre, 1971; and Deese, 1971). The studies investigating the relationship of the ITPA to reading are examined in detail on pages 102-112.


It must be emphasized that one cannot assume that diagnostic validity patterns observed in group studies is automatically applicable to the individual case. Inevitably the group results mask the performance of the individual.

Paraskevopoulos and Kirk (1969) differentiate between idiographic and nonmoehtic research. Idiographic research is suitable for clinical studies of the individual child. In this type of study children's deficits are determined, a diagnostic hypothesis is established, a remedial programme devised to ameliorate the deficit, and an assessment of progress made not only in retest scores on the ITPA but also on the effects of the amelioration of the deficit on life activities.

Another approach is with groups of children. This approach may be applicable to groups of children who, because of biological, genetic, or environmental factors, show a pattern of disabilities of the same type. Classroom instruction can often be designed to ameliorate the
pattern of deficits and through nonmothetic research establish the most effective remedial or intervention procedures for different patterns of disability.

This brings one to the educational significance of the ITPA and the extent to which it can be said to relate to academic performance.
II. Educational Validity of the ITPA

(i) Introduction

The statistical validity of the ITPA has been examined. No matter how significant in a statistical sense a test may be thought, if the test has little educational significance it is relatively worthless to educators. The ITPA is used widely by teachers and psychologists which suggests that they at least regard it as an educationally valid test. It is, therefore, of critical importance to examine the educational significance of the ITPA. In order to do this certain assumptions of fundamental importance must be examined. These are:

1. That psycholinguistic constructs are measurable by available tests and, therefore, their evaluation can lead to differential diagnosis of an individual's strengths and weaknesses.

2. That psycholinguistic constructs, as measured, are related directly to school failure.

3. That identified, psycholinguistic deficiencies are remediable by readily available programmes and techniques.

The September 1974 issue of "Exceptional Children" contained an article entitled, 'The Effectiveness of Psycholinguistic Training'. Therein, Hammill and Larsen reviewed the results of 38 studies which attempted to train children in psycholinguistic skills, using the ITPA as the criterion of improvement. Basing their judgment on comparisons between children trained in language and those who received no formal instruction or were enrolled in traditional programmes, these authors concluded that the effectiveness of psycholinguistic training has not been definitively demonstrated. As such, the position that psycholinguistic constructs, as measured by the ITPA, can be trained by existing techniques is non-validated and unwarranted. This article presaged Newcomer and Hammill's...
book "Psycholinguistics in the School" which presented studies from an extensive review of the literature in the psycholinguistic field. The conclusions reached by these authors were generally critical of psycholinguistic training based on the Kirk-Osgood model. This prompted critiques of Hammill and Larsen's review from educators who advocate psycholinguistic training. Of note were responses from Minskoff (1975), and Lund et al (1978) in "Exceptional Children", together with rebuttals from Bush, Minskoff, and McLeod, who had each been invited to contribute an article for inclusion in Newcomer and Hammill's, "Psycholinguistics in the Schools" (1976).

These opposing tenets reflect the debate and discussion in one of the most rapidly expanding movements and controversial fields in special education. In the review of the educational significance of the ITPA some of the conflicting arguments about psycholinguistic training will be examined.

(ii) Predictive Validity - Review of the Correlational Research

Correlation is increasingly used by educators to estimate a child's performance on one test using the knowledge of his performance on another test as the basis for prediction. Use of correlation in this manner establishes a test's predictive validity. Therefore, the demonstration of significant relationships between the ITPA subtests and various academic indices would establish its predictive validity of academic performance.

Concerning the magnitude of the correlations necessary to constitute a substantial relationship, Guilford (1956) has suggested a level of .3 or greater as minimally acceptable for validity purposes. Garrett (1954) argues that only coefficients of .4 or above are acceptable. Newcomer and Hammill compromise between these two levels and have chosen .35 to
serve as the cut-off point between coefficients with predictive usefulness and those without.

Newcomer and Hammill review 24 studies which have investigated the relationship between the ITPA and various academic achievement tests. Most of these studies were concerned with the relationship between the ITPA and reading. From these studies a total of 820 correlation coefficients depicting this relationship were reported. According to Newcomer and Hammill, only three subtests, Auditory Association, Grammatic Closure, and Sound Blending, as well as the Composite Score, established median coefficients which reached or exceeded .35. The other subtests yielded coefficients lower than .35 so as to indicate little predictive relationship between the subtests and reading. The predictive relationship between the subtests and reading is reduced further when median coefficients drawn from the five studies that controlled for intelligence were examined. Under this condition, only the Grammatic Closure subtest maintains a practically significant correlation ($r = .38$), and can be considered a useful predictor of reading proficiency after intelligence has been controlled for.

McLeod (1976) considers that there are inherent problems in using correlations to study the relationship between the ITPA and academic performance. He argues that for any group of children the correlation coefficient depicting the relationship between two variables might be $r = 0$, while for a subgroup within the group the relationship between the variables might be $r = .5$. McLeod is critical that a multiplicity of researchers have administered the ITPA to unselected samples of children and have correlated psycholinguistic age with scores on reading or other tests. If correlational analyses are conducted with unselected samples of children in this way, it might be that there is a subgroup of children whose school failure is caused by or associated with psycholinguistic deficits, but the relationship is obscured by the fact that they constitute a small portion within a large sample.
In McLeod's view correlational techniques present an oversimplistic view. The inclination to look for a simple one-to-one relationship between cause and effect leads one to assume that a cause is both necessary and sufficient, whereas it might be necessary but not sufficient in itself. Thus for a child with a learning disability, the detection of a deficient psycholinguistic skill provides information about what might well be a necessary contributing factor but not always a sufficient factor in itself.

One should not accept too hastily the results of the findings from the 24 correlational studies presented by Newcomer and Hammill. The following criticisms could be made of these studies:

1. Many authors used too few subjects, thus reducing the confidence one might have in their findings.

2. Few of the studies controlled for the influence of intelligence and several failed to control for the effects of age.

3. Some studies involved older children near the ceiling of the test norms, thereby resulting in truncated correlations.

4. The studies employed widely different tests of academic achievement.

(iii) Psycholinguistic Characteristics of Poor Readers as identified by the ITPA

For those active in the diagnosis of reading and learning disabilities a significant question is the consistency with which poor readers exhibit characteristic patterns of subtest deficits. Several studies have been made of the relationship between the ITPA and some of its subtests to reading disability.

In order to identify any pattern of deficit, Newcomer and Hammill (1976) assembled 24 studies from the literature which investigated the diagnostic of the ITPA for reading. After an examination of these studies they report that none of the ITPA subtests discriminate among
reading groups. According to Newcomer and Hammill, therefore, diagnosed psycholinguistic strengths and weaknesses based on the ITPA performance of school-aged children cannot be viewed as having any relationship to a child's observed difficulties in reading.

An exhaustive review of the literature by the writer located 30 studies investigating the relationship of the ITPA to reading. These investigations include the British studies omitted by Newcomer and Hammill. Practically all these analyses used typical elementary-school aged children as subjects and include most of the American studies in Newcomer and Hammill's review. However, the studies by Kier (1963), Sumner (1966), and Larsen et al (1974) were excluded as inappropriate as the subjects were mentally handicapped children. The cumulative results of these investigations are presented in Table 2 overleaf. The researchers included in this table usually selected two or three groups on the basis of their reading proficiency. The mean scores for each group on each of the twelve ITPA subtests were then determined, and compared to see if significant differences occurred, usually using a t-test or "anova" technique. In Table 2, a "L" has been used to signify that poor readers were significantly lower than good. An "O" indicates that the subtest failed to differentiate between the groups. In some studies, where the authors used only selected ITPA subtests, the remaining blank spaces indicate that the subtest was not administered.

It should be pointed out that there are inherent difficulties in trying to isolate characteristic patterns of psycholinguistic functioning across thirty differing studies. The chief amongst these is controlling for age, social class, reading level, and intellectual characteristics of the subjects. Studies involving older children (circa 9+ years or more) are less reliable than those involving younger children, as the older children are at the top of the test norms and many of them reach the ceiling of the test. The comparison of children across reading levels
is also extremely difficult, especially when a wide variety of tests have been used. Reading failure is a relative term and there are qualitative as well as quantitative differences between groups of poor readers. Generally, there is a vagueness among defining reading failure in operational terms. In the studies reviewed, reading failure can span the whole continuum from groups of children with no measurable reading age, to groups of children whose reading ages are only marginally below their chronological age. Clearly, the closer the reading age approaches the chronological age the less likely any observed discrepancy in psycholinguistic functioning.

With the above qualifications in mind an examination of the studies recorded in Table 2 shows the following results:

Five studies, Sears (1969), Ikeda (1970), Lagerman (1970), Clark (1970), and Hammill (1975) found that none of the ITPA subtests discriminate among reading groups. The children in three of the studies (Ikeda, Clark, Lagerman) were 9 years of age or over, in which case it is likely that they scored at the ceiling of the norms of the ITPA thus depressing the scores and eliminating any possible differences. One could also raise the question of whether differences between good and poor readers were large enough to bring out significant differences in psycholinguistic functions, as in the Lagerman study the children with reading disability were only found to be reading one year below their chronological age.

An examination of the remaining studies in Table 2 shows that poor readers exhibit the following pattern of ITPA subtest deficits. Visual Sequential Memory appears most frequently as an area of weakness being reported in 15 studies, followed by Grammatic Closure cited in 13 studies, Auditory Sequential Memory cited in 11 studies, Sound Blending cited in 8 studies, and Auditory Closure cited in 7 studies. An inspection of
<table>
<thead>
<tr>
<th>Name</th>
<th>Date</th>
<th>No of Children</th>
<th>Age</th>
<th>AR</th>
<th>VR</th>
<th>AA</th>
<th>VA</th>
<th>VE</th>
<th>ME</th>
<th>GC</th>
<th>VC</th>
<th>ASM</th>
<th>VSM</th>
<th>AC</th>
<th>SB</th>
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<td>73</td>
<td>8-9</td>
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<td>0</td>
<td>0</td>
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<td>0</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>L</td>
</tr>
<tr>
<td>Bateman</td>
<td>1963</td>
<td>131</td>
<td>6-9</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<td>0</td>
<td>0</td>
<td>L</td>
<td>L</td>
<td>L</td>
</tr>
<tr>
<td>Bruininks et al</td>
<td>1970</td>
<td>105</td>
<td>8-9</td>
<td>L</td>
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<td>0</td>
<td>0</td>
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<tr>
<td>Celebre</td>
<td>1971</td>
<td>104</td>
<td>8-10</td>
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<td>0</td>
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<td>0</td>
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Key:

"L" indicates that poor readers were significantly lower than good readers,

"0" indicates that the subtest failed to differentiate between good and poor readers.
the table also shows that deficits occur predominantly at the automatic, rather than the representational level of organization.

There is considerable support, therefore, for Kirk's (1971) assertion that reading disability cases tend to have superior abilities at the conceptual or representational level as compared to abilities at the automatic level, such as Grammatic Closure, and Visual and Auditory Sequential Memory (Ragland, 1964; McLeod, 1965; Kass, 1966; Macione, 1969; Doese, 1971; Celebre, 1971; Naylor, 1972, 1973).

In an early American based study Kass (1966) explored some of the psycholinguistic correlates of reading disability using the ITPA supplemented by five tests at the automatic-sequential level of psycholinguistic functioning. These tests were: (1) Visual-Automatic, (2) Sound Blending (Monroe), (3) Mazes (WISC), (4) Memory-for-Design (Graham-Kendall), and (5) Perceptual Speed (PMA). The reading disability children (N = 21) were aged between 7-10 years, of normal intelligence, with no known sensory defects and their reading retardation as measured by Monroe's diagnostic battery of tests (Monroe, 1932) was given as: one-half year retarded if in second year in school; 1 1/2 years retarded if in third year; and 2 1/2 years retarded if in fourth year.

Kass found that these poor readers were deficient in seven out of eight abilities at the automatic-sequential level of language usage and deficient in only one of the six representational level abilities. Children showed significant deficits (p<0.01) in the following subtests: Sound Blending, Visual Sequential Memory, Auditory Association (ITPA), Perceptual Speed, Mazes, and Memory-for-Design. Marginal deficits (p<0.10) were found in Visual Closure and Grammatic Closure. Kass concluded that these deficiencies relate to possible brain-stem dysfunction which limit symbolic storage, which in turn may create deficits in integrational functions such as closure, sequential memory and perceptual speed.
Macione (1969) conducted a similar study with 28 poor readers (not operationally defined) and 28 good readers in the second and third grades using the revised edition of the ITPA. Macione found that five of the automatic level tests were lower for poor readers, four of which showed statistically significant differences ($p < 0.05$): Visual Sequential Memory, Grammatic Closure, Visual Closure, and Sound Blending. There were no significant differences between poor readers and good readers on any of the representational level subtests.

Again, McLeod (1966, 1967) found that deficits as tested by the ITPA are primarily at the automatic level for children with reading disability.

In this country, the writer, Naylor (1972, 1973), has carried out two investigations into the psycholinguistic disabilities of poor readers.

Involved in the first study, Naylor (1972), were 48 children aged between 7-8 years (mean CA: 7 yr 9m). These children were severely retarded in reading, i.e. each child was over 2 years retarded in reading (mean RA: 4yr 9m) as measured on the Burt-Vernon Graded Word Test. The children's IQ distribution as measured by the Raven's Matrices Test approximated to normal (mean IQ: 96, SD: 14). The writer found that the composite mean psycholinguistic language age of the children (PIA: 6 yrs 6m) was 1yr 3m below their mean CA (7yr 9m). Compared with the ITPA normative group, the poor readers showed deficits in language age on the 10 ITPA subtests, together with a substantial deficit in psycholinguistic development on the Auditory Closure subtest ($p < 0.01$), and a borderline deficit on the Visual Sequential Memory subtest ($p < 0.05$). The group showed relative strength on the Auditory Sequential Memory subtest gaining a higher score than the normative group ($p < 0.05$). This agrees with the findings of Kass and Macione, in the studies cited above, who both noted no difference between good
and poor readers in Auditory Sequential Memory. Further, it was noted from the ITPA subtest correlations that Sound Blending (0.61) and Visual Sequential Memory (0.45) correlated most highly with reading age as measured by the Burt-Vernon test. In a predictive validity study, reported by Hirshoren (1969), it was also found that correlations between the ITPA subtests and the seven tests of the California Achievement Test (CAT) showed that Visual Sequential Memory correlated the highest from 0.51 with reading comprehension to 0.61 with reading vocabulary.

A further investigation to determine the psycholinguistic disabilities of a second group of poor readers, using children of the same age and drawn from the same population as the children involved in the first study, was carried out by Naylor (1973). Sixty children aged 7-8 years (mean CA: 7yr 6m) were used in the study. The mean IQ of the children, as measured on the Raven's Matrices Test, was found to be 97.1, SD: 10; and their mean reading age was 4.8 years on the Burt-Vernon Graded Word Test. When compared with the normative group, the children of the experimental group were found to be retarded in psycholinguistic language age on each of the 10 ITPA subtests, all deficits being significant at 0.01 level, with the exception of Auditory Sequential Memory where the difference did not reach significance. The experimental group's composite psycholinguistic age (PLA: 6yr 9m) was 1yr 6m below their mean CA (7yr 6m). As in the first experiment substantial deficits in psycholinguistic functioning were observed in the areas of Auditory Closure, and Visual Sequential Memory (p< 0.01). Once again the experimental group's performance on Auditory Sequential Memory was found to be an area of strength (p<0.01). When the profiles of psycholinguistic abilities derived from the two studies were compared they were found to be almost identical (p189).
Other British studies investigating the relationship between the ITPA and reading have been conducted by Halsey (1975), Shute and Graham (1977) and Hinnells (1978).

Volume 3 of the well known EPA Projects edited by Halsey (DES, 1975) reports the "Junior School Language Work" carried out in ILEA, EPA Junior Schools. The objective of this project was to assess the effect of language programmes on the linguistic development of the experimental group of children over their second junior school year. The ITPA was chosen as the major test with which to evaluate the language work. In addition to their use to measure changes in score over the school year the ITPA results were also used to obtain a psycholinguistic profile of EPA children. An examination of this profile showed that English EPA children scored lower than the American normative group on ten of the twelve ITPA subtests, the exceptions being in the areas of Manual Expression and Auditory Sequential Memory where the English children scored higher than the normative group. The two reception items on the test - Visual and Auditory Reception - were found to be the most depressed for the EPA group. Relative to their representational level of functioning, the scores of the EPA children on the automatic level items was not depressed. This finding is at variance with many research findings cited in this review which indicate that children with reading difficulties have lower scores on automatic level subtests than on representational level items. However the following methodological inadequacies in the experiment could account for this discrepancy:

1. Whilst the children were classified as attending EPA schools their reading level was not specified, therefore, it is not known to what extent the children were retarded in reading, if at all.
(ii) The experimental group (N = 134) was not an homogeneous ethnic group but contained 33 immigrant children.

(iii) Rather than utilise the American norms, the analyses were performed using raw scores, a procedure which does not take into account variability across age levels and subtests.

Hinnells' (1978) study into the psycholinguistic abilities of poor readers was designed primarily as a replication of Naylor's (1972) study. Thirty-six children attending EPA schools in Salford were involved in the study. This sample was selected on the basis of comparable selection criteria to the 48 children used in the present writer's experiment. The mean CA of the Salford children was 8 years, their Raven's Matrices IQ approximated to normal (mean IQ: 96, SD: 15), and their mean RA, as measured on the Salford Reading Test, was 6 years 2 months.

Hinnells reported that there was a reasonably strong resemblance between the total psycholinguistic performance of the Salford sample compared with the writer's sample. In particular, the performance of the two groups was very similar on the following subtests: Auditory Reception, Visual Reception, Auditory Association, Auditory Sequential Memory, Auditory Closure, Sound Blending, and Composite PLA. The psycholinguistic development of the Salford children showed a substantial deficit in Auditory Closure function, as was reported by the writer, but no deficit in Visual Sequential Memory was observed. The fact that Hinnells did not identify a deficit in Visual Sequential Memory, which was found by the present writer and other researchers, is probably because her sample did not match the writer's on the criterion of reading age. As the mean RA of the children in the writer's study was 4 years 9 months against a mean RA: 6 years 2 months in the Hinnells' study, one could argue that the children in Hinnells' sample
were not sufficiently retarded in reading to give rise to psycholinguistic deficits. Problems of comparisons by RA on different tests standardized on different samples make this a more complex issue than at first appears.

An investigation at Aston University by Shute and Graham (1977) involved fifteen boys exhibiting severe reading disability. Two groups of children were selected for detailed observation and investigation. Group A consisted of ten boys, classified as dyslexic by the authors. The remaining five, Group B, were not felt to be truly dyslexic even though their reading difficulties were as bad as, if not worse, than the dyslexic group. The ages of the boys ranged from 12yr - 16yrs, and their retardation in reading ranged from 2-7 years. The WISC IQ's of the dyslexic group were in the high average/superior range, whilst Group B IQ's were in the average/borderline range. The subjects were investigated using a battery of tests which examined aspects of cognitive/perceptual functioning. Included in the test battery were 4 ITPA subtests from the automatic level: Visual Sequential Memory, Visual Closure, Auditory Closure, and Sound Blending. Of these four psycholinguistic skills tested, both groups were found to be significantly retarded ($p < .01$) in Visual Sequential Memory (mean PLA: 7.1yrs), and Auditory Closure (mean PLA: 7.2yrs).

Even though the children's ages were well above the ceiling of the test norms, the findings of this investigation relating to psycholinguistic disabilities are in line with the writer's research findings (Naylor, 1972, 1973), which also identified deficits in Auditory Closure and Visual Sequential Memory functioning though in younger poor readers.
Conclusion

Doubt is cast upon Newcomer and Hammill's judgment that, the consensus of all investigations into the ITPA's diagnostic validity is that none of the subtests discriminate among reading groups. Although some of the studies reviewed in table 2 present ambiguous results, a considerable number of studies affirm that poor readers exhibit automatic level skill deficits. In particular, Visual Sequential Memory, Grammatic Closure, Auditory Sequential Memory, Auditory Closure, and Sound Blending, have diagnostic validity for reading. The fundamental premise that the ITPA can be used to identify deficits which underlie academic failure, in particular reading failure, is in the writer's estimation validated by the existing research literature.

Some of the inconsistencies amongst the 30 studies, presented in table 2, probably arise because of the imprecision in defining reading levels. The extent of the reading disability of the subjects in many studies is not apparent. It is probable, therefore, that many researchers failed to isolate psycholinguistic disabilities because their subjects were not genuinely learning disabled, i.e. their retardation in reading was not severe enough. This hypothesis at least merits attention.

(iv) Effectiveness of Psycholinguistic Training

The ITPA clinical model and the original Osgood schema have served as the basis for several remedial and developmental programmes that are used extensively in schools (Dunn and Smith, 1966; Karnes, 1968; Bush and Giles, 1969; Minskoff, Wiseman, and Minskoff, 1972).

Psycholinguistic training is based upon the assumption that psycholinguistic constructs are identifiable and measurable, that they provide the underpinning for learning, and that defective psycholinguistic skills are remediable. An additional assumption is that the cause of the
child's learning failure is within himself and that strengthening weak areas will produce a positive, beneficial transfer effect to basic school subjects. If this assumption is valid, then programmes designed to alleviate psycholinguistic deficits would be appropriate and viable.

In an attempt to answer the question of the efficacy of psycholinguistic training, Hammill and Larsen (1974) have analyzed 38 studies dealing with psycholinguistic training. The question underlying the Hammill and Larsen analysis is: "Is psycholinguistic training effective?" The findings of the 38 studies are summarised in Table 3. A "+" indicates that the experimental subjects did considerably better than the control subjects on a subtest analysis. A "o" indicates that the control subjects were equal to or better than the experimental subjects. In most cases "+" or "o" are the same as statistical significance (.05 level) or nonstatistical significance respectively. The blank spaces in the table occur because some authors used the nine subtest 1961 experimental edition, whilst others used the twelve subtest 1968 revised edition. Some researchers were concerned only with selected subtests whilst others were interested in the ITPA total score and not at all in the subtests. The effects of training on Auditory Closure and Sound Blending are virtually nonexistent which was probably because these subtests only became available with the publication of the revised ITPA, and are only supplemental tests in that version.

From the 38 research studies Hammill and Larsen were able to compare the performance of experimental and control subjects on ITPA subtest and ITPA total score. They then computed the percentage of analyses which indicated that special psycholinguistic training was beneficial for differing types of children, e.g. retarded, disadvantaged, preschool, and elementary. The percentage of analyses, by subgroup, which found the intervention successful is found in Table 4.
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*Code:*  
+ means experimental subjects did considerably better than control subjects  
0 means control subjects were equal to or better than experimental subjects

(From: "The Effectiveness of Psycholinguistic Training" by Donald D Hammill and Stephen C Larsen, Exceptional Children, 1974, 41, 5–14)
Table 4: The Percentage of Analyses, by Subgroup, which found Psycho-
linguistic Training to be Successful

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(From Hammill and Larsen, 1974, p 10.)

From the information provided in Tables 3 and 4, Hammill and Larsen drew the following conclusions:

1. The value of psycholinguistic training with retarded children was investigated by fifteen researchers. There was not a single subtest for which a majority of researchers reported that training was beneficial. Therefore, the value of training retarded subjects in psycholinguistics has not been demonstrated to date.

2. Eighteen authors gave psycholinguistic training to disadvantaged children. This training was apparently successful in the areas of Auditory Association and Verbal Expression. However, as the positive percentages are only in the 50's and as the remaining ITPA subtests did not respond to instruction, support for training disadvantaged children in psycholinguistic skills is at best limited.

3. The effect of psycholinguistic training at the preschool level was investigated by 15 authors, and at the elementary level by 19 authors. At preschool level the training programme successfully
developed Auditory Associational ability, whilst at the elementary level expressive language abilities were stimulated. Once again, the positive findings are limited to the representational level sub-tests.

4. A prescriptive approach was used by eight researchers, i.e. they diagnosed their subjects, usually with the ITPA, then designed programmes specifically for each child. This approach was successful in stimulating expressive language abilities and Visual Association.

5. The nonindividualised approach to training, i.e. the approach in which all children are exposed to a set programme, was studied by thirty investigators. This approach was found to be minimally effective in teaching Auditory Associational and Verbal Expressive abilities.

6. Two kinds of curricula were employed most often: the "selected activities" approach, used by thirteen researchers, and the PLDK approach used by sixteen researchers. The selected activities approach was successful in stimulating Manual Expression skills. With the exception of Verbal Expression, the PLDK does not seem to be an efficient method for developing language processes.

7. The total column at the bottom of Table 4 reflects the overall situation relative to psycholinguistic training as reported in the 38 studies. It is apparent that for most part, researchers have been unsuccessful in developing skills which underpin the ITPA. The Verbal Expression subtext seems to be the most responsive to intervention, while Visual Closure, Grammatic Closure, Visual Sequential Memory, Visual Reception, and Auditory Reception are the most resistant.

The collective results of the studies reviewed draw from Hammill and Larsen the following main conclusion:
The idea that psycholinguistic constructs, as measured by the ITPA, can be trained by existing techniques remains non-validated. Comparatively speaking, the most encouraging findings pertain to training at the representational level, especially the expressive process. The most discouraging results were associated with training at the automatic level, the receptive and organising processes, and both the auditory-vocal and visual-motor modalities."

(Hammill and Larsen, 1974, p 11).

Advocates of Psycholinguistic Training

Critical analyses of Hammill and Larsen's (1974) review have been presented by educators who advocate psycholinguistic approaches in education (Minskoff, 1975; Bush, 1976; McLeod, 1976; and Lund, Foster, and McCall-Perez, 1978). Of particular cogency are the articles by Minskoff and Lund et al.

Minskoff attacked the accuracy of the Hammill-Larsen conclusions regarding the efficacy of psycholinguistic training on the grounds that they were based on an "apples and pears" comparison of studies which differed markedly in that:

1. they involved different types of subjects, most of whom were not learning disabled;
2. they used varying, non comparable treatments with the children;
3. they employed different experimental designs and were riddled with methodological errors.

Minskoff's objections relating to each of these three main points are examined below:

Minskoff argues that the nature of the subjects used in each of the 38 studies was radically different from one study to another. She notes that the studies included in the review involved diverse subjects, i.e. mental retardates, underachieving, culturally different, as well as learning disabled children. In most, if not all, of the 31 studies in
which a general approach to treatment was taken, there was no analysis of each subject's profile of learning characteristics. Therefore, Minskoff believes that the experimental subjects, for the most part, were not in fact learning disabled. In these studies, heterogeneous groups of non learning disabled children, as well as children with different types of psycholinguistic disabilities, were given the same treatment. Such a group approach masks any positive results of remediation for specific kinds of children. Children who do not have learning disabilities in particular psycholinguistic areas, who are given treatment to develop these areas, will not show any sizeable improvement. This is a logical assumption, according to Minskoff, as these children are already functioning at or near their current capacity in these psycholinguistic areas. Generalizations from such studies cannot be made to children who are learning disabled, and who do have room for substantial improvement in their disability areas.

Minskoff's second objection relates to the inconsistencies in the nature of the psycholinguistic treatments in the efficacy studies. Specifically she notes that:

1. In 31 of the 38 studies there was a general, nonindividualised approach in which there was no relationship between the treatment given and the children's psycholinguistic disabilities. One of the established principles for treating learning disabled children is that such children require programmes tailored to their specific disability areas. As this was not done in any of these 31 studies, they cannot, therefore, be considered appropriate treatment studies.

2. The 38 studies varied regarding instructional factors. In each of 15 studies less than 50 hours treatment time was given, and in the other studies more than 50 was given. Even though 50 hours seems
like a considerable amount of time, Minskoff considers it is negligible when compared to the many hours required for mastery of various academic activities. Children with learning disabilities cannot be expected to master tasks that they have been unable to master previously with traditional teaching in weeks, or even months. Minskoff argues that it is unlikely that any of these studies provided adequate time for mastery.

3. Hammill and Larsen did not consider whether remediation in the studies was given on an individual, small group, or large group basis. The results of individual remediation cannot be generalized to those of group remediation, and results with small groups are not directly applicable to large groups. Furthermore, Minskoff is critical that no consideration was given to whether the teachers implementing the treatment did so competently or not.

Minskoff's third objection to the research studies relates to methodological weaknesses in the experimental design. Minskoff considers that the methodological weaknesses of the studies made it difficult to obtain significant results in favour of the experimental group. She lists ten sources of error, one or more of which were included in each of the 38 studies. Among the more serious of these were:

1. Subjects came from different populations than the population to be investigated.
2. Heterogeneous subjects were combined into groups that should have been homogeneous.
3. Groups were not matched on variables relevant to treatment.
4. No randomization of groups was attempted.
5. The description of the treatment was inadequate.
6. Evaluation procedures were biased.
Minskoff dismisses the negative findings from the analysis of the literature reported by Hammill and Larsen. She considers that their analysis has resulted in oversimplified conclusions and faulty implication and must therefore, be viewed with extreme caution. The question underlying the Hammill and Larsen analysis was, "Is psycholinguistic training effective?" Minskoff believes, however, that the central question to be answered by research is, "What types of remedial methods are most effective with what kinds of psycholinguistic disabilities under what conditions?" Underlying this question are the following seven assumptions: (1) the learning disabled children represent a heterogeneous population, (2) psycholinguistic disabilities can be identified, (3) psycholinguistic disabilities can be trained, (4) psycholinguistic functioning is related to social and academic learning, (5) psycholinguistic training differs at various age levels, (6) psycholinguistic disabilities can be ameliorated, not cured, and (7) psycholinguistic training is part of a total remedial and compensatory teaching programme.

Lund, Foster, and McCall-Perez (1978) have carried out a re-examination of the original data from some of the studies in the Hammill and Larsen review. Of the 38 studies reported by Hammill and Larsen, 24 were reevaluated. Not all of the studies could be examined as some reports were unavailable to the authors, whilst other studies provided insufficient information. In analyzing the 24 available studies, Lund et al grouped them into the following three categories:

(a) those studies showing positive results in the table on six or more of the subtests and on the total;

(b) those studies showing negative results in the table on all subtests or, if no subtests were reported on the total; and

(c) other studies including those showing positive results on some but less than six of the subtests or on the total, as well as those with additional problems in reporting.
Reanalysis of 24 of the 38 studies shows:

1. Of the studies reported by Hammill and Larsen, 6 clearly show positive results suggesting that psycholinguistic training is effective. These studies contraindicate the conclusions that such training is nonvalidated.

2. Of the 10 studies indicated in the table as showing negative results, only 2 of them were reported accurately as having clear cut negative results. The other 8 were either equivocal or showed positive results. Specifically:
   a. Four of the 10 studies were inaccurately reported as showing negative results since the original data shows positive results on some functions.
   b. Two of the 10 studies compared groups under different training programmes. The negative results in the table indicate no difference between training groups. Hammill and Larsen failed to report that both groups made substantial progress.
   c. Two of the 10 studies contained insufficient data on which to base judgment regarding the validity of psycholinguistic training.

3. Hammill and Larsen noted 8 studies to show positive results on some, but less than six, of the subtests or on the total. These included:
   a. Three studies that attempted to train subjects only in one or more specific areas.
   b. One study that compared treatment groups instead of trained versus non-trained subjects.
   c. Four studies that had varying degrees of relevance to the question at hand.
Lund et al conclude that their re-evaluation leads to conclusions markedly at variance with Hammill and Larson's statement that psycholinguistic training is nonvalidated. The analyses of Lund et al indicate, that some studies show significant positive results as measured by the ITPA, some studies show positive results in the areas remediated, and some do not show results from which any conclusion can be drawn. It is, therefore, not logical to conclude either that all studies in psycholinguistic training are effective or that all studies in psycholinguistic training are not effective. If psycholinguistic training is feasible in some situations and not in others, further research is needed to explore carefully the multitude of variables surrounding training in order to draw conclusions about effectiveness.

The present writer's investigation into the alleviation of psycholinguistic disabilities of poor readers also provided strong support for: (a) the use of the ITPA as a test of differential diagnosis, and (b) the validity of psycholinguistic training (Naylor, 1973).

The purposes of this study were: (i) to investigate the use of the ITPA in the diagnosis of psycholinguistic deficit in first year junior children experiencing reading difficulties, and (ii) to study some effects of three educational programmes on the modification of the children's psycholinguistic abilities and reading attainments.

From 1,035 children considered, by their teachers, to be at educational risk because of low reading attainment, 60 were tested on the ITPA. Substantial deficits in psycholinguistic development were found in the areas of Auditory Closure and Visual Sequential Memory. Three intervention programmes were constructed. The first was a prescriptive approach, designated "Kirk" programmes, because they were designed to remediate the specific disabilities in the areas specified above. The second approach was a global approach to remediation whose primary aim was
to stimulate oral language development and verbal intelligence. As the programmes were constructed from a representative sample of activities drawn from the PLDK they were called "Peabody" programmes. A third group of children, acting as a control group, received a "Number" programme. The children were retested on the ITPA and on three measures of reading attainment at the end of a twelve week treatment period, and again three months later. At the end of the experiment, the performance of the children on the Kirk and Peabody Programmes combined (Language Programmes) was compared with that of the Control group. The result of the analyses showed:

1. Children on the Language Programmes performed significantly better \((p<.01)\) than children in the Control group in respect of: Auditory Reception, Auditory Association, Grammatic Closure, Visual Closure, Auditory Closure, Visual Sequential Memory, Sound Blending, and Composite PIA.

2. Children on the Language Programmes performed significantly better than children in the Control group in respect of: Carver Reading Test \((p<.01)\), Southgate Reading Test \((p<.01)\), Burt-Vernon Reading Test \((p<.01)\).

3. No significant differences were recorded between the two groups in respect of: Visual Reception, Visual Association, Verbal Expression, Manual Expression, and Auditory Sequential Memory.

4. At the end of the experiment the gain in Composite PIA by the three groups was as follows: Kirk Group (27.8 months), Peabody Group (23.1 months), Control Group (3.9 months).
When comparisons were made between the Kirk and the Peabody treatments, the following findings emerged:

1. Children on the Kirk Programmes performed significantly better than children on the Peabody Programmes in respect of:
   (a) Visual Sequential Memory, Auditory Closure, Visual Closure, Grammatic Closure, Sound Blending, and Composite PLA (all p<.01).
   (b) Burt-Vernon Reading Test (p<.01), Carver Reading Test (p<.01), and Southgate Reading Test (p<.05).

2. No significant differences were found between the two groups in respect of:

3. On none of the 25 criterion tests, used in the experiment, did the Peabody Group achieve a significantly higher score than the Kirk Group.

   At the end of the experiment an examination of the deviation scores of the Kirk group showed that there were no deficits in psycholinguistic growth and that their performance approximated to the normative groups. The programmes had, therefore, been successful in ameliorating the deficits in Auditory Closure and Visual Sequential Memory that were shown to be present at the start of the experiment.

   When the deviation scores of the Peabody Group were examined, however, substantial deficits were recorded in the areas of Auditory Closure and Visual Sequential Memory. Although it was evident that the programmes had successfully raised the overall level of psycholinguistic functioning, the basic linguistic impairments that were characteristic of the group at the start of the experiment remained.
In the opinion of the writer the above findings lend considerable support to the validity of psycholinguistic training and its relevance to educational achievement. Over the whole experiment, the Kirk Group gained 1.7 years RA, the Peabody Group gained 1.6 years RA, whilst the Control Group gained only 0.3 years RA (all reading ages measured on the Burt-Vernon Test). As no direct training in reading instruction was given in the programmes, this illustrates the transfer effect from psycholinguistic abilities to reading development.

The findings from the experiment also indicate conclusively that the Kirk Programme was superior to the Peabody Programme both in ameliorating psycholinguistic disabilities and promoting superior all round language performance. There is, therefore, considerable support for the approach of Kirk who advocates the training of specific disabilities rather than the global training of oral language. Kirk's claim that deficits, far from being innate and unalterable, can through carefully designed remedial programmes be brought up to average functioning, is also strongly supported.
DESIGN OF THE EXPERIMENT
The Design of the Experiment

Introduction

This study is the third investigation using the ITPA in the diagnosis of psycholinguistic disabilities of poor readers carried out by the writer. All three studies have involved children, aged 7+ years, who were experiencing reading failure and who were attending schools in a large industrial city in the North of England.

The first of these studies examined the psycholinguistic profile of abilities of 48 poor readers and then looked at this pattern across three levels of ability (Naylor, 1972).

In a follow up study a similar profile of abilities was found using a further sample of 60 poor readers attending two schools (Naylor, 1973). Three intervention programmes were devised and administered by the writer. The differential effects of the programmes in alleviating psycholinguistic deficit was then investigated. Both these studies are reported in detail in the literature review.

This current study takes note of suggestions made by the external examiner for the 1973 study. Essentially this was that a more substantial investigation should be conducted involving a further 60 poor readers drawn from four schools. The psycholinguistic profiles were again to be examined to determine whether any distinctive ITPA profile features emerged and intervention programmes once again devised. However, instead of these programmes being taught by the writer, as in the 1973 study, it was recommended that they should be administered by four teachers, i.e. one in each of the children's schools. In this way experimenter bias would be minimized, and generalizations of more relevance could be made.
The Aims of the Experiment

As summarized in The Statement of the Problem the research was designed with the following aims in mind:

1. To utilize the ITPA as a test of differential diagnosis to determine the psycholinguistic characteristics of a group of junior school children, aged 7-8 years old, deemed to be at educational risk because of reading failure.

2. To construct remedial programmes, as advocated by Kirk and Kirk, to alleviate any specific disability or disabilities in psycho-linguistic functioning revealed in (1) above. These programmes to be designated, "Kirk" Programmes.

3. To construct remedial programmes drawn from a representative sample of activities from the Peabody Language Development Kits (Manual - Level II), the primary aim of the programmes being to stimulate oral language development and verbal intelligence, rather than the training of isolated processes. These programmes to be designated, "Peabody" Programmes.

4. To conduct a method's experiment to investigate the effectiveness of the above two programmes in the alleviation of psycholinguistic disabilities, (a) in the short term, and (b) in the long term.

5. To determine the effect of the remedial work on psycholinguistic abilities, non-verbal intelligence and on related aspects of language such as articulation and reading skills.
Outline of the Research

The Population

The children involved in this study comprise the entire 7+ age group attending every First School of the LEA of a large industrial city. In the September of each academic year the LEA conducts an investigation into the reading attainments of all children in the 7-8 years age group. This survey is carried out by the School Psychological Service and has taken place for the past ten years. In this return the headteachers of the LEA's First Schools are asked to administer the Young's Group Reading Test to all children in the 7+ year group. They are then asked to record the reading quotients of the children, in rank order, on tabulated score sheets and forward the results to the School Psychological Service. Following on the recommendation of the Principal Educational Psychologist all those children whose reading quotients on the Young's Test fall below a reading quotient of 80 are deemed to be at educational risk because of reading failure. The learning disabilities of these children are then investigated in depth by the Specialist Teachers of the School Psychological Service.

The purpose of this survey is:

1. To identify those children who are in need of an individual assessment because it is thought that they are likely to need placing in an ESN school.

2. To alert the headteachers in the schools of the LEA of their respective children who are in need of special reading provision.

3. To make the most effective use of the specialist teachers of the School Psychological Service.
Returns are received from 201 First Schools and involve 11,169 children of the 7+ age group. About 10 per cent of the children of this age range annually achieve reading quotients of 80 or below. These children were, therefore, considered to be at educational risk because of poor reading attainment. Included in this total were a fair number of immigrant children some of whom were non-English speaking rather than slow learning. No immigrant children were, therefore, included in this study.

The Sample

A total of sixty children aged 7-8 years attending four First Schools (i.e. 15 children in each school) was selected from the population of poor readers identified by the screening procedure outlined above. These children were all considered to be at educational risk on the criterion that their reading quotient as measured on the Young's Group Reading Test was below 80. Excluded from this study was:

1. Any coloured immigrant child.
2. Any child with marked physical or sensory handicap.
3. Any maladjusted child.

Outline of the Method

Before outlining the method it should be pointed out that the research was undertaken by the writer on a part-time basis. This meant that the research programme had to be combined along with the writer's professional duties with the School Psychological Service. Because of this it was not possible to carry out the programme in the four schools B1, B2, B3 and B4, simultaneously in one academic year. As a result of this, time was only available to complete
the work involving the first group of children \((N = 30)\), in schools B1 and B2, in one academic year. This procedure had then to be repeated in the following academic year in schools B3 and B4 with the second group of thirty children.

For the convenience of the reader a brief outline of the method will now be presented. A description of all the variables that make up the design, together with the statistical analyses to be made, will be given in detail later in this section.

The research programme was divided into three stages:

**Stage 1 (Occasion C1)**

This section of the programme was completed in two parts as outlined below:

**Part I**

This part of the research was undertaken during the period September 1975 - December 1975.

(i) Group testing of half the sample of poor readers \((N = 30)\), in two schools B1 and B2, on the Young's Group Reading Test.

(ii) Individual testing of children \((N = 30)\), oldest children tested first) on the following tests:


(b) Raven's Coloured Progressive Matrices.

(c) Burt-Vernon Graded Word Test.

The results obtained from the above battery of tests were then subjected to an analysis to determine whether there were any deficits in psycholinguistic functioning. Remedial programmes A1, A2 and A3
were then constructed. Sufficient remedial programmes were prepared for use in a programme of remedial teaching of two terms' duration.

Programmes A1 (Kirk)

Those were designed to remediate any specific psycholinguistic disabilities revealed in the profile analysis. They have been designated 'Kirk' programmes because they follow the training of isolated processes as advocated by Kirk and Kirk (1971).

Programmes A2 (Peabody)

These were constructed by taking a representative sample of activities from the Peabody Language Development Kits. They are global programmes as they stress overall language training rather than specific training in selected psycholinguistic processes.

Programmes A3 (Controls)

This was a Number programme consisting of very simple exercises, undertaken by the Control Group, designed to offset the Hawthorne Effect.

Part II

This section of the research programme was completed during the period September 1976 - December 1976. It was a repeat of the procedure outlined in Part I above, involving the second group of poor readers (N = 30) in schools B3 and B4. At the end of the testing programme the results were once again subjected to a profile analysis to determine whether or not there were any developmental imbalances in psycholinguistic growth. Remedial programmes A1, A2 and A3 were then constructed as before.
Stag II (Occasion C2)

This section of the research was carried out during the period January 1976 - July 1977.

Design of the 'Methods' Experiment

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<tr>
<th>School B1</th>
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<th>School B3</th>
<th>School B4</th>
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<tr>
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<td>C1 5 C2 5 C3 5</td>
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NB. Children have been shown allocated to ABC cells in respect of occasion C1 only.

The above design resembles a 3 (Programmes A) x 4 (Schools B) x 3 (Occasions C) factorial experiment with 36 cross classifications. It should be noted, however, that different levels of programmes and schools contain the scores of different pupils, while all the occasions contain the scores of the same pupils. Pupils, in other words, appear as an additional factor, one which is nested within programmes and schools, but which, within each of the cross classifications of programmes and schools is crossed with occasions. The design can, therefore, be classified as a four way model, since each score may be classified in four ways, i.e. as belonging to a particular programme (A), school (B), occasion (C), and pupil (P). (Lewis, 1970, p 130).

(i) The 15 poor readers in each of the four schools B1, B2, B3 and B4, were taken and randomly assigned to Programmes A1, A2, or A3 as shown in the matrix above.
(ii) Remedial teaching sessions in schools B1 and B2 began in January 1976 and continued until July 1976. The children on each programme received 2 x 45 minutes sessions of remedial teaching per week. The remedial sessions were supervised by a teacher from within each school released to do this by the writer taking over his/her duties.

(iii) Remedial teaching sessions in Schools B3 and B4 began in January 1977 and continued until July 1977. The organization and supervision of the remedial programmes was a repeat of the procedure as in (ii) above.

(iv) At the end of the remedial teaching programme in (ii) and (iii) above, all the children were retested for the second occasion (C2) on all the criterion tests.

Stage III (Occasion C3)

Six months after the cessation of remedial teaching the children were retested for the third occasion on all the criterion tests. Again, the same sequence in the testing programme was followed as in stages I and II above, i.e. the oldest children being taken first. This testing on the third occasion was in two parts:

(i) The final testing of 30 children in schools B1 and B2 was begun in January 1977.

(ii) The final testing of 30 children in schools B3 and B4 was begun in January 1978.

Statistical Treatment of Results

These will be analysed using an Anova design as follows:
(i) Three way analysis of variance
  Programmes A(3) x Schools B(4) x Occasions C(3).

(ii) Breakdown analyses of all the significant main effects, found in
  respect of the A and C variables, in the three way analysis above.

The following 24 analyses were carried out:

(a) 12 ITPA subtests, Mean Scaled Score, Composite PLA.

(b) Automatic and Representational Level of ITPA; Auditory-Vocal
  and Visual-Motor Channels; Reception, Association and Expression
  Processes.

(c) Burt-Vernon Graded Word Test, Young's Group Reading Test.

(d) Raven's Coloured Progressive Matrices Test.

Description of the Variables entering into the Design of the Experiment

The design of the experiment has been classified as a 3 (Programmes A)
  x 4 (Schools B) x 3 (Occasions C) factorial experiment. Each variable
  will now be described more fully:

**Remedial Programmes A**

The three programmes specified in the design, A1 (Kirk Programmes),
  A2 (Peabody Programmes), A3 (Control), are as follows:

**Programme A1**

These programmes were designated 'Kirk' programmes because they
  follow the training of isolated processes as advocated by Kirk and
  Kirk (1971). They believe that in dealing with learning disabilities
  the emphasis should be on intra-individual assessment suggesting
  remedial prescription. They assert that psycholinguistic deficits
  far from being innate and unalterable, can be ameliorated.
  Disregarding a deficit and developing other abilities to take its
place is compensation. Many psycholinguistic deficits found in children are probably due to disuse and lack of training rather than to neurological origins. Even among those whose disabilities are neurologically related it is likely that behavioural deficits become exaggerated because of avoidance and can be improved through remediation (Kirk, 1967). The aim of remedial programmes, therefore, should be to stimulate the functioning of those abilities in which the child is below par.

With these views of Kirk in mind, the patterns of abilities and disabilities of the children were examined that emerged through a profile analysis. A diagnostic hypothesis was then evolved which indicated the basic areas to remediate. Remedial programmes whose aim was to remediate the specific disabilities indicated by the analysis were then designed. Sufficient programmes were constructed for a remedial programme of two terms' duration. The rationale underlying the design and construction of the programmes is given on page 196, and the programmes are presented in Volume II pages 1-84.

**Programme A2**

These were designated "Peabody" because the remedial programmes utilized were taken from the Peabody Language Development Kits (Dunn and Smith, 1966). The PLDK is essentially a global approach to remediation and was designed primarily to stimulate overall language development of disadvantaged and retarded children. A secondary purpose was to develop their verbal intelligence. Emphasized is overall linguistic and cognitive development rather than the specific training of psycholinguistic processes. Like the ITPA, the PLDK is based on Osgood's linguistic theory. Manual 2 of the PLDK
consists of 180 programmes constructed from 24 different types of activity. This level is designed for children whose language ages are in the range 6 – 8 years. Twenty-five remedial lessons were prepared from the PLUK comprising a representative sample of the activities used in Manual 2. These remedial programmes are included in Volume II, pages 85-171.

Programme A3

This was a Number Programme undertaken by a control group of children. The aim of this was to offset the Hawthorne effect to be anticipated when an interested adult works with small groups of children using any materials. In order that linguistic factors might be excluded from the Number programmes, the children were given simple exercises and computations rather than oral work. The exercises were kept low in difficulty level so that the children would find them enjoyable and achieve some success. The number programme involved the following activities:

(i) Extension of ideas of number to include numbers between 20 and 100; addition and subtraction of numbers between 20 and 100.

(ii) The four operations: addition, subtraction, multiplication and division applied to number.

(iii) Patterns and relationship of numbers; Magic Squares, making patterns on 100 square.

(iv) Simple symmetry, symmetrical shapes using squared paper.

(v) Multiplication tables, building tables by means of block graphs.

(vi) Fractions; simple fractions of everyday life, i.e. $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$, $\frac{1}{16}$, $\frac{1}{12}$.

(vii) Sets and collections of things.
2. **Schools (B)**

Four schools B1, B2, B3 and B4 were involved in the study. The selection of the schools, followed by the description of each school, will then be outlined.

**Selection of the Schools**

The four schools used in the study were situated in the Eastern Section of the Metropolitan Area. For ease of administration the Child Guidance Service is divided into three Area Bases situated in the Northern, Southern and Eastern sections of the city. All the schools within the LEA are then allocated to one of these three areas. The area base of the Schools' Psychological Service to which the writer is attached is the Eastern Area. This area incorporates 73 First Schools. Not all of these schools, however, could be used in the investigation. Only those schools whose 7+ Infant Referral Return showed that 15 children or more achieved a reading quotient of less than 80 on the Young's Group Reading Test could be considered. This reduced the number of schools that could be used in the study to a total number of fifteen. From this pool of fifteen First Schools, four schools B1, B2, B3 and B4 were selected at random. The procedure of selecting schools in this way so that the school variable is a "random" effect is an important part of the design of this experiment. It enables one to generalize the experimental findings, arising from the experiment, to a wider population of schools than if the schools were not selected randomly. Further consideration to this point will be given in the statistical implications of the design that follows.

It was then necessary to approach the Director of Education, and Headteachers of the four schools to obtain their permission to conduct the research programme. It was explained that this would
involve their cooperation in:

(a) Making available a room in which the diagnostic testing and remedial teaching of a small group of children could take place.

(b) Allowing groups of children to be withdrawn from classes whenever required.

(c) Agreeing that a teacher from the school could teach the Remedial Programmes A. This was to be made possible by the writer taking over the teacher's duties, thereby releasing him to teach the programmes.

The Director of Education gave permission for the investigation to be carried out and the Headteachers readily agreed to cooperate. The writer had previously worked in three of the four schools as a Specialist Teacher of the School Psychological Service and was, therefore, known to some of the children and staff.

Description of the Selected Schools

School B1

Material Environment

A comparatively modern First School opened in 1965 and situated on a large corporation estate in an outer ward of the city. The school was a one story verandah type with a corridor running the entire length, off which run the classrooms. The school was very attractively decorated. The classrooms were pleasant, south facing, with large windows opening onto playing fields and gardens. There were two large halls, a library, medical room, drying room and television room. Surrounding the school were playing fields, gardens and the children's playground.
The estate from which the children were drawn was a large over-spill estate. There were five schools scattered throughout the estate. The estate constitutes one of the problem areas of the city. There were a large number of problem families living on the estate. Vandalism and crime was commonplace. Because of repeated acts of vandalism at the school an alarm system had been fitted. Many of the shops serving the estate had their windows boarded or bricked up. Social workers working amongst families had large case loads. Cases ranged from those which were designated family problems viz. financial, matrimonial, accommodation and child care problems. The houses on the estate were built in the 1930's and consisted of three or four bedroomed houses. Because the houses were considered to be lacking in basic modern amenities, a vast modernisation scheme was being undertaken with families being rehoused whilst this took place. The problems of the estate, though, seemed to lie not in the age or condition of the property, but in the inability of many of the residents to manage their affairs. Entertainment on the estate was catered for by public houses, social clubs and a bingo hall. There was a large playing field for the children. The school was designated as in an Educational Priority Area (E.P.A.).

The Children and Organization of the School

The majority of the children came from homes that were below the average in socio-economic status. Most of the parents had semi-skilled occupations. According to the headteacher nearly half the children came from broken homes and about the same proportion of children received free dinners. Many of the parents did not appear to have educational aspirations for their children, as shown by the interest they displayed in their children's education. The linguistic
development of the children was poor and many arrived at school with so little oral language as to almost constitute a language barrier. Ever since the school opened there had been a large proportion of children who failed to achieve satisfactory reading skills. At the age of 9 years when children transfer to a 'Middle School', many of them had reading ages below their chronological age. Because classes in the school were unstreamed, but were grouped according to their age, the younger children tended to be the poorer readers. A large proportion of these younger children at the age of 7+ years had not acquired the skills basic to reading. Many of the children exhibited a passive participation to the learning situation, others were restless and some were aggressive and maladjusted. Most children appeared anxious for adult acceptance as was reflected by mildly attention seeking behaviour. Children were often kept from attending school by their parents for trivial reasons and there was some truancy.

Since the granting of E.P.A. status the staffing at the school had become more stable and there was systematic teaching being carried out. Teacher morale, however, was not very high and the teacher expectation for pupil performance was low. The children were perceived by the teachers as being reluctant to learn with short attention spans. They were said to be happiest when working in a routine way such as copying from the blackboard or from books. There was a remedial teacher on the staff who took small groups of children on a withdrawal basis. No special strategies had been devised or adopted to cope with the severe reading problem within the school. There was a parent teachers association and meetings were held about four times a year. Teachers complained that parents of problem
children rarely attended the meetings. Apart from this there had been no other attempt to liaise with parents in ways which would engender their cooperation and interest in their children's education.

The reading schemes in use in the school were the Ladybird Gay Way and Griffin Series.

School B2

Material Environment

A school opened in 1937 and situated on a large corporation estate in an outer ward of the city. There were 383 children attending the school with an additional 70 children attending the Nursery Unit. Five other schools serving the estate were situated nearby. All six schools were designated as being situated in an E.P.A.

The school was a one story type built around a quadrangle with classrooms on four sides. The classrooms were pleasant with large windows from floor to ceiling and were reasonably well decorated. There were two halls, a library, a television room and a resources room. The Nursery Unit was housed in the nearby Community Centre. There was a playground to two sides beyond which ran a network of streets of the estate. At some distance from the school were some shared playing fields.

The estate, on which the school was situated, consisted of older three and four bedroomed houses together with some modern high rise flats. There was a general air of untidiness about the estate but none of the property fell into a Plowden category. On the fringe of the estate there was some private housing from which some
children attending school were drawn. There was a reasonable range of facilities on the estate including the community centre, three social clubs, two churches, a group medical practice, a branch library, public houses and a bingo hall. There was also a small shopping area.

As with other large estates of the city there was a problem with crime and vandalism. The school was frequently the target for vandals especially at weekends. There were problem families on the estate, some of these families being housed in certain streets, thereby causing them to achieve notoreity. Social workers had very large case loads, with a wide variety of family problems. These included the inability of a large number of residents to manage their affairs, cases of wife and child beating, and the problems of one parent families (usually mother).

The Children and the Organization of the School

The majority of the children attending the school were the children of unskilled or semi-skilled workers. Many of these children were severely handicapped by their home conditions. Over one third of the children were receiving free dinners. Large families, the occupation of their father, and the financial circumstances of their family resulted in a cumulative deprivation. Such deprived circumstances meant that a large proportion of the children started school with language deficiencies. Language development and vocabulary were unsatisfactory and at 7+ years of age many had severe reading problems particularly with the development of reading skills. Some children were seen by the teachers as lacking in interest, learning ability and social training. A good many were attention seeking and seemed anxious for adult and peer group acceptance. The homes and
environment from which the children came provided little support and stimulus for learning. Parental attitude to the educational process was apathetic. Many parents were reluctant to visit school when invited and appeared disinterested in the future progress of their children.

The school had a stable staff of devoted and hard working teachers. The morale of the staff was very good despite the special and additional demands made upon them. Starting with the nursery unit and extending into the infant school a conscious policy had been adopted towards improving the children's linguistic development. Of particular help had been in-service training courses on language development at the university, such as the one run by Joan Tough, which teachers had attended. With the older juniors failing in reading, daily remedial help was given to small withdrawal groups taken by a remedial teacher. The headmistress and her staff were making a determined effort to liaise with parents so as to increase parental involvement in school and in their children's education. Regular monthly activities were held in school to which parents were invited. At these, parents had been encouraged to provide conversational opportunities for their children and shown how to monitor their children's reading at home. Parents were also being encouraged to participate in the classroom. Some parents listened to children reading in school, others talked to small groups of attention seeking children. Some supervised picture painting, helped in the school library, or acted as escorts on journeys. In this way parents were being brought into a cooperative relationship with school and also encouraged to play a part in their own child's education.
School B3

Material Environment

A school built in 1904 situated in an inner ring of the city. The area was composed of a network of 'back to back' terraced houses, each street being hard to distinguish from the next one. The houses were built between 1890 and 1910 and most were privately owned. The houses were in various stages of decay, some being earmarked for demolition in the near future. Others were being carefully maintained with modern amenities and well kept gardens. Where some of the older houses had been demolished maisonettes had been constructed recently by the corporation.

There was some mobility of families in the area as some of the houses had been bought by young married couples as first homes, who then moved on into a better house after an initial period. But those parents with children presumably lacked the means to move into better accommodation so there was also a stable settled community in the area. There was some crime and vandalism in the area but this was not as serious a problem as on the larger corporation estates of the city.

The school, situated in the centre of densely populated streets, was a one story building with a central hall off which ran the classrooms. In order to increase the accommodation prefabricated classrooms had been built onto the main building. Though old the interior of the school was pleasantly decorated and the classrooms were bright and cheerful. Even so the rooms by present day standards were badly designed with windows set high in the walls. There was a lack of storage space for books, equipment and apparatus. Extensive work had been carried out inside to install hot water and indoor toilets. Surrounding the school was the playground, but the playing
fields were situated on a nearby park over one quarter of a mile from the school.

Children and Organization of the School

There were approximately 350 children attending the school. The majority of the children came from working class backgrounds with parents who were semi-skilled manual workers in the lower income brackets. However, most children appeared well cared for and arrived at school clean and well dressed. Despite this material welfare many of the children started school with language inadequacies including limited vocabulary and poor syntactical structure. Partly as a consequence of this there was a reading problem in the school and many children had reading ages which were below their chronological age. Some of the children were reluctant to learn, some were apathetic and some had short attention spans.

The school was led by an experienced Headmaster supported by a dedicated staff. The morale of the staff was good and teacher turnover in the school was low. Attempts had been made by the staff to develop a greater structure in the reading curriculum. This structure included daily practice on the reading scheme (Ladybird), a systematic approach to phonic skills, the preparation of a wide variety of materials, and the improvement of resources ranging from reading games to cassette tapes. There was a full time remedial teacher in the school who helped poor readers on a withdrawal basis.

As parental involvement in school activities had not been great, efforts were being made to foster stronger links between school and home. Parents were encouraged to visit school and discuss any
problems relating to their children's education. There was a flourishing P.T.A. with monthly held meetings. Educational activities were being instigated to which parents were invited. These were being well attended. Parents were being advised as to how best they could help their children benefit more from school. Discussions had taken place at evening activities to explain the aims and methods of the school. Parents were also encouraged to recognize and have confidence in their own capacity to teach their own children.

Although the school was not designated an E.P.A., the head felt that most of the criteria for conferring E.P.A. status were present in the environment from which his children were drawn.

School B4

Material Environment

The school was situated on a large corporation estate in an outer ward of the city. The estate was composed of property built in the early 1930's and to the same design. All the houses were in need of modernization and this was in progress. There was an air of dilapidation about the estate made worse by the fact that work was progressing on the houses. Some houses were empty ready for work to begin. In some of these windows had been broken, other windows had been boarded up. Rubbish and litter of all kinds was found in the gardens and streets. Young children played on the pavements and packs of mongrel dogs roamed around the streets. As with other large corporation estates in the city there was a serious problem with crime and vandalism. There were many problem families living on the estate and a high rate of family mobility.
The school which is one of four serving the estate was opened in 1934. It was a one story building with a large central hall, around which ran a corridor, off which ran the classrooms. Over four hundred children attended the school. In order to increase the accommodation prefabricated classrooms had been erected in the playground. The classrooms were well decorated with large windows opening on to the playground. The view from the windows, however, was uninspiring as the children looked out beyond the playground to the streets of the estate surrounding the school. Accommodation was very poor, all classrooms were in use, and the corridor was being used for display purposes. The school was designated as being in an E.P.A.

**Children and Organization of the School**

The majority of the children attending the school came from homes which were overwhelmingly working class with disproportionately large numbers of unskilled or semi-skilled workers. Many came from large families of five or six children, and there were some families with over twelve children. There was a high rate of marital instability amongst families and a high incidence of households headed by females. Over half the children received free dinners, and there was much absenteeism particularly with certain children. Many children were restless with an inability to persevere and a liking for easy moment-to-moment satisfaction. Anxiety for acceptance by adults and peers was great. Large numbers of children started school with serious language difficulties. For many communication in speech was an art to be acquired at school. A large proportion of children at the age of seven had not acquired the skills basic to reading. Most parents appeared apathetic to their children's educational progress and had little conception of what the school was trying to achieve.
The school was led by an experienced Headmistress supported by a dedicated staff of teachers. Despite the difficulties, teacher morale was very good and there was a low teacher turnover. The school was making a determined effort to improve the children's standards of literacy. A systematic programme of instruction had been devised involving the Scott Foresmann Programmes, Joyce Morris's, Language in Action and Breakthrough to Literacy Scheme.

Attempts were being made to foster a better relationship between home and school. Educational activities and open evenings were being held monthly to bring parents into school. At these meetings the aims and methods of the school had been explained, and parents were being encouraged to join in the educational process. In this way they had been helped to understand the process of language development in their children, and how they could play an active part in their children's language growth. These meetings had been very successful and at a recent open evening three hundred out of a total of four hundred parents attended.

Summary of the characteristics of the Sample

For the convenience of the reader, the characteristics common to the sixty children involved in the study are summarized below:

Basic Reading Skills

The children at 7+ years had acquired few of the skills basic to reading and the language development of many was inadequate. The majority of the children had virtually no working sight vocabulary. All of the children tested as having a reading quotient of 80 or
below on the Young's Group Reading Test.

**Individual Attributes**

Most of the children exhibited a high incidence of unfavourable attitudes to reading. Amongst those reported by the schools were the following:

(i) Poor motivation, lack of interest and apathy to the learning process. Poor work and achievement habits.

(ii) General restlessness and an inability to concentrate except for short periods. A liking for easy moment-to-moment satisfaction.

(iii) Attention seeking behaviour which ranged from mild to aggressive characteristics. Desire for adult and peer group acceptance.

(iv) Poor attendance record; children absent for trivial reasons.

(v) Children happiest working in a routine way, e.g. performing copying tasks from the blackboard or books.

**Home Circumstances**

Information was obtained from teachers, children themselves and available records. It should be pointed out that home variables can only be adequately studied by visiting homes and interviewing parents. As the writer did not undertake any home visits, the circumstances reported below could be a crude assessment of the home environment.

(i) Most children came from homes that were below average in socio-economic status. Parents were unskilled or semi-skilled workers.

(ii) Homes failed to provide early training in literacy, numeracy, and achievement habits, essential for their children to take full use of the opportunities offered at school.
(iii) Educational aspirations of parents for their children were low. Homes provided little support stimulus for learning.

(iv) Family size was above the average. There was much marital instability, and a high incidence of one parent families usually headed by females.

**School Conditions**

(i) Material school and classroom environments in all four schools was good.

(ii) The morale of the teachers in three of the four schools was very good. There was little staff turnover in any of the schools, thus ensuring continuity of teaching.

(iii) All children were being taught in classes containing less than thirty children.

(iv) Systematic teaching of reading was being carried out in three of the schools. Teachers in three of the schools had attended, or were attending, in-service courses on language development and reading.

(v) Remedial teaching was given to poor readers in all the schools.

(vi) Three of the schools were being very successful at fostering better home and school links.

**Use of Teachers to control Experimenter Bias**

As has been pointed out this study incorporates suggestions made by the external examiner of the 1973 study. The most important of these was the need to minimize experimenter bias. In the earlier study the intervention programmes had been taken by the writer. This left one open to the criticism that an experimenter in a comparative
methods experiment is subject to influences, in many cases of which he is unaware, which can bias the data so as to obtain a required directional effect. In order to control such biasing forces it was decided to approach four teachers, one in each of the four schools, to administer the programmes. This meant that the writer had to take over the teacher's duties in their respective schools thereby releasing them to take the groups. So as to minimize the disturbance of the organizational routine within the schools the class teachers of the children used in the study were invited to cooperate. In each of the four schools the class teachers agreed to assist. It was then explained that they would be required to administer three different programmes, each to a group of five children. Each group would receive 45 minutes of instructional time for 2 sessions per week. The intervention programmes, which had been prepared by the writer, were given to the teachers who were given adequate supervision to ensure that they followed them accurately. For the duration of the teaching period, both the administration of the programmes and the progress of the children was monitored on a lesson by lesson schedule.

Strategies were also introduced to control teacher bias. As with an experimenter's expectations inadvertently affecting the kind of result he obtains, teachers taking part in an experiment are also a source of error due to bias. If sufficiently motivated and inspired, it seems that a teacher may achieve outstanding results with almost any method in a short-term experiment. Furthermore, teacher attitudes or feelings about a research method can seriously influence the result. In this respect teachers are prone to give their own interpretations to instructions varying from them as they
think best. They may well give different emphases to certain skills than the writer intended. This teacher variable can partially be controlled by avoiding the stimulation of the knowledge that they are involved in a comparative experiment. The teachers, therefore, were given no indication that comparisons were being made between the methods. They were simply assigned the approach and given adequate supervision to ensure them following it accurately.

**Organization of the Treatment Groups**

The organization and supervision of the remedial groups was as follows. An identical procedure was carried out in each of the four schools.

The two treatment groups A1 and A2, together with the control groups A3, each received 45 minutes of instructional time for 2 sessions per week. The treatments were carried out over a two term period until 25 sessions had been taught. The programmes were administered during the morning. The programmes and times for each school session were as in the time-table shown below:

<table>
<thead>
<tr>
<th>Times</th>
<th>1st session</th>
<th>2nd session</th>
<th>3rd session</th>
<th>4th session</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.10-9.55 a.m.</td>
<td>A1</td>
<td>A2</td>
<td>A3</td>
<td></td>
</tr>
<tr>
<td>9.55-10.40 a.m.</td>
<td>A2</td>
<td>A3</td>
<td>A1</td>
<td></td>
</tr>
<tr>
<td>11.00-11.45 a.m.</td>
<td>A3</td>
<td>A1</td>
<td>A2</td>
<td></td>
</tr>
</tbody>
</table>

(* This allocation of groups to times was then repeated every 3 sessions until 25 sessions had been completed.)

Because it is sometimes argued that a child's response to the learning situation varies according to the time of the day, the treatment groups were taken at different times on successive sessions as shown in the time-table above.
3. **Occasions (C)**

This study is a longitudinal study one of the purposes of which is to examine how different groups of poor readers respond differently to a given treatment over a period of time. Time, therefore, as well as the treatments is an independent variable, the dependent variable being the psycholinguistic development of the children as sampled by the criterion tests. The treatments as well as the control activity have already been specified. The measures to sample the dependent variable have also been outlined. Three occasions were chosen in the design to explore the nature of the differential response. These are designated C1, C2 and C3 and are as follows:

**Occasion C1**

This refers to the pretest scores of the children (N = 60) on all of the criterion tests used to sample the dependent variable, as outlined in the Method. As this was a part-time study, the writer had to conduct the programme alongside his professional duties. This meant that the research programme had to be completed in two parts. In the first part, thirty children attending Schools B1 and B2 were tested on all the criterion tests during the period September 1975 - December 1975. The remaining children attending schools B3 and B4 were, likewise, administered pre-tests during the period September 1976 - December 1976. At the end of each testing programme a profile analysis was carried out on the data to identify any areas of deficit in psycholinguistic functioning. Remedial programmes A1, A2, and the control activity A3 were then constructed by the writer. Sufficient remedial programmes were prepared for use in a programme of remedial teaching of two terms' duration.
Past experience had shown that only 3-4 children could be satisfactorily tested on the ITPA during any one day. In an attempt to equalize the ages of the children, the children were always tested in the same sequence, i.e. beginning with the oldest children. This procedure was followed in the subsequent testing carried out in occasions C2 and C3.

**Occasion C2**

This refers to the post-test scores on all the criterion tests at the end of the treatment period. This took place in July 1976 in schools B1 and B2, and in July 1977 in schools B3 and B4. Differences in children's scores on the criterion tests between C2-C1 will indicate the nature of the changes in the dependent variable which can be ascribed to the effects of the independent variables. In this way one can explore the nature of the differential response of the groups to the given treatments over a period of time.

**Occasion C3**

This refers to the final testing of the children for the third occasion on all the criterion tests. The testing programme began after a period of six months had elapsed after the cessation of treatments. Again the testing was carried out in two parts, i.e. the final testing of thirty children in Schools B1 and B2 began in January 1977, and of the remaining thirty children in schools B3 and B4 in January 1978.

Differences in children's scores between occasions C3-C2 reflect the changes in the dependent variable over a period of time after the specified treatments had finished. One can examine the nature of any changes that occur and whether the treatment groups show the same
rates and patterns of change. Of interest is whether the rate of change of the dependent variable is positively accelerated, that is, increasing with time? Or, whether the rate of change is negatively accelerated, that is, decreasing with time?
Statistical Treatment of the Results
Statistical Treatment of the Results

Design of the Method's Experiment

<table>
<thead>
<tr>
<th>School</th>
<th>Programme A1</th>
<th>Programme A2</th>
<th>Programme A3</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>B2</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>B3</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>B4</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>

(N.B. Children have been shown allocated to ABC cells in respect of occasion C1 only.)

The model for the experiment is shown above. It resembles a 3 (Programmes A) x 4 (Schools B) x 3 (Occasions C) factorial experiment with 36 cross classifications. It should be noted, however, that different levels of programmes and schools contain the scores of different pupils, while all the occasions contain the scores of the same pupils. Pupils, in other words, appear as an additional factor, one which is nested within programmes and schools, but which, within each of the cross classifications of programmes and schools is crossed with occasions. The design can, therefore, be classified as a four way model, since each score may be classified in four ways, i.e. as belonging to a particular programme (A), school (B), occasion (C), and pupil (P). Lewis refers to this design as, "a design with Nesting and Crossing" (Lewis, 1968, pp 130-152).

Breakdown of variation in a three factor experiment

The breakdown of variation is shown in the figure below:
The between-cells sum of squares can be partitioned into the three main effects, Programmes (A), Schools (B), and Occasions (C). In addition there are sums of squares for the three first-order interactions (AxB), (AxC), and (BxC), and the sum of squares for one second-order interaction (AxBxC) between these effects.

The within-cells component is partitioned into two parts, one which represents the variation of pupils within the programmes x schools cross-classifications. The other part, the residual, is the pupils x occasions interaction within the programmes x schools cross-classifications.

The model for a single crossing of the nested factor

Lewis (1968) provides a model for a single crossing of the nested factor:

\[ x_{ijkl} = M + A_i + B_j + C_k + (AB)_{ij} + (AC)_{ik} + (BC)_{jk} + (ABC)_{ijk} + P_{iji} + (PC)_{ijk} \]

Where:

- \( M \) is a component common to all scores,
- \( A_i \) is a component common to all scores in level \( i \) of factor A,
- \( B_j \) is a component common to all scores in level \( j \) of factor B,
- \( C_k \) is a component common to all scores in level \( k \) of factor C,
- \( (AB)_{ij} \) is a component resulting from the interaction of level \( i \) of factor A and level \( j \) of factor B,
(AC)_{ik}^j: is a component resulting from the interaction of level \(i\) of factor A and level \(k\) of factor C,

(BC)_{jk}^i: is a component resulting from the interaction of level \(j\) of factor B and level \(K\) of factor C,

(ABC)_{ijk}^l: is a component resulting from the interaction of level \(i\) of factor A, level \(j\) of factor B, and level \(k\) of factor C,

\(P_{ij}^l\): is a component common to all the scores of pupil \(l\) of level \(i\) of factor A, and level \(j\) of factor B,

\((PC)_{ijkl}\): is a component specific to the score of pupil \(l\) of level \(i\) of factor A, and level \(j\) of factor B on occasion \(k\).

Generally \(i\) runs from 1 to \(a\), \(j\) from 1 to \(b\), \(k\) from 1 to \(c\), i.e. in this analysis \(a = 3\) (number of treatments), \(b = 4\) (number of levels of schools), \(c = 3\) (number of levels of occasions).

Note that the subscript \(l\) occurs only with the accompanying subscripts \(i\) and \(j\), so expressing the nesting of pupils within programmes and schools. In this experiment \(l\) runs from 1 to 5.

The ten contributions to the score \(X_{ijkl}\) are all independent of each other, and the \(A_5^2\), \(B_5^2\), \(C_5^2\), \((AB)_5^2\), \((AC)_5^2\), \((ABC)_5^2\), \(P\) within \((AB)_5\), and \(PxC\) within \((AB)_5\) are regarded as being drawn from normally distributed populations with means of zero and variance of: \(\sigma^2_A\), \(\sigma^2_B\), \(\sigma^2_C\), \(\sigma^2_{AB}\), \(\sigma^2_{AC}\), \(\sigma^2_{BC}\), \(\sigma^2_{ABC}\), \(\sigma^2_{P.AB}\), and \(\sigma^2_{PC.AB}\) respectively.

Components analysis for a four-factor experiment one factor being nested and singly crossed

In order to determine the correct error term for testing effects in the analyses, it is essential to carry out a full components analysis.
Before mean square expectations can be arrived at, consideration must be given to which of the main effects are fixed, and which of the main effects are random.

In this experiment the main effects are as follows:

Programmes A = Fixed effect
Schools B = Random Effect
Occasions C = Fixed effect

Programmes (A) and Occasions (C) are clearly fixed effects since they are not subject to sampling. Schools (B) however is a random effect, and the procedure for selecting the four schools involved in the experiment was explained earlier. This has been made an integral part of the design of the experiment, in order to make wider generalizations from the findings of the experiment.

For an experiment with one or more random effects, the choice of error term for any particular effect must be worked out systematically by writing down the full components analysis.

Lewis (1968) recommends that it is best to begin setting out the mean-square expectations from the bottom upwards (i.e. starting with the basic variation PxC, within AxB) on the assumption that all effects are random. Certain of the components in the mean-square expectations have then to be deleted. Schultz (1955) provides a convenient rule for doing this. This rule may be stated as follows:

1. Retain the last component in each line, the components designating the particular effect under consideration
2. Retain also the first component in each line
3. Of the remaining components delete those with any subscript representing a fixed effect other than the particular effect under consideration.
One further point, however, needs to be made respecting these deletions. A component can qualify for deletion in the case of nesting only in respect of subscripts preceding the dot. (These subscripts are referred to by Schultz (1955) as 'essential'.) A component is not deleted because of the fixedness of any effect specified by a subscript after the dot. The components for the case of all effects being random are shown below, the subsequent deletions for fixedness of effects A and C being indicated by oblique lines:

\[
\begin{align*}
A &: \sigma^2_{PC. AB+co} + \sigma^2_{P. AB+co} + \sigma^2_{ABC+pc} + \sigma^2_{AC+pc} + \sigma^2_{AB+pbc} \\
B &: \sigma^2_{PC. AB+co} + \sigma^2_{P. AB+co} + \sigma^2_{ABC+pc} + \sigma^2_{AC+pc} + \sigma^2_{AB+pbc} \\
C &: \sigma^2_{PC. AB+co} + \sigma^2_{P. AB+co} + \sigma^2_{ABC+pc} + \sigma^2_{AC+pc} + \sigma^2_{AB+pbc} \\
AXB &: \sigma^2_{PC. AB+co} + \sigma^2_{P. AB+co} + \sigma^2_{ABC+pc} \\
AXC &: \sigma^2_{PC. AB+co} + \sigma^2_{ABC+pc} \\
BXC &: \sigma^2_{PC. AB+co} + \sigma^2_{ABC+pc} \\
AXBXC &: \sigma^2_{PC. AB+co} \\
P, \text{ within } AXB &: \sigma^2_{PC. AB+co} \\
PXC, \text{ within } AXB &: \sigma^2_{PC. AB}
\end{align*}
\]

With the deletions indicated the mean square expectations arrived at are shown in the table:

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Degrees of Freedom*</th>
<th>Mean Square Expectations**</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>a-1</td>
<td>(\sigma^2_{PC. AB+co} + \sigma^2_{P. AB+co} + \sigma^2_{ABC+pc} + \sigma^2_{AC+pc} + \sigma^2_{AB+pbc} )</td>
</tr>
<tr>
<td>B</td>
<td>b-1</td>
<td>(\sigma^2_{PC. AB+co} + \sigma^2_{P. AB+co} + \sigma^2_{ABC+pc} + \sigma^2_{AC+pc} + \sigma^2_{AB+pbc} )</td>
</tr>
<tr>
<td>C</td>
<td>c-1</td>
<td>(\sigma^2_{PC. AB+co} + \sigma^2_{ABC+pc} + \sigma^2_{AC+pc} + \sigma^2_{AB+pbc} )</td>
</tr>
<tr>
<td>AXB</td>
<td>(a-1)(b-1)</td>
<td>(\sigma^2_{PC. AB+co} + \sigma^2_{P. AB+co} + \sigma^2_{ABC+pc} )</td>
</tr>
<tr>
<td>AXC</td>
<td>(a-1)(c-1)</td>
<td>(\sigma^2_{PC. AB+co} + \sigma^2_{ABC+pc} )</td>
</tr>
<tr>
<td>BXC</td>
<td>(b-1)(c-1)</td>
<td>(\sigma^2_{PC. AB+co} + \sigma^2_{ABC+pc} )</td>
</tr>
<tr>
<td>AXBXC</td>
<td>(a-1)(b-1)(c-1)</td>
<td>(\sigma^2_{PC. AB+co} )</td>
</tr>
<tr>
<td>P, within AXB</td>
<td>ab (p-1)</td>
<td>(\sigma^2_{PC. AB+co} )</td>
</tr>
<tr>
<td>PXC, within AXB</td>
<td>ab (p-1)(c-1)</td>
<td>(\sigma^2_{PC. AB} )</td>
</tr>
</tbody>
</table>

* These are written for a levels of A, b levels of B, c levels of C, and p levels of P within each of the ab cross-classifications of AXB.

** A and C are taken to be fixed effects, B and P are random effects.
It follows from an examination of the above table that the residual mean square (PxC, within AxB) is the correct error term for testing the (AxBxC) and (BxC) interaction effects. This follows since all the expectations for these effects involve only $\sigma^2_{PC,AB}$ plus the component specific to the effect itself.

Similarly the pupils mean square (P, within AxB) is the correct error term for the main effect B, and the first-order interaction (AXB).

The correct error term for the A effect is the (AXB) mean square, and for the C effect the (BxC) mean square.

This leaves the (AxC) interaction which has to be tested for significance against the (AXBxC) mean square.

**Further consideration of Error Terms**

Notwithstanding the implications of a component analysis, there are times when the use of another mean square is justified (Lewis, 1968, pp 149-150).

In the components analysis just described it has been shown, for example, that the correct error term for the A effect is the (AXB) interaction mean square. However, quite often in practice, the (AXB) effect might turn out to be below expectations: it has turned out to be less than that for the pupils mean square (P, within AxB).

$$F = \frac{\text{Mean Square for AxB}}{\text{Mean Square for P, within AxB}} \text{ estimates} \frac{\sigma^2_{PC,AB+\hat{C}}}{\sigma^2_{PC,AB+\hat{C}} + \sigma^2_{P,AB}}$$

which cannot be less than unity, even if $\sigma^2_{AB} = 0$. 
Significance tests based on the \((AxB)\) mean square will then be unduly optimistic, i.e. significant results will be obtained too frequently. The use of the pupils mean square \((P, \text{ within } AxB)\) as error term is then to be preferred.

Similar considerations would caution against the use of the mean square for the schools x occasions interaction \((BxC)\) as an error term when this turns out to be less than the mean square for \((PxC, \text{ within } AxB \text{ residual})\) - and also against the use of the mean square for the programmes x schools x occasions interaction \((AXBxC)\) when this is less than the residual mean square \((PxC, \text{ within } AxB)\).

### Table of Error Terms to be used in the Analyses

The appropriate error term for testing the significance of effects is summarized in the table below:

<table>
<thead>
<tr>
<th>Effect</th>
<th>Error Term to be used</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>(AxB) mean square. (If (AxB &lt; P, \text{ within } AxB) mean square, use (P, \text{ within } AxB))</td>
</tr>
<tr>
<td>B</td>
<td>(P, \text{ within } AxB) mean square</td>
</tr>
<tr>
<td>C</td>
<td>(BxC) mean square. (If (BxC &lt; PxC, \text{ within } AxB) mean square, use (PxC, \text{ within } AxB))</td>
</tr>
<tr>
<td>(AxB)</td>
<td>(P, \text{ within } AxB) mean square</td>
</tr>
<tr>
<td>(AXC)</td>
<td>(AXBxC) mean square. (If (AXBxC) mean square (&lt; PxC, \text{ within } AxB) mean square, use (PxC, \text{ within } AxB))</td>
</tr>
<tr>
<td>(BxC)</td>
<td>(PxC, \text{ within } AxB) mean square</td>
</tr>
<tr>
<td>(AXBxC)</td>
<td>(PxC, \text{ within } AxB) mean square</td>
</tr>
</tbody>
</table>

### Further analysis of the Data

In designing this experiment the limitation of the \(F\) test of significance has been taken into consideration. It is an overall test, one assessing the differences among the groups as a whole.
Where more than two groups are concerned, it does not follow that the difference between any particular two group means is significant at the same level.

For example, if in this experiment the variation between the three treatment groups on Programmes A1, A2, or A3 is significant, one cannot assume that the difference between any particular group means, e.g. A1 - A2 is significant at the same level. Differences between particular groups must be considered separately, such designed comparisons being more likely to lead to the detection of real differences than the indiscriminate testing of differences among the separate group means.

Of particular interest are the comparisons made between the three groups undergoing treatment on programmes A1 (Kirk), A2 (Peabody), and A3 (Controls). As the sum of squares for the A effect has 2 degrees of freedom (being based on the difference between 3 groups), the A effect can be partitioned into two separate components, each with a single degree of freedom as shown below:

\[
\text{Partition A variation} \quad (\text{d.f.} = 2)
\]

\[
\frac{(A1 - A2)}{2} \quad \text{d.f.} 1
\]

\[
\frac{(A1 + A2 - A3)}{2} \quad \text{d.f.} 1
\]

In this way specific comparisons can be made between the Kirk (A1) and the Peabody (A2) programmes. Also the mean variation derived from combining programmes A1 and A2 can be compared with A3 (Controls).

The variation among occasions can, also, be partitioned in the same way:

\[
\text{Partition C variation} \quad (\text{d.f.} = 2)
\]

\[
\frac{(C3 - C2)}{2} \quad \text{d.f.} 1
\]

\[
\frac{(C3 + C2 - C1)}{2} \quad \text{d.f.} 1
\]
The first component \((C_3 - C_2)\) provides information about what has taken place in the post-remedial period. It indicates the trend in the post-remedial period, whether any significant gains have been made, or whether any regression has taken place. The second component \(\left(\frac{C_3+C_2}{2} - C_1\right)\) enables one to compare the post-test means obtained on occasions C2 and C3 combined, with the pre-test means obtained on occasion C1. It is, therefore an indication of the effectiveness of remedial teaching in the short and long period combined.

Similarly the \((AxC)\) interaction variation can be partitioned into two components indicating the differential influence of programmes on occasions:

\[
\text{(A1-A2xC) d.f. 2} \quad \left[ \frac{(A1+A2-A3)}{2} \times C \right] \quad \text{d.f. 2}
\]

Statistical Analyses

The following 24 analyses will be carried out:

(i) Twelve ITPA subtests, Composite Psycholinguistic Age, Mean Scaled Score.

(ii) Automatic and Representational Levels of ITPA; Reception, Association, and Expression Processes; Auditory-Vocal and Visual-Motor Channels.

(iii) Burt-Vernon, and Youngs Group Reading Tests.

(iv) Raven's Coloured Progressive Matrices Test.
DESCRIPTION OF MEASUREMENT TECHNIQUES
Description of the Measurement Techniques

To each experimental and control subject there were three administrations of the following tests:

1. The Revised Illinois Test of Psycholinguistic Abilities
2. The Burt-Vernon Graded Word Test
3. The Young's Group Reading Test
4. Raven's Coloured Progressive Matrices Test

The above tests were selected because of their capacities for measuring changes in the experimental group's psycholinguistic development, reading skills, and non-verbal intelligence before and subsequent to presentation of specialised training.

As all the above instruments are well known tests, with which the examiners will be familiar, a description of their rationales is not thought to be necessary.

However, a detailed account of the rationale underlying the ITPA has been presented in Appendix C (pp. 392-414). This has been included for the benefit of any teacher who might consult this thesis. When Kirk constructed the ITPA he intended it primarily as a diagnostic test for the use of teachers. However, restrictions have been placed on the use of the ITPA in this country which rule out its use by teachers, unless they possess psychological qualifications, consequently it is used principally by educational psychologists. The majority of teachers are, therefore, unfamiliar with the ITPA and its rationale.
INTERPRETATION AND DISCUSSION OF RESULTS

PART I
Because of the nature of this research study the interpretation and discussion of the results are in two parts:

Part I - The determination of the psycholinguistic characteristics of the experimental group of children after the criterion tests had been administered on the first occasion (C1).

Part II - The examination and interpretation of the results after the remedial programmes had been carried out (i.e. occasions C1, and C2).

The procedure followed in Part I has been fully described on pages 130-133. However, for the convenience of the reader, the design of the method's experiment is presented again below, and the salient points of the method are summarised:

<table>
<thead>
<tr>
<th></th>
<th>School B1</th>
<th>School B2</th>
<th>School B3</th>
<th>School B4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>C1  C2  C3</td>
<td>C1  C2  C3</td>
<td>C1  C2  C3</td>
<td>C1  C2  C3</td>
</tr>
<tr>
<td>Programme A1</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Programme A2</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Programme A3</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>
It has been pointed out that this investigation was conducted by the writer on a part-time basis. This meant that the study took place during the writer's professional duties with the School Psychological Service. Because of this the L.E.A. would not permit the writer to complete the programmes in the four schools, simultaneously, in one academic year. Instead the investigation had to be completed, in two parts, in two academic years. Therefore, in the first year, the research involved only half of the experimental group of children (N = 30) attending schools B1 and B2. After the initial testing programme had been administered, a profile analysis was carried out to determine the developmental imbalances in psycholinguistic growth. Remedial programmes A1, A2 and A3 were then constructed to remediate any specific psycholinguistic disabilities revealed in the profile analysis.

This procedure had then to be repeated in the following year, involving the second group of children attending schools B3 and B4, the data being analysed exactly as before.

As the ITPA scores can be used to evaluate inter- and intra-individual differences, the results will be examined from both these points of view.
(1) **Interindividual Differences**

The interindividual approach compares the performance of the experimental group of children with that of children of the same age level comprising the normative group. The ITPA normative group was composed of approximately 1000 American children, who were selected as being of average mental and school achievement ability, socio-economic status, and sensory development. By implication, the children of the normative group exhibited no reading difficulties.

Tables 5 and 6 contain the mean and standard deviations of psycholinguistic age scores (PLA) and scaled scores (SS), obtained on the ITPA subtests, by the normative and experimental groups.

An inspection of Table 5 shows that the experimental group obtained significantly lower scores \( (p < .01) \), than the normative group, on ten of the ITPA subtests and composite PLA. As the composite PLA is a global measure, it is the most meaningful index from which to evaluate the overall level of psycholinguistic development of the experimental group. As the experimental group's composite PLA is 18.8 months below that of the normative group, this shows that they are functioning at a much lower level of language competence.

Substantial significant subtest deficits in PLA scores are recorded in: Auditory Closure (45.3 months), Visual Sequential Memory (34.7 months), Auditory Reception (31.5 months), Visual Association (25.0 months), Visual Reception (24.5 months), Grammatic Closure (23.6 months), and Auditory Association (22.6 months). Relatively smaller deficits are found in Sound Blending (10.1 months), Verbal Expression (10.3 months) and Auditory Sequential Memory (15.9 months).
Table 5

Comparisons of means and standard deviations of PLA's on ITPA subtests for the normative and experimental groups.

<table>
<thead>
<tr>
<th>ITPA Subtests</th>
<th>Normative Group</th>
<th>Experimental Group</th>
<th>Difference in Means</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean (x)</td>
<td>Standard Deviation (S.D.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Auditory Reception</td>
<td>97.9</td>
<td>20.14</td>
<td>66.4</td>
<td>12.73</td>
</tr>
<tr>
<td>Visual Reception</td>
<td>96.0</td>
<td>18.58</td>
<td>71.5</td>
<td>12.09</td>
</tr>
<tr>
<td>Auditory Association</td>
<td>94.5</td>
<td>13.81</td>
<td>71.9</td>
<td>9.61</td>
</tr>
<tr>
<td>Visual Association</td>
<td>94.8</td>
<td>17.14</td>
<td>69.8</td>
<td>9.38</td>
</tr>
<tr>
<td>Verbal Expression</td>
<td>93.9</td>
<td>20.49</td>
<td>83.6</td>
<td>11.42</td>
</tr>
<tr>
<td>Manual Expression</td>
<td>96.3</td>
<td>18.77</td>
<td>101.1</td>
<td>15.07</td>
</tr>
<tr>
<td>Grammatic Closure</td>
<td>95.3</td>
<td>14.58</td>
<td>71.7</td>
<td>11.53</td>
</tr>
<tr>
<td>Visual Closure</td>
<td>95.1</td>
<td>16.09</td>
<td>93.8</td>
<td>14.29</td>
</tr>
<tr>
<td>Auditory Memory</td>
<td>91.8</td>
<td>21.80</td>
<td>75.9</td>
<td>22.33</td>
</tr>
<tr>
<td>Visual Memory</td>
<td>94.1</td>
<td>20.01</td>
<td>59.4</td>
<td>10.48</td>
</tr>
<tr>
<td>Auditory Closure</td>
<td>92.3</td>
<td>17.68</td>
<td>47.2</td>
<td>6.30</td>
</tr>
<tr>
<td>Sound Blending</td>
<td>88.3</td>
<td>15.21</td>
<td>78.2</td>
<td>12.98</td>
</tr>
<tr>
<td>Composite PLA</td>
<td>94.6</td>
<td>9.18</td>
<td>75.8</td>
<td>6.85</td>
</tr>
<tr>
<td>I.Q.</td>
<td>101.8</td>
<td>7.88</td>
<td>97.33</td>
<td>9.45</td>
</tr>
<tr>
<td>C.A.</td>
<td>94.8</td>
<td>2.09</td>
<td>91.6</td>
<td>3.97</td>
</tr>
<tr>
<td>N</td>
<td>126</td>
<td>60</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

All the above psycholinguistic ages in months.

Probability levels determined by the use of 't' test of significance.
The experimental group, however, showed relative strength in the areas of Manual Expression and Visual Closure, where there was no difference between the two groups. In Manual Expression the experimental group scored slightly higher than the normative group, whilst in the Visual Closure, the scores of the two groups approximated closely.

In making these comparisons it must be emphasised that discrepancies as measured by PLA scores are deceptive and have serious limitations. This is because they do not take into account the differences in variability of the scores across age levels and subtests. For this reason scaled scores (SS), which take into account both group means and variances are more appropriate when comparing the performance of the two groups. ITPA subtest mean scaled scores for both experimental and normative groups are contained in Table 6. A 'z' test of the difference between the two group means forms the basis for judging deficits.

An inspection of table 6 shows that the mean SS of the experimental group is significantly lower than that of the normative group in respect of: Auditory Closure ($p < .01$), Visual Sequential Memory ($p < .01$), Grammatic Closure ($p < .05$), and Auditory Association ($p < .05$). The remaining eight subtest differences were all non-significant, as was the Composite Mean Scaled Score.

Looking at the part scores derived from each of the three dimensions (i.e. levels of organisation, channels of communication, and psychological processes), it will be seen that there are no significant level deficits, channel deficits, or process deficits.
### Table 6

Comparison of ITPA mean scaled scores between experimental and normative group

<table>
<thead>
<tr>
<th>Test Type</th>
<th>Mean Scaled Score</th>
<th>Deviation from Normative Mean</th>
<th>'Z' score</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auditory Reception</td>
<td>27.1</td>
<td>8.9</td>
<td>1.48</td>
<td>N.S.</td>
</tr>
<tr>
<td>Visual Reception</td>
<td>27.0</td>
<td>9.0</td>
<td>1.50</td>
<td>N.S.</td>
</tr>
<tr>
<td>Auditory Association</td>
<td>26.0</td>
<td>10.0</td>
<td>1.66</td>
<td>&lt; 0.05</td>
</tr>
<tr>
<td>Visual Association</td>
<td>27.3</td>
<td>8.7</td>
<td>1.45</td>
<td>N.S.</td>
</tr>
<tr>
<td>Verbal Expression</td>
<td>33.7</td>
<td>2.3</td>
<td>0.39</td>
<td>N.S.</td>
</tr>
<tr>
<td>Manual Expression</td>
<td>37.7</td>
<td>1.7</td>
<td>0.28</td>
<td>N.S.</td>
</tr>
<tr>
<td>Grammatic Closure</td>
<td>25.7</td>
<td>10.3</td>
<td>1.71</td>
<td>&lt; 0.05</td>
</tr>
<tr>
<td>Visual Closure</td>
<td>36.2</td>
<td>0.2</td>
<td>0.03</td>
<td>N.S.</td>
</tr>
<tr>
<td>Auditory Memory</td>
<td>32.1</td>
<td>3.9</td>
<td>0.65</td>
<td>N.S.</td>
</tr>
<tr>
<td>Visual Memory</td>
<td>22.3</td>
<td>13.7</td>
<td>2.28</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Auditory Closure</td>
<td>11.8</td>
<td>24.2</td>
<td>4.03</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Sound Blending</td>
<td>31.6</td>
<td>4.4</td>
<td>0.72</td>
<td>N.S.</td>
</tr>
<tr>
<td>Mean Scaled Score</td>
<td>29.7</td>
<td>6.3</td>
<td>1.06</td>
<td>N.S.</td>
</tr>
<tr>
<td>Reception</td>
<td>27.0</td>
<td>9.0</td>
<td>1.50</td>
<td>N.S.</td>
</tr>
<tr>
<td>Association</td>
<td>26.6</td>
<td>9.4</td>
<td>1.56</td>
<td>N.S.</td>
</tr>
<tr>
<td>Expression</td>
<td>35.7</td>
<td>0.3</td>
<td>0.05</td>
<td>N.S.</td>
</tr>
<tr>
<td>Representational Level</td>
<td>29.8</td>
<td>6.2</td>
<td>1.04</td>
<td>N.S.</td>
</tr>
<tr>
<td>Automatic Level</td>
<td>26.6</td>
<td>9.4</td>
<td>1.56</td>
<td>N.S.</td>
</tr>
<tr>
<td>Auditory-Vocal Channel</td>
<td>28.9</td>
<td>7.1</td>
<td>1.18</td>
<td>N.S.</td>
</tr>
<tr>
<td>Visual Motor Channel</td>
<td>30.4</td>
<td>5.6</td>
<td>0.93</td>
<td>N.S.</td>
</tr>
</tbody>
</table>

In the above table the normative mean scaled score for all ITPA subtests is 36 and the standard deviation is 6.
As the normative sample is a non-disabled reading group, it will be noted that Auditory Closure, Visual Sequential Memory, Grammatic Closure, and Auditory Association appear to discriminate between good and poor readers. With the exception of Auditory Association, all these subtests are at the automatic level of organisation. This result shows that the basic psychological deficiencies among children with reading difficulties are primarily at the automatic level rather than at the representational level of organisation.

Discussion on Individual Differences

The interindividual approach is relevant to the question: How does the child's performance on a subtest compare with the performance of other children of the same age?

The following reservations must be made when interpreting the significance of the above interindividual comparisons. Firstly, the children in the normative group are 3.2 months older, on average, than the children of the experimental group. Secondly, both Carroll and Chase, writing in the Seventh Mental Measurement Yearbook, have commented that the normative group is an unrepresentative sample being drawn from a population slightly above the U.S. national average in income and education. In contrast the majority of the children involved in this study are from homes that are well below average in socio-economic status. Furthermore, three of the four schools the children were attending were situated in E.P.A. areas.
These reservations aside however, the findings are in agreement with the considerable evidence accumulated by writers such as Templin (1957), Bernstein (1960), and Loban (1963, 1965), who have found that children from poor home backgrounds are relatively retarded in size of vocabulary, sentence length, and use of grammatical structure, the gap widening as they grow older (Deutsch, 1965). The recorded ITPA language age deficits in Composite PLA and ten of the subtests are an indication of how unfavourable environmental conditions affect the linguistic development of children who have been found to be of average mental ability on a non-verbal test. One must conclude that these children have been deprived of adequate linguistic experience.

The significant deficits of the experimental group in Auditory Closure ($p<.01$), Visual Sequential Memory ($p<.01$), Grammatic Closure ($p<.05$), and Auditory Association ($p<.05$) is in line with other research studies which, when comparing poor and good readers, have indicated that deficiencies are primarily at the automatic level rather than the representational level of organisation (Ragland, 1964; McLeod, 1965; Kass, 1966; Macione, 1969; Deese, 1971; and Celebre, 1971). In context here is the relevance of the ITPA to reading development. Some writers are critical of the ITPA because they claim it does not consistently identify patterns of subtest scores that are characteristic of poor readers (Clark, 1970; Spache, 1976; Newcomer and Hammill, 1976; and Salvia and Ysseldyke, 1978). In addition to this present study, the writer has carried out two earlier investigations into the psycho-linguistic disabilities of poor readers (Naylor, 1972; 1973). In each of these studies, the three experimental groups were comparable, exactly the same selection criteria being employed in formulating them.
Table 7 sets out the scaled score comparisons between experimental and normative groups for each of the three studies. The reader will note the almost identical pattern of subtest scores across the studies bearing in mind the fluctuations of sampling variability. Thus, Visual Sequential Memory ($p<.01$), and Auditory Closure ($p<.01$) have, in all three studies, differentiated between poor and good readers, whilst smaller deficits were recorded in Grammatic Closure ($p<.05$), and Auditory Association ($p<.05$) on two occasions. Also, across the studies a consistent pattern of strength was recorded in the areas of Manual Expression, Visual Closure, and Auditory Sequential Memory. The consistency of these results provides considerable support for the diagnostic validity of the ITPA. The fundamental premise that the ITPA can be used to identify deficits which underlie academic failure, in particular reading failure, is also supported.

(ii) Intraindividual Differences

The intraindividual approach is relevant to the question: How does the child's performance on each of the ITPA subtests compare with his overall performance? In making this comparison, a reference line should be established which reflects the child's typical performance. Such a reference line can be the mean scaled score or the median scaled score. The shape of the profile determines which of these represents the typical performance of the group. In the case of the experimental group in this study, the mean scaled score has been chosen for the reference line since the profile scatter is relatively symmetrical.
<table>
<thead>
<tr>
<th></th>
<th>1972 Study</th>
<th>1973 Study</th>
<th>Present Study</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Deviation</td>
<td>'Z' score</td>
</tr>
<tr>
<td></td>
<td>Scaled</td>
<td>from</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Score</td>
<td>Normative</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mean</td>
<td></td>
</tr>
<tr>
<td><strong>Auditory Reception</strong></td>
<td>30</td>
<td>6</td>
<td>1.0</td>
</tr>
<tr>
<td><strong>Visual Reception</strong></td>
<td>27</td>
<td>9</td>
<td>1.5</td>
</tr>
<tr>
<td><strong>Auditory Association</strong></td>
<td>27</td>
<td>9</td>
<td>1.5</td>
</tr>
<tr>
<td><strong>Visual Association</strong></td>
<td>26</td>
<td>10</td>
<td>1.67 &lt;0.01</td>
</tr>
<tr>
<td><strong>Verbal Expression</strong></td>
<td>32</td>
<td>4</td>
<td>0.66</td>
</tr>
<tr>
<td><strong>Manual Expression</strong></td>
<td>36</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Grammatic Closure</strong></td>
<td>29</td>
<td>7</td>
<td>1.16</td>
</tr>
<tr>
<td><strong>Visual Closure</strong></td>
<td>35</td>
<td>1</td>
<td>0.16</td>
</tr>
<tr>
<td><strong>Auditory Memory</strong></td>
<td>36</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Visual Memory</strong></td>
<td>22</td>
<td>14</td>
<td>2.33 &lt;0.01</td>
</tr>
<tr>
<td><strong>Auditory Closure</strong></td>
<td>14</td>
<td>22</td>
<td>3.67 &lt;0.01</td>
</tr>
<tr>
<td><strong>Sound Blending</strong></td>
<td>33</td>
<td>3</td>
<td>0.50</td>
</tr>
<tr>
<td><strong>Composite Mean</strong></td>
<td>30</td>
<td>6</td>
<td>1.0</td>
</tr>
</tbody>
</table>

| C.A.                     | 93.5mths   | 19.0mths    |               | 91.6mths   | 0mths      |               |            |            |               |
| I.Q.                     | 96         |            |               | 97         |            |               |            |            |               |
| R.A.                     | 4.8yrs     | 5.2yrs     |               | 4.5yrs     | 6yrs       |               |            |            |               |

* All other 'p' values non-significant
* All scaled scores to nearest integer
i.e., high scores in Manual Expression and Visual Closure balance low scores in Auditory Closure and Visual Sequential Memory.

Tables 8, 9, and 10 present the mean scaled scores of the experimental group on the ITPA subtests. Also shown are the deviation scores from the Group Mean, the percentage of normative children who exhibited this deviation score, and the probability that subtest scores are reliably different from the Group Mean.

Deviation scores on the various subtests are used to determine suspected deficits and assets in the children's psycholinguistic development. Negative deviation scores indicate liabilities. Positive deviation scores indicate assets. In general, the larger the absolute value of the deviation, the greater the probability that the discrepancy is both statistically and psychologically significant. In determining statistical significance deviation scores have been evaluated using the appropriate standard error of measurement for scaled scores, (Kirk et al, 1969, table 7 - 9, p. 116). In determining psychological significance the deviation scores have been compared with the distribution of deviations for average children (Kirk et al, 1969, tables 8 - 9, p.149). Statistical significance refers to the stability and accuracy of the measures while psychological significance relates to the diagnostic value of the difference. Statistical significance is a necessary condition but not a sufficient condition for psychological significance; some statistically reliable differences are not of diagnostic significance.

As has previously been explained, because of the design of this investigation, two profile analyses had to be carried out. This was necessary because in the first year the sub-group comprising only
Table 8

<table>
<thead>
<tr>
<th></th>
<th>Experimental Group in schools B1 + B2 (N = 30)</th>
<th>Experimental Group in schools B3 + B4 (N = 30)</th>
<th>Total Experimental Group (N = 60)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean SS</td>
<td>S.D.</td>
<td>Mean SS</td>
</tr>
<tr>
<td>Auditory Reception</td>
<td>26.7</td>
<td>4.8</td>
<td>27.4</td>
</tr>
<tr>
<td>Visual Reception</td>
<td>28.4</td>
<td>5.2</td>
<td>25.6</td>
</tr>
<tr>
<td>Auditory Association</td>
<td>27.7</td>
<td>4.4</td>
<td>24.2</td>
</tr>
<tr>
<td>Visual Association</td>
<td>28.7</td>
<td>4.6</td>
<td>25.8</td>
</tr>
<tr>
<td>Verbal Expression</td>
<td>33.9</td>
<td>3.7</td>
<td>33.4</td>
</tr>
<tr>
<td>Manual Expression</td>
<td>37.3</td>
<td>3.2</td>
<td>38.1</td>
</tr>
<tr>
<td>Grammatic Closure</td>
<td>27.0</td>
<td>7.0</td>
<td>24.4</td>
</tr>
<tr>
<td>Visual Closure</td>
<td>35.7</td>
<td>4.6</td>
<td>36.7</td>
</tr>
<tr>
<td>Auditory Memory</td>
<td>33.1</td>
<td>5.4</td>
<td>32.0</td>
</tr>
<tr>
<td>Visual Memory</td>
<td>22.1</td>
<td>5.1</td>
<td>21.1</td>
</tr>
<tr>
<td>Auditory Closure</td>
<td>12.7</td>
<td>5.2</td>
<td>11.0</td>
</tr>
<tr>
<td>Sound Blending</td>
<td>32.9</td>
<td>5.1</td>
<td>30.4</td>
</tr>
<tr>
<td>Reception Process</td>
<td>27.6</td>
<td>26.5</td>
<td>27.1</td>
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<tr>
<td>Association Process</td>
<td>28.2</td>
<td></td>
<td>25.0</td>
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<tr>
<td>Expression Process</td>
<td>35.6</td>
<td></td>
<td>35.8</td>
</tr>
<tr>
<td>Representational Level</td>
<td>30.5</td>
<td></td>
<td>29.1</td>
</tr>
<tr>
<td>Automatic Level</td>
<td>27.2</td>
<td></td>
<td>26.0</td>
</tr>
<tr>
<td>Auditory-Vocal Channel</td>
<td>29.7</td>
<td></td>
<td>28.2</td>
</tr>
<tr>
<td>Visual-Motor Channel</td>
<td>30.4</td>
<td></td>
<td>29.8</td>
</tr>
<tr>
<td>Group Mean Score</td>
<td>30.1</td>
<td>2.3</td>
<td>29.0</td>
</tr>
</tbody>
</table>

NB

Scores of children in schools B1 + B2 were compared with those of children in schools B3 + B4, using standard errors of measurement for ITPA scaled scores (Kirk et al, 1969, Table 7-9, p.116).

All the above ITPA subtest SS differences were found to be non-significant.
half the experimental group of children (i.e. the 30 children attending schools B1 and B2) was involved. Whilst in the following year the second sub-group, consisting of the remaining 30 children attending schools B3 and B4, was included. Table 8, therefore, records the scores for the two sub-groups and the total experimental group.

Table 9 presents the profile of the scaled scores for the first sub-group of experimental children in schools B1 and B2. An inspection of this table shows that statistically significant deviation scores are recorded in Auditory Closure (p<.01), Visual Sequential Memory (p<.01), Manual Expression (p<.01) and Visual Closure (p<.05).

The deviation score of -17 in Auditory Closure indicates atypical performance since less than one per cent of average children would exhibit a deviation score of this magnitude. This deficiency in Auditory Closure indicates discrepant psycholinguistic functioning and is considered a substantial discrepancy.

The deviation of -8 in Visual Sequential Memory also signifies a possible area of disability since only 10 per cent of average children exhibit a deviation of -8 or below. This deficit in Visual Sequential Memory, though less atypical than that in Auditory Closure, nevertheless, is indicative of a discrepant function and is considered a borderline discrepancy.

The performance in Manual Expression (deviation of +7) might be considered as an area of strength, since only about 11 per cent of normal children exhibit a deviation equal to or larger than +7.
### Table 9

ITPA subtest mean scaled scores and deviation scores for children in schools B1 & B2

<table>
<thead>
<tr>
<th>Test</th>
<th>Mean Scaled Score</th>
<th>Deviation Score</th>
<th>Percentage from table</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auditory Reception</td>
<td>27</td>
<td>-3</td>
<td>74</td>
<td></td>
</tr>
<tr>
<td>Visual Reception</td>
<td>28</td>
<td>-2</td>
<td>80</td>
<td></td>
</tr>
<tr>
<td>Auditory Association</td>
<td>28</td>
<td>-2</td>
<td>86</td>
<td></td>
</tr>
<tr>
<td>Visual Association</td>
<td>29</td>
<td>-1</td>
<td>85</td>
<td></td>
</tr>
<tr>
<td>Verbal Expression</td>
<td>34</td>
<td>4</td>
<td>72</td>
<td></td>
</tr>
<tr>
<td>Manual Expression</td>
<td>37</td>
<td>7</td>
<td>11</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Grammatic Closure</td>
<td>27</td>
<td>-3</td>
<td>87</td>
<td></td>
</tr>
<tr>
<td>Visual Closure</td>
<td>36</td>
<td>6</td>
<td>76</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Auditory Memory</td>
<td>33</td>
<td>3</td>
<td>70</td>
<td></td>
</tr>
<tr>
<td>Visual Memory</td>
<td>22</td>
<td>-8</td>
<td>10</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Auditory Closure</td>
<td>13</td>
<td>-17</td>
<td>no data available</td>
<td></td>
</tr>
<tr>
<td>Sound Blending</td>
<td>33</td>
<td>3</td>
<td>&quot;</td>
<td></td>
</tr>
<tr>
<td>Mean Deviation</td>
<td>4.9</td>
<td></td>
<td>76</td>
<td></td>
</tr>
<tr>
<td>Group Mean Score</td>
<td>30</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

N = 30

**NB**

Criteria for classifying abilities and disabilities as stated on ITPA Examiner’s Manual:

- Differences between the mean SS and a subtest SS of ± 7, ± 8, ± 9, are considered borderline discrepancies.
- A difference between the mean SS and a subtest SS of ± 10 or greater is considered a substantial discrepancy.
In the case of Visual Closure, however, the deviation of +6 though statistically significant is not psychologically significant. This is because 76 per cent of average children would achieve a deviation score of this size. This deviation, therefore, does not have diagnostic significance in differentiating from the performance of average children.

In the remaining subtest areas: Auditory Reception, Visual Reception, Auditory Association, Visual Association, Verbal Expression, Grammatic Closure, Auditory Sequential Memory, and Sound Blending, the experimental group's deviation scores are typical of those of average children, since from 70-86 per cent of average children exhibited similar deviation scores. The group's performance, on each of these subtests, indicates that they are developing evenly in all the above functions.

Table 10 presents the profile of scaled scores for the second sub-group of experimental children attending schools B3 and B4. A perusal of this table will show that the profile scatter of subtest scores is extremely similar to that of the first sub-group set out in Table 9.

The reader will note that the basic disabilities are again in the areas of Auditory Closure and Visual Sequential Memory. The deviation score of -18 in Auditory Closure is indicative of a substantial discrepancy, whilst the smaller deviation of -8 in Visual Sequential Memory is considered a borderline discrepancy. In the case of Auditory Association, however, the deviation score of -5, though statistically significant, is not psychologically significant.
### Table 10

ITPA subtest mean scaled scores and deviation scores for children in schools B3 & B4

<table>
<thead>
<tr>
<th></th>
<th>Mean Scaled Score</th>
<th>Deviation Score</th>
<th>Percentage from table</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auditory Reception</td>
<td>27</td>
<td>-2</td>
<td>74</td>
<td></td>
</tr>
<tr>
<td>Visual Reception</td>
<td>26</td>
<td>-3</td>
<td>80</td>
<td></td>
</tr>
<tr>
<td>Auditory Association</td>
<td>24</td>
<td>-5</td>
<td>86</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Visual Association</td>
<td>26</td>
<td>-3</td>
<td>85</td>
<td></td>
</tr>
<tr>
<td>Verbal Expression</td>
<td>33</td>
<td>4</td>
<td>72</td>
<td></td>
</tr>
<tr>
<td>Manual Expression</td>
<td>38</td>
<td>9</td>
<td>4</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Grammatic Closure</td>
<td>24</td>
<td>-5</td>
<td>87</td>
<td></td>
</tr>
<tr>
<td>Visual Closure</td>
<td>37</td>
<td>8</td>
<td>6</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Auditory Memory</td>
<td>32</td>
<td>3</td>
<td>70</td>
<td></td>
</tr>
<tr>
<td>Visual Memory</td>
<td>21</td>
<td>-8</td>
<td>10</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Auditory Closure</td>
<td>11</td>
<td>-18</td>
<td>no data avilable</td>
<td></td>
</tr>
<tr>
<td>Sound Blending</td>
<td>30</td>
<td>1</td>
<td>&quot; &quot;</td>
<td></td>
</tr>
<tr>
<td>Mean Deviation</td>
<td>5.5</td>
<td></td>
<td>90</td>
<td></td>
</tr>
<tr>
<td>Group Mean Score</td>
<td>29</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**N** = 30

*NB*

Criteria for classifying abilities and disabilities as stated in ITPA Examiner's Manual:

Differences between the mean SS and a subtest SS of ± 7, ± 8, ± 9, are considered borderline discrepancies.

A difference between the mean SS and a subtest SS of ± 10 or greater is considered a substantial discrepancy.
since 86 per cent of average children would achieve a deviation score of this magnitude.

Manual Expression is again found to be an area of strength, together with the group's performance in Visual Closure where the deviation score of +8 would only be achieved by about 6 per cent of average children.

In the remaining seven subtests: Auditory Reception, Visual Reception, Visual Association, Verbal Expression, Grammatic Closure, Auditory Sequential Memory, and Sound Blending, the deviations recorded are typical of average children. No special abilities or disabilities are indicated in these areas and the group is considered to be developing evenly in all of these functions.

It is clear from the above analyses that the profile of abilities, for each experimental sub-group, is virtually identical showing the same subtest patterns of strengths and weaknesses. This is best illustrated by the profile of the scaled scores for the two sub-groups, shown graphically on page 184. The graph concisely shows the similarity of each group's pattern of language abilities.

Also the abilities of the two sub-groups, in each of the three dimensions which the ITPA measures, is similar. It will be noted, from Table 8, that there is little difference between the performance of the sub-groups on the two levels of the test, or the two channels. Whilst for each sub-group, expression emerges as the strongest of the three processes.

All the results obtained so far have been derived from group analyses involving the two experimental sub-groups and the total
experimental group. One cannot assume, however, that diagnostic validity patterns observed in group studies are automatically applicable to the individual case. Inevitably group results mask the performance of the individual. An examination was made, therefore, of the strengths and weaknesses of each individual child in the experimental group in comparison with his own general level of psycholinguistic functioning. Each child's Mean Scaled Score was chosen as a reference point and Kirk's recommendations for classifying abilities and disabilities, as set out in the ITPA manual and reproduced as a footnote to Tables 11 and 12, was adopted. From Table 11 it will be seen that:--

1. All 60 poor readers had deficits in Auditory Closure, 58 children having substantial deficits, and 2 children borderline deficits.
2. Thirty eight children had deficits in Visual Sequential Memory, 20 children having substantial deficits, and 18 children borderline deficits.
3. Seventeen children had deficits in Grammatic Closure, 12 children having substantial deficits, and 5 children borderline deficits.
4. Relatively few deficits were recorded in the remaining ITPA subtests.

Whilst from Table 12 it will be noted that:--

1. Twenty-two children showed substantial ability in Manual Expression, and 20 children borderline ability.
### Table 11  
Patterns of psycholinguistic disabilities exhibited by children of the experimental group.

<table>
<thead>
<tr>
<th></th>
<th>Experimental Group in schools B1 + B2 (N = 30)</th>
<th>Experimental Group in schools B3 + B4 (N = 30)</th>
<th>Total Experimental Group (N = 60)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Substantial Disability</td>
<td>Borderline Disability</td>
<td>Substantial Disability</td>
</tr>
<tr>
<td>Auditory Reception</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Visual Reception</td>
<td>2</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Auditory Association</td>
<td>1</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Visual Association</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Verbal Expression</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Manual Expression</td>
<td>7</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Grammatic Closure</td>
<td>10</td>
<td>11</td>
<td>10</td>
</tr>
<tr>
<td>Auditory Closure</td>
<td>29</td>
<td>1</td>
<td>29</td>
</tr>
<tr>
<td>Sound Blending</td>
<td>-</td>
<td>1</td>
<td>-</td>
</tr>
</tbody>
</table>

**NB**
Criteria for classifying abilities and disabilities as stated in ITPA Examiner's Manual:—
Differences between the mean SS and a subtest SS of $\pm 7$, $\pm 8$, $\pm 9$, are considered borderline discrepancies.
A difference between the mean SS and a subtest SS of $\pm 10$ or greater is considered a substantial discrepancy.
<table>
<thead>
<tr>
<th></th>
<th>Experimental Group in schools B1 + B2 (N = 30)</th>
<th>Experimental Group in schools B3 + B4 (N = 30)</th>
<th>Total Experimental Group (N = 60)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Substantial Ability</td>
<td>Borderline Ability</td>
<td>Substantial Ability</td>
</tr>
<tr>
<td>Auditory Reception</td>
<td>-</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>Visual Reception</td>
<td>-</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>Auditory Association</td>
<td>-</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>Visual Association</td>
<td>-</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>Verbal Expression</td>
<td>1</td>
<td>4</td>
<td>-</td>
</tr>
<tr>
<td>Manual Expression</td>
<td>8</td>
<td>11</td>
<td>14</td>
</tr>
<tr>
<td>Grammatic Closure</td>
<td>-</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>Visual Closure</td>
<td>9</td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td>Auditory Memory</td>
<td>4</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Visual Memory</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Auditory Closure</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Sound Blending</td>
<td>4</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>

**NB**
Criteria for classifying abilities and disabilities as stated in ITPA Examiner's Manual:

Differences between the mean SS and a subtest SS of $\pm 7$, $\pm 8$, $\pm 9$, are considered borderline discrepancies.

A difference between the mean SS and a subtest SS of $\pm 10$ or greater is considered a substantial discrepancy.
It is clear that the results from the above individual analyses are in harmony with those from the group analyses, and indicate that poor readers appear to be deficient in automatic level skills.

**Discussion on Intraindividual differences**

Examination of the ITPA scores for the experimental group of sixty poor readers has revealed the following psycholinguistic profile:

A substantial discrepancy in psycholinguistic functioning was found in Auditory Closure and a borderline discrepancy in Visual Sequential Memory. Manual Expression and Visual Closure were considered areas of strength as in these subtests the children’s performance was equal to the normative groups. In terms of the remaining subtests, the psycholinguistic development of the experimental group was found to be developing evenly, albeit at a depressed level in relation to the normative group.

The identification of a distinctive pattern of psycholinguistic abilities in a group of children from a particular population of poor readers is of some importance, providing such a finding is not a consequence of sampling fluctuation or other source of error such as inadequate test administration or an invalid instrument. With reference to the first point, almost identical psycholinguistic patterning was found in two previous studies conducted by the writer, involving comparable experimental groups drawn from parallel infant referrals (Naylor, 1972; Naylor 1973). The extreme similarity of the profiles will be seen by comparing the patterns of psycholinguistic abilities from the three studies, shown graphically on page 189.
Comparison of Profiles for three Experimental Groups drawn from the same population and investigated in 1972, 1973, and 1980.
In a replication of the writer's (1972) study, Hinnells (1978) examined the psycholinguistic abilities of 36 poor readers attending E.P.A. schools in Salford. Hinnells reported that there was a reasonably strong resemblance between the total psycholinguistic performance of the Salford sample compared with the writer's sample. The Salford group showed a substantial deficit in Auditory Closure although no deficit in Visual Sequential Memory was observed. On the remaining ITPA subtests and Composite PLA the performance of the two groups was similar.

The above distinctive psycholinguistic profile obtained consistently in the three investigations conducted by the writer is in harmony with a considerable number of other studies which have found that poor readers exhibit characteristic patterns of subtest deficits. From 30 studies which investigated the diagnostic value of the ITPA for reading reported in the literature review (Table 2, p 105) the following researchers found that poor readers exhibit automatic level skill deficits (Bateman, 1963; Ragland, 1964; Kass, 1966; McLeod, 1967; Macione, 1969; Bartin, 1971; Celebre, 1971; Deese, 1971; Evans et al, 1976).

The evidence from this study, therefore, provides further support for the diagnostic validity of the ITPA. In particular Auditory Closure, and Visual Sequential Memory appear to have diagnostic validity for reading.

While acknowledging the support of these findings to the ITPA rationale, the following reservations must be borne in mind:
1. Much criticism has been directed at the ITPA's reliability, validity, and factorial structure. Because of these reported weaknesses, the ITPA's diagnostic, predictive, and programming values have been questioned by many (Weener, Barritt and Semmel, 1967; Ryckman & Wiegerink, 1969; Kaluger & Kolson, 1969; Hammill & Larsen, 1974; Newcomer & Hammill, 1976).

2. In reviewing evidence on the construct validity of the ITPA subtests, Newcomer & Hammill (1976) claim that the Visual Sequential Memory subtest appears to be totally lacking in construct validity. Certainly the Visual Sequential Memory subtest is one in which considerable experience in administration is essential before reliable results can be obtained.

3. In a survey of 40 studies into the predictive and diagnostic value of the ITPA, Newcomer & Hammill (1976) question the assumption that the ITPA can be used to identify deficits which underlie academic failure. On the evidence presented they conclude that neither Auditory Closure nor Visual Sequential Memory had diagnostic value for reading.

4. The writer has the following reservation concerning the Auditory Closure subtest. Some of the words used as test items, whilst familiar to American children, are clearly unfamiliar to British children, e.g., baseball, sidewalk, movie star, Easter bunny, candy bar. As all 60 experimental group children were in deficit in Auditory Closure it might be argued that this, in no small part, was a result of unsuitable test items. However, most of the unsuitable items occur in the second half of the test,
i.e., between items 15-30. As the experimental group's mean raw score was only 7 items, the test ceiling being 6 consecutive failures, it is thought that the group's performance would only be affected very marginally by unsuitable items and it is unlikely to have affected the substantial deficit recorded in Auditory Closure.

(iii) Summary of the Findings

For the convenience of the reader the findings relating to the psycholinguistic growth of the experimental group are summarised and can be stated as follows:

1. Pretesting showed the experimental group had the following characteristics:

   C.A. : \( \bar{x} = 91.6 \) months, S.D. = 3.97
   Burt RA : \( \bar{x} = 4.5 \) years, S.D. = 0.47
   Ravens I.Q. : \( \bar{x} = 97.3 \) S.D. = 9.45
   Composite PLA : \( \bar{x} = 75.8 \) months, S.D. = 6.85

   Thus considerable discrepancies exist between:
   CA - RA = 3.1 years; CA - LA = 15.8 months; MA - LA = 13.3 months.

2. Compared with the normative group:

   (a) the experimental group's ITPA subtest mean scaled scores showed deficits in:

       Auditory Closure (p<.01), Visual Sequential Memory (p<.01),
       Grammatic Closure (p<.05), and Auditory Association (p<.05).
No significant differences were observed in any of the remaining 9 ITPA subtests, although the experimental group's scores were lower on every subtest, with the exception of Manual Expression where their performance approximated to that of the normative groups.

(b) The experimental group was almost 19 months retarded in Composite PLA and was retarded in language age on every ITPA subtest \((p<.01)\), with the exception of Manual Expression and Visual Closure where their performance approximated to that of the normative groups.

3. The psycholinguistic development of the experimental group was found to be developing evenly in respect of all the ITPA subtests; levels of organisation of the test; channels of communication; and the psychological processes, with the exception of:

(a) Auditory Closure where a large substantial deficit was observed indicating discrepant psycholinguistic functioning in this area. All 60 children of the experimental group exhibited a deficit in this function, 58 children having substantial deficits and 2 children borderline deficits.
(b) Visual Sequential Memory where the group's negative deviation score was exhibited by less than 10 per cent of average children. This was considered a borderline discrepancy and signifies an area of disability. Fifty-four children obtained negative deviation scores in this function, 22 children recording substantial discrepancies and 16 children borderline discrepancies.

(c) Positive deviation scores were recorded in Manual Expression and Visual Closure. These were considered to be areas of strength as in these functions the experimental group's performance was comparable to that of the normative groups.

4. Almost identical psycholinguistic profiles were obtained in two previous studies carried out by the writer, involving comparable experimental groups drawn from parallel infant referral populations. (Naylor, 1972, 1973).

(iv) **Diagnostic Hypothesis**

In the light of these findings, relating to the psycholinguistic growth of the poor readers it was concluded that the basic disabilities are in Auditory Closure and Visual Sequential Memory. A correlative relationship between these psycholinguistic disabilities and lack of reading achievement is, therefore,
supported. A programme of training to ameliorate these disabilities was designed. The rationale and construction of the intervention programmes is described below.

(v) Rationale and Construction of the Remedial Programmes

The design and construction of the remedial programmes to ameliorate the basic disabilities in Auditory Closure and Visual Sequential Memory, as set out in the diagnostic hypothesis, is central to this investigation.

In the first year of the study, after the initial testing programme was completed involving the first experimental sub-group of children in schools B1 and B2, the first profile analysis was carried out. The details of this analysis have already been presented in Table 9 and the findings have been examined. The remedial programmes now to be described were planned as a result of this first analysis and then implemented.

In the following year the second analysis involving the second sub-group of children in schools B3 and B4 was conducted. As the evidence in Table 10 has shown, the pattern of sub-test deficits of the second experimental sub-group was identical with that exhibited by the first experimental sub-group. No revision of the remedial programmes was, therefore, necessary and these were administered to the second sub-group of children, as before.

The two main treatment programmes, the Peabody Programmes and the Kirk Programmes, are presented together in Volume II of this study. The reader is reminded again of their objectives:
Peabody Programmes

Twenty four programmes, drawn from a representative sample of activities given in Manual II of the Peabody Language Development Kits, stressing overall training in language development rather than the training of selected psycho-linguistic processes. These programmes can be examined in Volume II, pages 84 - 176.

Kirk Programmes

Twenty four programmes, designed by the writer, to ameliorate the deficits in Auditory Closure and Visual Sequential Memory revealed in the analyses. These programmes can be examined in Volume II, pages 1 - 83.

The rationale of the PLDK has been discussed in the literature review and, again, more fully in the appendices (pp 288-91) The objectives and construction of the Kirk Programmes will now be examined.

Objectives of the Kirk Intervention Programmes

When designing the Kirk Programmes, the writer kept the following fundamental objectives in mind:

(a) Motivation to Learn

Many primary level retarded children are often disinterested in activities related to learning the basic reading skills. In the early school years one can survive without being highly skilled in reading and many children fail to perceive why they should learn
to read effectively. The degree of interest in and amount of need for acquiring a skill, however, are important if learning is to be facilitated. In designing the programmes the following points were considered:

1. Nothing succeeds like success and nothing inhibits interest more than failure. Retarded children should be placed in situations in which they can perceive their performance as being very successful. Not only a history of success, but subsequent successful experiences will stimulate in children a desirable level of motivation.

2. If a child is pressed to achieve beyond reasonable expectations, failure is likely and he will quickly lose interest in participating and generalise negative attitudes to activities. Care was taken to ensure that the long- and short-term goals of the programmes were realistic and sensitive to the children's individual strengths and weaknesses.

(b) **Active Involvement**

Active involvement by the children will facilitate learning. If the children are not provided with opportunities to actively participate, boredom will result and the tendency for desired responses to be extinguished will increase. Active participation by the learner alerts the child to his importance in the teacher-learning process, it helps to focus the child's attention on the task in hand and provides a useful source of feedback. Even under optimum conditions in which the material is interesting and the child is
motivated, learning will become inefficient if the length of time for practice is prolonged and not determined according to the child's learning rate. In view of this, it was decided to divide the Kirk Programmes into two parts:

1. A training programme, conducted by the teacher, in which the children would receive training in specific areas.

2. Children's programmes, whose aims are to directly involve the child in activities based on the training programme above.

The time allocated to each lesson would be equally divided between the two parts of the programme. Switching the emphasis from a teacher orientated programme to a child orientated programme, would, it was hoped, make for more effective learning.

(c) **Reinforcement of Success**

In designing the programmes activities have been constructed so that the children can be successful, with consistent and immediate rewards provided for by an accurate performance. In this, the child's own feedback and monitoring system is important. In constructing the children's programmes, an attempt has been made to make them self-instructional, thereby incorporating feedback and self-correction mechanisms. To achieve this cues have been included in the programmes in the hope that the child through a feedback mechanism will be able to monitor his own response and assess its correctness. Initially the teacher will have to act as monitor for the children before they have a chance to practice and reinforce errors. Gradually, it is
hoped, children will develop their own feedback and evaluative strategies if adequate reinforcement is given.

(d) Overlearning of Material

Overlearning is defined as the practice of a task beyond the point of initial mastery. Retarded children do not have a complete understanding of a concept after having accurately responded on the first few occasions. Since retarded children often have difficulty in attention, short-term memory and association, there is a need for overlearning to be an integral part of any programme. Improvement in learning, retention, and transfer will be facilitated if overlearning has taken place.

Considerable overlapping of material and over-exposure of words has, therefore, been incorporated into the programmes so as to facilitate retention and transfer thereby increasing the children's response repertoire.

(e) Sequencing of Materials

Awareness of the need for sequential presentation of material is important in designing programmes for the learning disabled. Retarded children will learn more effectively if materials are programmed so that abrupt shifting between concepts and activities is minimised. All activities should move from simple to more complex situations. The material in the programme has, therefore, been carefully sequenced in a step-by-step progression of activities which do not require the children to make conceptual jumps.
Careful sequencing of material is also necessary to counteract retroactive and proactive inhibition. When learning material is too similar in character and presented initially at approximately the same time, there is an increased possibility that one learning task will interfere with another. Care has been taken to ensure that, in the initial learning, material with different characteristics has been presented in close temporal contiguity. After the children have developed an awareness of differences and similarities, material which is more similar in character can be presented. Gradually the similarity of the stimuli can be increased as the child's performance level increases.

Rationale of the Kirk Programmes

Twenty four programmes were constructed, twelve to remediate Auditory Closure and twelve to remediate Visual Sequential Memory. Each remedial programme was in two parts:

1. An oral programme conducted by the teacher and designed to train the children in a specific area.

2. Children's programmes, a programme of activities based on the oral lesson and designed to actively involve the child.

It was decided to train the deficient Visual Sequential Memory process first. It was hoped that the Visual Sequential Memory programmes would establish a basic sight vocabulary of 'Key' words, the ready recognition of which would then help the children with many of the sentence completion type exercises used in the Auditory Closure training.
The children's programmes were reproduced on foolscap size paper using a spirit duplicator. Colour was used extensively throughout the programmes both to code the exercises where appropriate, and also to make them more attractive to the children. As writing is thought to assist reading greatly, space was provided for the children to rewrite the whole sentence, as for example in the closure-type exercises which quite often required the child to supply only one word. The children were encouraged to use felt pens, in this way it was thought a stronger kinaesthetic image of the word would emerge, also they were allowed to select preferred colours in an attempt to make the task more satisfying. As the training programmes were completed they were stapled together in a folder to make a book. It was hoped that after preliminary instructions had been given by the teacher, the children would be able to complete the programmes with little further assistance. With small remedial groups, however, the teacher would be able to intervene before the child had a chance to practise and reinforce errors.

Visual Sequential Memory training programmes

The twelve programmes designed to remediate Visual Sequential Memory process gave training in the following areas:

Lesson 1: Visual-motor activities; training in visual patterns

Lesson 2: Visual sequencing; training in the sequential nature of patterns

Lesson 3: Train children in attending to visual detail

Lesson 4: Visual discrimination; the distinctive features of letters.
Lesson 5: Training in visual detail; emphasising letter combinations in words and sentences.

Lesson 6: Memory sequencing; training in the orientation and letter sequences of words.

Lesson 7: Memory sequencing; words of a sentence; rearranging jumbled sentences

Lesson 8: Training in visual matching and visual copying

Lesson 9: Visual Memory; recognition of 3 letter Key words

Lesson 10: Visual Memory; recognition of 4 letter Key words

Lesson 11: Visual Memory, recognition of 5 letter Key words

Lesson 12: Visual discrimination; training in discrimination between words of similar perceptual configurations.

The following points were considered important when designing the above programmes:

Visual Sequential Memory involves the ability to reproduce from memory sequences of visually received stimuli. According to Kirk, the child deficient in this function may have difficulty attending to visual details; may have difficulty remembering what he has seen and attended to; may be unable to read and spell; may have difficulty storing and retrieving information once learned (Kirk & Kirk, 1971, p. 137). Some children are able to remember and reproduce a design or form, but are unable to remember and reproduce a series of symbols in the sequence presented. It is this latter kind of visual memory that seems to be related to reading.

There are two general kinds of responses to be considered when working to improve the memory process: recognition and recall. Recognition responses refer to a less complex memory process that
entails choosing the correct answer from several possible choices. Recall is a higher level, more complex form of mental functioning, and demands more cognitive sophistication. Improvement of visual memory is facilitated through tasks that are based on short-term recall, be it a page of pictures, geometric forms, letters or words.

As the children in the study were all experiencing reading failure, one must decide whether it is better to train their visual sequential memory using shapes and patterns, or more directly using letters and words. Kirk (1971) recommends that for poor readers, who are deficient in visual sequential memory, it is preferable to give direct training using letters and words rather than in isolation with diamonds, squares and triangles (Kirk & Kirk, 1971, p.59). Coins (1958) found, after training 6-7 year old beginners for a term in perceiving and recording geometrical shapes and digits, that although their performance at this task improved it had no significant effect on reading performance. Vernon (1971) also is of the opinion that training in the discrimination of shapes other than letters is of little assistance; but training in the construction of words from isolated letters, in correct sequential order, might be valuable (Vernon, 1971, p.23). Spache (1976) also writes that training in visual memory and orientation may well prove very profitable if exercises are constantly pointed and shaped towards word and letter discrimination (Spache, 1976, pp38-39).

In view of these findings, after some preliminary training occupying the first three lessons in which geometric shapes and
objects were used, subsequent training programmes utilised letters and words directly.

Another point to be considered was, if words are to be used to train visual sequential memory directly, which words should be selected? Of help were the studies that have been carried out on word frequency lists: Thorndike (1944), Gates (1955), McNally & Murray (1968). As McNally and Murray's list of Key words is a basic sight vocabulary for British children, this was thought to be the most appropriate. The first 200 Key words, therefore, form the basis of the programmes, as these are the ones most frequently encountered in reading, the ready recognition of which is essential for the development of basic reading skills. The aim was to expose the children to as many of the first 200 Key words as possible, beginning with the highest frequency words, each lesson. Each of the children's programmes was designed to expose the children to between 30-50 words each lesson. Furthermore, there was considerable overexposure of the words used from programme to programme, to facilitate overlearning and thereby promote short-term recall.

A further strategy used in the training programme was borrowed from the Fernald (1943) method of teaching reading. Experiments have shown that a child can learn a list of words more efficiently if he vocalises the words than if he does not. In organising the remedial programmes, provision was made for the vocal and/or motor response when appropriate, so that the child would obtain internal and external feedback. Keeping in mind that the motor response of
vocalising and the feedback of Kinaesthesia as he writes aids the ability to visualise, the child was encouraged to look at the letter or word, trace it in the air, then write it and say it.

Auditory Closure training programmes

The twelve programmes designed to remediate Auditory Closure function gave training in the following areas:

Lesson 1: Training in automatic habits; encourage imitation of correct grammatical language.

Lesson 2: Automatic Closure; train the child to complete incomplete sentences.

Lesson 3: Grammatic Closure; repetitive exposure to the exceptions of language.

Lesson 4: Sound Blending; training at blending the sounds of three letter words with vowel sounds 'a' and 'e' in the medial position.

Lesson 5: Sound Blending; vowel sound 'i' in the medial position

Lesson 6: Sound Blending; vowel sound 'o' and 'u' in the medial position.

Lesson 7: Auditory Acuity; initial and final consonant discrimination; rhyming words.

Lesson 8: Consonant Discrimination; initial, final, and vowel discrimination.

Lesson 9: Auditory Closure; closure of related sequences; categorisation and classification.

Lesson 10: Evoking Automatic Responses; paired response to a stimulus word.

Lesson 11: Grammatic Closure; phrase and sentence completion.

Lesson 12: Closure of familiar words in incomplete form.
When designing the above programmes the following principles were considered important:

Auditory Closure is the ability to recognise and reproduce a word when only part of the word is presented. The closure or automatic functions evolve from the redundancies in the environment which lead to overlearned and unconscious associations like those that are necessary for correct grammatical construction, proper syntax, or sound blending. Some children are deficient in the ability to recognise and use common units of auditory experience when only parts of those units are presented or heard. For such a child, remediation should be directed toward helping him fill in the missing parts of what is partially heard. He must be helped to internalize certain redundancies from his experience. Some children learn these redundant units of experience more readily than others. According to Kirk, these redundancies include common sequences of phonemes in words; the sequence of numerals in learning to count; sequences of sounds common in the particular language he hears; the order of words in a sentence; grammatical habits of inflecting words; and idioms peculiar to the language. They include, at least tangentially, the ability to synthesize isolated sounds into a word as in sound blending (Kirk & Kirk, 1971, p.154).

In eliciting Auditory Closure, the likelihood that a specific response will be made is dependent upon such factors as:
(a) the frequency and recency with which the child has heard the expression;
(b) the number of alternatives possible;
(c) the position in the expression of the parts omitted;
(d) the number and length of the parts omitted; and
(e) the order of approximation to English phonetic and syntactic structure.

As it is very difficult to design programmes for the training of Auditory Closure that are uncontaminated with the Grammatical Closure function, training has been included to emphasise correct grammatical language. Overlearning at the automatic-sequential level has been deliberately sought in an attempt to give the children confidence to initiate oral language.

Many of the children's programmes have been based upon gestalt principles such as the use of sentence completion exercises and exercises involving the recognition of familiar words from their configuration. Not many authors in the remedial field provide particular suggestions for the development of the closure function. Nyklebust, whilst not specifically mentioning closure makes much use of sentence completion exercises, whilst Gillingham implements closure activities through her heavy emphasis on sound blending. In the visual field, the figure completion exercises of Frostig for training spatial relationships are also decidedly closure tasks.
(vi) **Relationship between reading and psycholinguistic abilities**

The psycholinguistic characteristics of the poor readers in this study are summarised again for the reader's convenience:

- **Chronological Age** = 91.6 months
- **Burt Vernon RA** = 4.5 years
- **Raven's IQ** = 97.3
- **Composite PLA** = 75.8 months

(a) Compared with the American normative group, the experimental subjects exhibited deficits in:
   - Auditory Closure (p < .01),
   - Visual Sequential Memory (p < .01),
   - Grammatic Closure (p < .05),
   - Auditory Association (p < .05).

(b) The psycholinguistic growth of the group was developing evenly in respect of all ITPA subtests, levels of organisation, channels of communication, and psycholinguistic processes, with the exception of:
   - Auditory Closure where a substantial disability was observed,
   - Visual Sequential Memory where a borderline disability was recorded.

(c) Almost identical psycholinguistic profiles were obtained in two previous studies conducted by the writer, involving comparable experimental groups drawn from parallel populations (Naylor, 1972; 1973).

The above results indicate that the poor readers in this study tended to have more deficits in psycholinguistic functioning at the Automatic
Level than in Representational Level operations. They had difficulty in closure-type tasks where they were asked to predict the whole from its parts, and also sequential memory tasks where they were unable to retain the order of a series of visually represented stimuli. These findings suggest that poor readers have difficulty accessing surface and not with accessing the deep structure of language. It appears that the Automatic-Sequential Level of the communication process is more closely related to the acquisition of reading skills than is the Representational Level of organisation. Osgood places an integration level within his communication model which involves the automatic and sequential memory aspects of communication. This needs to be thought of in terms of evocative integration in which short term memory processes are used and predictive integration which reflects past language experience. This may mean that beginner readers require more perceptual and memory-type activities than conceptual activities. While not all children with reading disability will exhibit these particular psycho-linguistic disabilities, it is suggested that such areas of dysfunction are ones which might be considered in planning for remediation of a reading problem. Breaking the code as Chall calls it may mean developing the Automatic Level.

Discussion

If one accepts the hypothesis that success in reading is related to Automatic Level functions, questions may be raised as to why this relationship should obtain and what are its implications.

Learning to read is frequently regarded as a sequential process developing from lower reading or decoding skills, through intermediate or language related skills, to higher or comprehension-based skills. For the beginner-reader seeking to establish a corpus of
sight words, reading is primarily a visual process with the emphasis on the graphic and perceptual features of language. As the reader becomes more skilled, it appears that less visual input is drawn upon and more non-visual information, such as syntactic and semantic cues, is utilized. Thus Smith (1969, 1970) asserts that fluent readers use 'immediate word identification' in the reading process, whereas beginner readers use 'mediated word identification'. He suggests that beginner readers construct 'distinctive features lists' of words and letters whereas fluent readers move straight to word identification and meaning. This implies a greater use of perceptual processes in the beginner.

Because perceptual-motor processes are thought to be important to early reading, many studies have investigated the relationship between Visual Sequential Memory and reading as it is thought that Visual Sequential Memory is vital to word recognition. A number of studies indicate that young children experience difficulty in the perceptual analysis of complex forms which may impede learning to read. These studies indicate that deficiencies in visual memory, in verbal memory for sequential order, and in matching spatial with temporal sequences, all characterise poor readers.

Thus Kass (1962), Doehring (1968), Guthrie and Goldberg (1972), King (1972), and Samuels and Anderson (1973) have found evidence for a relationship between reading and the performance of sequential memory tasks.

When comparing good and poor readers on short-term memory and visual discrimination tasks Lyle and Goyen (1973) have showed that the relative inferiority of the retarded readers was a function of slow processing of information, of faulty discrimination in responding, or of rapid decay of information from the memory system.

Bakker and Satz (1970) have shown that backward readers of seven to
thirteen years were significantly inferior to normal readers in remembering temporal order of presentation of letters and meaningful figures, but not of meaningless figures.

Other studies have found sequential processing is essential to the development not only of reading, but also of language and other academic skills. Hirshoren (1969) found that the best predictor of subsequent performance in reading, spelling and arithmetic was the Visual Sequential Memory subtest of the ITPA. More recently, Lunzer, Dolan, and Wilkinson (1976) found short-term memory for the presentation of a visual sequence to be the best predictor for success in word recognition and, to a lesser degree, in mathematical understanding. They concluded that the findings lend strong support to the view that significant progress in learning to read depends on the ability to discriminate between different sequential ordering of visual symbols and to retain a memory image of such sequences (Lunzer et al., p. 303).

One promising approach to investigating reading problems of children is based on recent work in psycholinguistics particularly information theory. Researchers in this field are specifically concerned with the learner's selecting, storing, processing and retrieving information. They have frequently stressed not only the limited capacity of the human information-processing system, but also the importance of subjective organization to recode stimulus inputs so as to maximise the amounts of relevant information that can be received, processed, and remembered (Broadbent, 1958; Ausubel, 1968; Bruner, Goodnow and Austin, 1956; Bruner, Oliver and Greenfield, 1966; Mandler, 1967). Human memory in this approach is viewed as an active process of organisation imposed by the learner on the stimulus input. It seems probable that language deficits including reading may be due in part to faulty or inefficient
processing of the stimulus input. If poor readers store information inefficiently, then relationships between words in storage are primitive relationships. As a result, it would be difficult for children to retrieve the information. By extending the memory capacity of poor readers we might improve their ability to process and organize reading material.

As mastery of oral language itself underlies the acquisition of reading, sociolinguistic factors are major determiners of reading disability (Deutsch, 1965; Bernstein, 1971). These writers argue that the difference between lower and middle class children seems to lie in the level of their syntactical organisation. The grammatical and structural aspects of language acquired automatically through repeated imitation and repetition in the middle class home appear to be deficient in lower class children. Because the experiential background of many children (such as those in this study) is impoverished, limitations are placed on their attaining an automatic and redundant language. It is the automatic sequential level of language function, particularly the closure function, that has a close relationship to the redundancy concept of language. There is much more automation in language usage than is commonly realized. Language is not random, it follows specific patterns. Because of these patterns, we are often able to guess correctly a missing word or letter on the basis of the words or letters that precede or follow it. As language becomes more structured, redundancy increases and correct prediction becomes easier. According to Goodman (1968), the redundancy concept is an important skill in the repertoire of the fluent reader.

Reading starts with the graphic display as input and ends with meaning as output. Goodman contends that the skilled reader goes directly from print to meaning without going through surface speech processes in between. He accomplishes this by sampling, relying on the redundancy of
language, and of his knowledge of linguistic constraints. Goodman claims that even beginning readers look for and use orthographic, syntactic and semantic redundancy in reading. It is important, therefore, to help children internalise the redundancies from their experience and develop automatic-responses. Despite this, current methods of teaching reading and reading materials pay little attention to the redundancy concept (Reid, 1973).

If language training is given, this raises the question of whether the training should be diffuse and based upon language structure or specific training based upon the graphic and perceptual features of language.

As has been emphasised, the diagnostic-remedial approach to learning disabilities, as advocated by Kirk, views allegedly deficient abilities as the proper focus of training.

The Peabody approach, however, is based upon language structure and language processing. It is a task analytic approach in which specific skills and subskills, considered necessary to achieve linguistic competence, are taught. The Peabody approach is representative of a growing trend in remedial education that shifts attention from the child’s strengths and weaknesses to the tasks that the child must learn.

It is hoped that some of these issues raised in the discussion above will be answered in Part II of this study.
STATEMENT OF RESULTS

PART II
Part II Of The Study

This section of the investigation relates to the interpretation of results obtained on the criterion tests after the remedial programmes, outlined in Part I, had been carried out.

The pattern of Part II will be presented as below:

Statement of Results

(i) Results of the Statistical Analysis

(ii) Examination of Inter- and Intraindividual Differences for the Experimental Group

(iii) Effect of the Remedial Work on Psycholinguistic Abilities, Reading Skills, and Non-Verbal Intelligence.
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* Significant at the 5 per cent level.
** Significant at the 1 per cent level.

A = Methods (3); B = Schools (4); C = Occasions (3).
Results of the Statistical Analyses

Introduction

The statistical analyses below have been carried out and will be reported on:

1. Three way analysis of variance involving: Programmes A (3) x Schools B (4) x Occasions C (3).
2. Breakdown analyses of significant main effects and interactions obtained in 1 above, in an attempt to detect real differences among the individual group means.

Procedure

The two analyses above have been carried out for each of the twenty four criterion tests below:

1. Twelve ITPA subtests; Composite Psycholinguistic Age; Mean Scaled Score.
2. Automatic and Representational Levels of ITPA; Reception, Association, and Expression Processes; Auditory-Vocal and Visual-Motor Channels.
4. Raven's Coloured Progressive Matrices Test.

Description of Tables

The following tables have been prepared for each of the twenty four criterion tests above:

1. Analysis of Variance data sheets for three way analyses.
2. Breakdown analysis data sheets.
3. Children's group mean scaled scores and standard deviations, in respect of the three treatment Programmes (Kirk, Peabody, and Control), in four schools, on three occasions.
Owing to the considerable number of tables involved (i.e. 72), it was thought that the most appropriate place to include these would be in the Appendix, rather than in the main body of the thesis. They have been presented in the Appendix, therefore, where they can be examined on pages 334-404.

Additional tables have been prepared, summarising data condensed from 3 above, and these have been included in the main body of the thesis.

Order of the Statistical Analyses

Owing to the large number of analyses those have been examined in the following order:

(a) Comparison of the Kirk (A1) and Peabody (A2) Programmes.
(b) Comparison of the Kirk and Peabody Programmes combined $(\frac{A1 + A2}{2})$ with the Control Group (A3).
(c) Comparison of pre-test means obtained on occasion C1 with post-test means combined $(\frac{C2 + C3}{2})$
(d) Examination of the significance of gains in the Post-Remedial Period.
(e) Comparison of the results in Schools B1, B2, B3 and B4.

Comparison of the effectiveness of the Remedial Programmes

In the experimental design section it has been outlined how, in order to isolate real differences among significant effects, a breakdown analysis would be carried out where appropriate. In the completed analysis of variance, therefore, all significant main effects concerning Programmes (A), have been replaced entirely by:

1. $(A1 - A2)$
2. $(\frac{A1 + A2}{2} - A3)$

The first component $(A1 - A2)$ compares the children's mean scores
on the Kirk and Peabody Programmes, whilst the second component 
\( \frac{A1 + A2}{2} - A3 \) compares the performance of the children on the 
Kirk and Peabody Programmes, combined together to form one group, 
with that of the Control Group.

In the analyses that follow, it must be emphasized that if 
either \((A1 - A2)\) or \(\left(\frac{A1 + A2}{2} - A3\right)\) have significant higher order 
interactions, then these take precedence in interpretation over the 
main effects of \((A1 - A2)\) and \(\left(\frac{A1 + A2}{2} - A3\right)\).

(a) **Comparison of the Kirk and Peabody Programmes**

The findings below, relating to the differences between the Kirk 
and Peabody Programmes \((A1 - A2)\), emerge from an inspection of the 
Analysis of Variance data sheets (Appendix pp 334-404).

1. There were no significant differences between the mean 
scores of the children on the Kirk and Peabody Programmes 
in respect of the following subtests:
   Auditory Reception, Visual Reception, Auditory Association, 
   Visual Association, Verbal Expression, Manual Expression, 
   Visual Closure, Auditory Sequential Memory, Sound Blending, 
   Composite PLA, Mean Scaled Score, Representational Level, 
   Reception Process, Association Process, Expression Process, 
   Visual-Motor Channel and Raven's Matrices.

2. Children on the Kirk Programmes performed significantly 
   better than children on the Peabody Programmes on the 
   following tests:
   Grammatic Closure \((p<.05)\), and Burt-Vernon Reading Test 
   \((p<.05)\).

As there are no significant higher order interactions in 
respect of the above, these findings are independent of 
schools \((B)\) and occasions \((C)\).
3. Children on the Kirk Programmes performed significantly better than children on the Peabody Programmes on: Visual Sequential Memory (p<.05), Auditory Closure (p<.01), Automatic Level of ITPA (p<.01), Auditory-Vocal Channel (p<.01), and Young's Group Reading Test (p<.05).
These findings though independent of schools (B) are not independent of occasions (C) as significant Programmes x Occasions (A1 - A2 x C) interactions occurred for all.

4. A significant first-order Programmes x Occasions (A1 - A2 x C) was found in respect of the following tests: Visual Sequential Memory (p<.05), Verbal Expression (p<.05), Auditory Closure (p<.01), Automatic Level of ITPA (p<.01), Auditory-Vocal Channel (p<.01), Mean Scaled Score (p<.05), and Young's Group Reading Test (p<.05).
Because of the significant first-order Programmes x Occasions (A1 - A2 x C) interaction, this means that the difference between A1 and A2 is not independent of C, and that any statement about the significant (A1 - A2) effect in (3) above must be qualified by the particular level of C involved. Until the Programmes x Occasions interaction has been examined, therefore, nothing useful can be said about the significant main effects in (3) above.

Interpretation of the Programmes x Occasions interaction
In order to facilitate the interpretation of the (A1 - A2 x C) interactions, tables of mean scores for the cross classification have been prepared and are set out below:
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Because the \((A_1 - A_2 \times C)\) mean square for the tests above is significant, we know that the A effect is not independent of the C factor. In other words the magnitude of the difference between A1 and A2 is not the same, within the limits of random variation for C1, C2 and C3.

An inspection of the cross classification tables shows that, the difference between the means of C1 and C2 for the A1 level is of much greater magnitude than the difference between the means of C1 and C2 for the A2 level.

Using the Visual Sequential Memory mean scores to illustrate this: the difference between the means of C1 and C2 for A1 = 13.5, and that for A2 = 3.5. It will be seen that the magnitude of these differences is not comparable.
By contrast the differences between the means of C2 and C3, for both A1 and A2 are much smaller and comparable in magnitude, than those between C1 and C2 above. Again, using the Visual Sequential Memory scores to illustrate, the difference in means between C2 and C3 for A1 = 0.1 scaled units, which compares with that for A2 = 0.2 scaled units.

It will be seen that this trend is fundamentally the same for all the above subtests, with the exception of Verbal Expression. In the remedial period (occasion C1 - C2) the children on both the Kirk (A1) and Peabody (A2) Programmes have achieved gains as a result of the treatment. The gains in respect of the Kirk Programmes, however, are significantly better than those of the Peabody Programmes, with the exception of Verbal Expression where the differences between C1 and C2 favour the A2 level.

In the post-remedial period (C2 - C3) either small regressions or small gains in mean scores are recorded, for both A1 and A2, and as these are comparable in magnitude they, therefore, do not differ significantly.

This differential effect of occasions on the Kirk and Peabody Programmes is the explanation of the (A1 - A2 x C) interaction.

Summary of Findings

The findings comparing the Kirk and Peabody Programmes can now be summarised:

1. Children on the Kirk Programmes performed significantly better than children on the Peabody Programmes on the following tests:

   Grammatic Closure (p<.05) and Burt-Vernon Reading Test (p<.05).

   These findings being independent of schools and occasions.
2. Children on the Kirk Programmes performed significantly better than children on the Peabody Programmes on:
Visual Sequential Memory (p<.05), Auditory Closure (p<.01),
Automatic Level of ITPA (p<.01), Auditory-Vocal Channel (p<.01),
and Young's Group Reading Test (p<.05).
The above effects whilst independent of schools are not independent of occasions and must, therefore, be qualified.
Examination of the Programmes x Occasions (A1 - A2 x C)
interaction has shown that they are only significant over occasions C1 - C2 (gains as a result of remediation), the differences between occasions C2 - C3 (post remedial period) are clearly not significant.

3. No significant differences were recorded between the performance of the two groups on the following tests:
Auditory Reception, Visual Reception, Auditory Association,
Visual Association, Verbal Expression, Manual Expression,
Visual Closure, Auditory Sequential Memory, Sound Blending,
Composite PLA, Mean Scaled Score, Representational Level,
Reception Process, Association Process, Expression Process,

(b) **Comparison of the performance of the children on the Kirk and Peabody Programmes with that of the Control Group**

The second component in the breakdown of variation analysis (i.e. \( \frac{A_1 + A_2}{2} - A_3 \)) relates to the difference between the mean scores of the children on the Kirk and Peabody Programmes combined (i.e. \( A_1 + A_2 \)) and the mean scores of the children in the Control Group (\( A_3 \)).
An inspection of the Analysis of Variance data sheets (Appendix pp 334-404) revealed the following findings:

1. There were no significant differences between the mean scores of the children on the Kirk and Peabody Programmes combined, and the mean scores of the Control Group, in respect of the following tests:

2. Children on the Kirk and Peabody Programmes combined performed significantly better than children in the Control Group on:
   Visual Sequential Memory (p<.05).
   As no significant higher order interaction occurs for this test, this finding is independent of schools (A) and occasions (B).

3. Children on the Kirk and Peabody Programmes combined performed significantly better than children in the Control Group on the following tests:
   Auditory Reception (p<.01), Visual Reception (p<.05),
   Auditory Association (p<.01), Visual Association (p<.01),
   Verbal Expression (p<.01), Grammatic Closure (p<.01),
   Visual Closure (p<.05), Auditory Closure (p<.01),
   Composite PLA (p<.01), Mean Scaled Score (p<.01),
   Automatic Level (p<.01), Representational Level (p<.01),
   Reception Process (p<.01), Association Process (p<.01),
   Expression Process (p<.01), Auditory-Vocal Channel (p<.01),
   Visual-Motor Channel (p<.01), Burt-Vernon Reading Test (p<.01),
   and Young's Group Reading Test (p<.01).
   These findings, though independent of schools, are not independent of occasions as a significant Programmes x Occasions interaction given in (4) below occurred for all.
4. A significant first-order interaction, \( \sqrt{\frac{(A_1 + A_2 - A_3)}{2}} \times C \) was found in respect of the following tests:

This first order interaction takes precedence in interpretation and must be examined before anything useful can be said about the significant main effects in (3) above.

Interpretation of Programmes x Occasions interaction

In order to interpret the Programmes x Occasions interaction, tables of mean scores for the cross classification have been prepared:

\[
\begin{array}{ccc}
A_1 + A_2 & 27.8 & 29.3 & 26.7 \\
2 & 25.7 & 22.6 & 19.6 \\
A_3 & 27.1 & 28.2 & 29.3 \\
2 & 26.9 & 24.0 & 22.0 \\
\end{array}
\]

Auditory Reception

\[
\begin{array}{ccc}
A_1 + A_2 & 27.3 & 31.6 & 29.5 \\
2 & 23.6 & 23.0 & 21.6 \\
A_3 & 27.5 & 29.7 & 28.6 \\
2 & 26.8 & 24.2 & 25.7 \\
\end{array}
\]

Auditory Association
<table>
<thead>
<tr>
<th></th>
<th>C1</th>
<th>C2</th>
<th>C3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Verbal Expression</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$A_1 + A_2/2$</td>
<td>34.0</td>
<td>38.5</td>
<td>37.4</td>
</tr>
<tr>
<td>$A_3$</td>
<td>33.2</td>
<td>32.4</td>
<td>31.2</td>
</tr>
<tr>
<td><strong>Visual Closure</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$A_1 + A_2/2$</td>
<td>37.2</td>
<td>41.2</td>
<td>42.4</td>
</tr>
<tr>
<td>$A_3$</td>
<td>35.2</td>
<td>34.2</td>
<td>34.6</td>
</tr>
<tr>
<td><strong>Composite PLA</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$A_1 + A_2/2$</td>
<td>77.7</td>
<td>92.6</td>
<td>100.3</td>
</tr>
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<td>$A_3$</td>
<td>72.1</td>
<td>75.3</td>
<td>80.6</td>
</tr>
<tr>
<td><strong>Reception Process</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$A_1 + A_2/2$</td>
<td>27.4</td>
<td>28.8</td>
<td>28.1</td>
</tr>
<tr>
<td>$A_3$</td>
<td>26.4</td>
<td>23.5</td>
<td>21.3</td>
</tr>
<tr>
<td><strong>Expression Process</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$A_1 + A_2/2$</td>
<td>36.2</td>
<td>38.7</td>
<td>37.9</td>
</tr>
<tr>
<td>$A_3$</td>
<td>35.2</td>
<td>34.6</td>
<td>33.4</td>
</tr>
<tr>
<td><strong>Grammatic Closure</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$A_1 + A_2/2$</td>
<td>27.0</td>
<td>29.0</td>
<td>26.7</td>
</tr>
<tr>
<td>$A_3$</td>
<td>23.1</td>
<td>19.8</td>
<td>14.2</td>
</tr>
<tr>
<td><strong>Auditory Closure</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$A_1 + A_2/2$</td>
<td>13.0</td>
<td>22.4</td>
<td>20.5</td>
</tr>
<tr>
<td>$A_3$</td>
<td>9.9</td>
<td>11.9</td>
<td>12.1</td>
</tr>
<tr>
<td><strong>Mean Scaled Score</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$A_1 + A_2/2$</td>
<td>30.3</td>
<td>33.3</td>
<td>32.6</td>
</tr>
<tr>
<td>$A_3$</td>
<td>28.2</td>
<td>27.2</td>
<td>25.8</td>
</tr>
<tr>
<td><strong>Representational Level</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$A_1 + A_2/2$</td>
<td>30.5</td>
<td>32.8</td>
<td>31.7</td>
</tr>
<tr>
<td>$A_3$</td>
<td>29.0</td>
<td>27.1</td>
<td>26.1</td>
</tr>
<tr>
<td><strong>Association Process</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$A_1 + A_2/2$</td>
<td>27.8</td>
<td>31.6</td>
<td>30.5</td>
</tr>
<tr>
<td>$A_3$</td>
<td>25.8</td>
<td>25.0</td>
<td>23.6</td>
</tr>
<tr>
<td><strong>Auditory-Vocal Channel</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$A_1 + A_2/2$</td>
<td>27.8</td>
<td>31.6</td>
<td>30.5</td>
</tr>
<tr>
<td>$A_3$</td>
<td>25.8</td>
<td>25.0</td>
<td>23.6</td>
</tr>
</tbody>
</table>
If one compares the difference between the means of $C_1$ and $C_2$ for the $\left(\frac{A_1 + A_2}{2}\right)$ level, with the difference between the means of $C_1$ and $C_2$ for the $A_3$ level, it will be seen that they are not comparable in magnitude, the difference in respect of the $\left(\frac{A_1 + A_2}{2}\right)$ level being much greater.

Comparing the difference between the means of $C_2$ and $C_3$ for the $\left(\frac{A_1 + A_2}{2}\right)$ level, with the difference between the means of $C_2$ and $C_3$ for the $A_3$ level, shows that they are comparable and much smaller than the ones above.

This feature is fundamentally the same for all the nineteen tests above. The magnitude of the difference between $C_1$ and $C_2$ is not the same for $\left(\frac{A_1 + A_2}{2}\right)$ and $A_3$, and this differential effect is the explanation of the interaction.

The reader will note that the children on the Kirk and Peabody Programmes combined have made considerable gains as a result of remediation, as is shown from the large increases in mean scores over occasions $C_1 - C_2$. Their progress over occasions $C_2 - C_3$ (post-remedial), however, is not so marked. In 6 of the 19 tests small gains occur
while in the remaining 13 tests small regressions in mean scores are recorded.

In contrast the Control Group, in all but 4 tests, show a progressive regression in mean scores during both the remedial period (occasions C1 - C2), and post-remedial period (occasions C2 - C3).

The significant differences observed between the Language Programmes combined and the Control Group, for the tests in (3) above, are clearly only valid over occasions C1 - C2. This is the only qualification that needs to be made in interpreting the significance of the main effect ($\frac{A_1 + A_2}{2} - A_3$), in (3) above.

**Summary of the Findings**

The findings, comparing the performance of the children on the Kirk and Peabody Programmes combined with that of the Control Group, are summarised below:

1. Children on the Language Programmes performed significantly better than children on the Control Programmes in respect of the following tests:
   
   (a) Visual Sequential Memory ($p<.05$), this finding being independent of schools and occasions
   
   (b) Auditory Reception ($p<.01$), Visual Reception ($p<.05$), Auditory Association ($p<.01$), Visual Association ($p<.01$), Verbal Expression ($p<.01$), Grammatic Closure ($p<.01$), Visual Closure ($p<.05$), Auditory Closure ($p<.01$), Composite PLA ($p<.01$), Mean Scaled Score ($p<.01$), Automatic Level ($p<.01$), Representational Level ($p<.01$), Reception Process ($p<.01$), Association Process ($p<.01$), Expression Process ($p<.01$), Auditory-Vocal Channel ($p<.01$), Visual-Motor Channel ($p<.01$), Burt-Vernon Reading Test ($p<.01$) and Young's Group Reading Test ($p<.01$).
The effects in (b) above, whilst independent of schools were not independent of occasions. An examination of the Programmes x Occasions interactions revealed that they were only valid over occasions C1 - C2 (gains as a result of remediation); the differences between occasions C2 - C3 (post-remedial period) were clearly not significant.

2. No significant differences were recorded between the performance of the two groups on the following tests: Manual Expression, Auditory Sequential Memory, Sound Blending and Raven's Matrices.

Effectiveness of Remedial Teaching

The effectiveness of the remedial teaching has been assessed by comparing the post-test scores with the pre-test scores for all the criterion tests. The reader is reminded that occasion C1 relates to the pre-test scores; occasion C2 relates to the post-test scores taken at the end of a period of twelve weeks remedial teaching; whilst occasion C3 relates to the post-test scores taken approximately 10 months after remedial teaching finished.

In order to make meaningful comparisons between pre-test and post-test scores all significant effects involving the occasions variable have been partitioned into two components:

1. \( \frac{(C_3 + C_2) - C_1}{2} \)

2. \( (C_3 - C_2) \)
The first component \( \left( \frac{C3 + C2}{2} - C1 \right) \) enables one to compare the post-test means obtained on occasions C2 and C3 combined, with the pre-test means obtained on occasion C1. It is, therefore, an indication of the effectiveness of remedial teaching in the short and long terms combined.

The second component \( (C3 - C2) \) provides information about the stability of the scores in the post-remedial period. It is based on the difference of mean scores obtained on occasion C3 and those obtained on occasion C2. It indicates the trend in the post-remedial period, whether any further significant gains have been made, or whether any regression has taken place.

(c) Comparison of Post-Remedial Scores with Pre-Remedial Scores

The findings relating to the \( \left( \frac{C3 + C2}{2} - C1 \right) \) variable, comparing the post-test mean scores for occasions C3 and C2 combined with the pre-test mean scores for occasion C1, are given below (see Appendix pp 317-387).

1. No significant differences were found, between the combined post-test mean score and the pre-test mean score, in respect of the following tests:
   Auditory Reception, Visual Reception, Visual Association,
   Manual Expression, Grammatic Closure, Representational Level,
   Reception Process.

2. Mean score on occasions C2 and C3 combined was significantly greater than the mean score on occasion C1, in respect of the following tests:
   (a) Auditory Sequential Memory \((p<.01)\), Sound Blending \((p<.01)\), and Raven's Matrices \((p<.05)\).
As no significant higher-order interactions occurred for the results in (a) above, these findings are independent of schools and programmes.

(b) Auditory Association (p<.01), Verbal Expression (p<.01), Visual Closure (p<.01), Visual Sequential Memory (p<.01), Auditory Closure (p<.01), Composite PLA (p<.01), Mean Scaled Score (p<.05), Automatic Level (p<.01), Association Process (p<.01), Expression Process (p<.01), Auditory-Vocal Channel (p<.01), Visual-Motor Channel (p<.01), Burt-Vernon Reading Test (p<.01), and Young's Group Reading Test (p<.01).

3. A significant Programmes x Occasions \( \frac{\sum A \times (C_3 + C_2 - C_1)}{2} \) was recorded for the following tests:
(For all the above tests p<.01, except for Mean Scaled Score where p<.05).

Once again the Programmes x Occasions interaction must be examined before any conclusions can be reached about the significant main effects in 2 (b) above.

**Examination of the Programmes x Occasions interaction**

Tables of mean scores for the \( \frac{\sum A \times (C_3 + C_2 - C_1)}{2} \) cross classification are given below:
<table>
<thead>
<tr>
<th></th>
<th>C1</th>
<th>C3+C2</th>
<th></th>
<th>C1</th>
<th>C3+C2</th>
<th></th>
<th>C1</th>
<th>C3+C2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auditory Association</td>
<td>27.2</td>
<td>29.9</td>
<td>34.6</td>
<td>37.2</td>
<td>28.0</td>
<td>30.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>27.3</td>
<td>31.1</td>
<td>33.4</td>
<td>38.7</td>
<td>25.3</td>
<td>25.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>23.6</td>
<td>22.3</td>
<td>33.2</td>
<td>31.8</td>
<td>23.1</td>
<td>17.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Visual Closure</td>
<td>36.4</td>
<td>41.7</td>
<td>21.8</td>
<td>35.2</td>
<td>14.5</td>
<td>29.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>38.0</td>
<td>41.8</td>
<td>24.7</td>
<td>28.3</td>
<td>11.6</td>
<td>13.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>35.2</td>
<td>34.4</td>
<td>20.6</td>
<td>26.7</td>
<td>9.9</td>
<td>11.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Composite PLA</td>
<td>77.0</td>
<td>96.5</td>
<td>30.2</td>
<td>33.4</td>
<td>28.3</td>
<td>35.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>78.3</td>
<td>96.4</td>
<td>30.3</td>
<td>32.4</td>
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</tr>
<tr>
<td></td>
<td>72.1</td>
<td>77.9</td>
<td>28.2</td>
<td>26.5</td>
<td>24.7</td>
<td>25.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Visual-Symbolic</td>
<td>27.8</td>
<td>29.4</td>
<td>36.4</td>
<td>38.0</td>
<td>28.6</td>
<td>32.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>26.9</td>
<td>30.1</td>
<td>36.0</td>
<td>38.5</td>
<td>27.0</td>
<td>29.4</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>25.7</td>
<td>24.2</td>
<td>35.2</td>
<td>34.0</td>
<td>25.8</td>
<td>24.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Association Process</td>
<td>30.1</td>
<td>34.5</td>
<td>7.0</td>
<td>29.5</td>
<td>7.9</td>
<td>25.4</td>
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<td></td>
<td>31.4</td>
<td>33.6</td>
<td>5.8</td>
<td>23.1</td>
<td>8.0</td>
<td>20.5</td>
<td></td>
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<td>10.8</td>
<td>8.1</td>
<td>15.5</td>
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<tr>
<td>Auditory-Vocal Channel</td>
<td>28.6</td>
<td>32.7</td>
<td>7.9</td>
<td>25.4</td>
<td>8.0</td>
<td>20.5</td>
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</tr>
<tr>
<td></td>
<td>27.0</td>
<td>29.4</td>
<td>8.0</td>
<td>20.5</td>
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<tr>
<td></td>
<td>25.8</td>
<td>24.3</td>
<td>8.1</td>
<td>15.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
An inspection of the cross classification tables shows that there is a differential effect of Programmes on Occasions for the above subtests. The reader will note that the difference between the means of C1 and $\frac{C_3 + C_2}{2}$ for both the A1 and A2 levels is quite marked, and though the difference for A1 is more often greater than the difference for A2, the two are generally comparable in magnitude.

By contrast the difference between the means of C1 and $\frac{C_3 + C_2}{2}$ for the A3 level shows that a regression has taken place for 9 of the above 15 subtests, whilst on the remaining 6 subtests recorded gains are only small and clearly insignificant.

Exceptions to this trend will be seen in the areas of Visual Sequential Memory, Auditory Closure, Grammatic Closure and the Automatic Level. In these instances, the difference in mean scores for the A1 level is significantly greater than the difference in mean scores for either the A2 or A3 level. This clearly reflects the training of the Kirk Group in Visual Sequential Memory and Auditory Closure function, with the resultant improvement in the Automatic Level.

Thus, for children on the Kirk Programmes, the remediation has been very successful with significant gains on all 15 subtests. For children on the Peabody Programmes the remediation has been less successful with significant gains recorded on 11 of the 15 subtests. By contrast the Control Group has made little progress on any subtest and in 9 instances has regressed.

Summary of the Findings

The findings, comparing the post-test mean for occasions C3 and C2 combined with the pre-test mean for occasion C1, are summarised below:

1. Post-test means combined were significantly greater than pre-test means in respect of the following tests:
(a) Auditory Sequential Memory (p<.01), Sound Blending (p<.01), and Raven's Matrices (p<.05).

The above effects are independent of schools and programmes.

(b) Auditory Association (p<.01), Verbal Expression (p<.01), Visual Closure (p<.01), Visual Sequential Memory (p<.01), Auditory Closure (p<.01), Composite PLA (p<.01), Mean Scaled Score (p<.05), Automatic Level (p<.01), Association Process (p<.01), Expression Process (p<.01), Auditory-Vocal Channel (p<.01), Visual-Motor Channel (p<.01), Burt-Vernon Reading Test (p<.01), and Young's Group Reading Test (p<.01).

The significant effects in (b) above, though independent of schools, were not independent of programmes as a significant programmes x occasions interaction occurred for all. On examination of this interaction it was shown that:

(i) Significant differences between post-test and pro-test means were valid for the A1 (Kirk) level on all the subtests in (b) above

(ii) Significant differences between post-test and pro-test means were valid for the A2 (Peabody) level on all the subtests in (b) above with the exception of Visual Sequential Memory, Auditory Closure, and the Automatic Level

(iii) The differences between the post-test and pro-test means for the A3 (Control) level did not reach significance in respect of any of the above subtests, and a regression was recorded in 11 instances.
2. No significant differences between post-test and pre-test means were found in respect of:
   Auditory Reception, Visual Reception, Visual Association,
   Manual Expression, Grammatic Closure, Representational Level,
   and Reception Process.

(d) **Examination of the Post-Remedial Progress**

The comparison of post-test means for occasion C3 with post-test means for occasion C2 provides information about the stability of the scores approximately 10 months after remediation had taken place. Of interest, in the post-remedial period, is whether the experimental groups continued to achieve gains in mean scores or whether regressions in scores had taken place. The findings below relating to the (C3 - C2) variable were obtained from the Analysis of Variance data sheets (Appendix pp. 317-387).

1. There were no significant differences between post-test means for occasion C3 and post-test means for occasion C2, in respect of the following tests:
   Auditory Reception, Visual Reception, Visual Association,
   Manual Expression, Visual Closure, Auditory Sequential Memory,
   Visual Sequential Memory, Auditory Closure, Sound Blending,
   Mean Scaled Score, Automatic Level, Representational Level,

2. Significant post-remedial gains in mean scores were found in respect of:
   (a) Composite PLA (p<.01), and Burt-Vernon Reading Test (p<.01)

   These findings are independent of schools and programmes as no significant higher-order interactions occurred.
(b) Young's Group Reading Test \((p<.01)\)

This result is independent of schools but not of programmes as a significant \((A \times C_3 - C_2)\) interaction occurred.

3. Significant post-remedial regressions in mean scores were found in respect of:

(a) Auditory Association \((p<.05)\), Verbal Expression \((p<.05)\), Association Process \((p<.05)\), Auditory-Vocal Channel \((p<.01)\), and Expression Process \((p<.05)\).

These findings are independent of schools and programmes as no significant higher-order interactions occurred.

(b) Grammatic Closure \((p<.05)\)

This result is independent of schools but not of programmes owing to a significant \((A \times C_3 - C_2)\) interaction.

4. A significant Programmes x Occasions \((A \times C_3 - C_2)\) interaction was recorded for the following tests:

Grammatic Closure \((p<.05)\), Visual-Motor Channel \((p<.05)\), and Young's Group Reading Test \((p<.05)\).

The above first-order interactions must be examined in order to detect differences of trend for the three levels of \(A\).

**Examination of the Programmes x Occasions Interaction**

Cross classification tables of mean scores are set out below for the \((A \times C_3 - C_2)\) interaction:

<table>
<thead>
<tr>
<th></th>
<th>C2</th>
<th>C3</th>
<th></th>
<th>C2</th>
<th>C3</th>
<th></th>
<th>C2</th>
<th>C3</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>31.5</td>
<td>29.5</td>
<td>A1</td>
<td>33.9</td>
<td>35.1</td>
<td>A1</td>
<td>22.3</td>
<td>28.5</td>
</tr>
<tr>
<td>A2</td>
<td>26.5</td>
<td>23.9</td>
<td>A2</td>
<td>33.9</td>
<td>33.4</td>
<td>A2</td>
<td>17.8</td>
<td>23.3</td>
</tr>
<tr>
<td>A3</td>
<td>19.8</td>
<td>14.2</td>
<td>A3</td>
<td>29.3</td>
<td>28.9</td>
<td>A3</td>
<td>13.9</td>
<td>17.1</td>
</tr>
</tbody>
</table>

Grammatic Closure | Visual-Motor Channel | Young's Group Reading Test
An inspection of the three cross classification tables above shows:

(i) In the case of Grammatic Closure the regression in mean scores between C3 and C2 for both A1 and A2, is comparable in magnitude and significantly less than the regression for A3.

(ii) For the Young's Group Reading Test the gain in mean scores for A1 and A2 is comparable in magnitude and significantly greater than the gain for A3.

(iii) For the Visual-Motor Channel whilst the A2 and A3 levels record regression in mean scores, the A1 level has achieved an overall gain.

It is these differences in trend between the three levels of A which underlie the interaction.

Summary of the Findings

The findings relating to the post-remedial (C3 - C2) period are summarised below:

1. Post-remedial gains were significant in respect of:
   (a) Composite PM (p<.01), and Burt-Vernon Reading Test (p<.01). These findings being independent of schools and programmes.
   (b) Young's Group Reading Test (p<.01).

   The above effect is independent of schools but not of programmes. An examination of the programmes x occasions interaction showed that it was only valid for the A1 and A2 levels (i.e. Kirk and Peabody treatments).

2. Post-remedial regressions in mean scores were significant in respect of:
   (a) Auditory Association (p<.05), Verbal Expression (p<.05), Association Process (p<.01), Expression Process (p<.05), and theAuditory Vocal Channel (p<.01). These findings
were independent of schools and programmes.

(b) Grammatic Closure (p<.05)

The above effect is independent of schools but not of programmes. An examination of the Programmes x Occasions interaction showed that the significant regression was only valid for the A3 (Control) level, this being much larger than the regression for either A1 or A2.

3. There were no significant differences in the post-remedial period in respect of:
Auditory Reception, Visual Reception, Visual Association,
Manual Expression, Visual Closure, Auditory Sequential Memory,
Visual Sequential Memory, Auditory Closure, Sound Blending,
Mean Scaled Score, Automatic Level, Representational Level,

Small gains or regressions in mean scores were recorded for the above 15 subtests in the post-remedial period. These were distributed as follows for the three levels of A:

(i) A1 (Kirk) level recorded gains on 8 subtests and regressions on 7 subtests;
(ii) A2 (Peabody) level recorded gains on 4 subtests and regressions on 11 subtests;
(iii) A3 (Control) level recorded gains on 4 subtests and regressions on 11 subtests.

(e) Comparison of the results in Schools B1, B2, B3 and B4

The findings comparing the performance of the children in the four schools B1, B2, B3 and B4 are set out below:

1. The performance of the children in the four schools differed significantly in respect of the following tests:
Auditory Association (p<.05), Visual Association (p<.05), and Composite PLA (p<.05).
The above findings are independent of programmes and occasions as no significant higher-order interaction occurred.

2. No significant differences between the performance of the children in the four schools were found for any of the remaining twenty-one criterion tests.

3. No significant higher-order interactions (i.e. A x B, B x C) were found for any of the twenty-four criterion tests.

As there are only three significant main effects involving the schools (B) variable, a breakdown analysis has not been carried out. It is not possible, therefore, to say whether there are real differences between the individual group means for the four schools, although as significance was reached in (1) above, there is an overall difference.

The fact that there are only three significant effects involving the B variable and, in particular, no significant programmes x schools (A x B) interaction for any of the 24 criterion tests, adds weight to any of the findings that emerge from this study. With the exception of the above three tests in (1) above, the results of this study are independent of schools. For each of the three levels of A, the trend of results across the schools was extremely similar over the entire experiment.
(ii) Examination of Interindividual and Intraindividual Differences for the Experimental Group

The ITPA was designed as a test of differential diagnosis to interpret results from two points of view, (a) intraindividual differences, (b) interindividual differences.

The intraindividual approach compares the child's performance on various subtests with each other and indicates discrepancies in growth and developmental imbalances within the child himself.

The interindividual approach compares children's scores with the performance of children of similar chronological age and provides information relative to the child's position in the normative group.

The pre-test and post-test scores of the three experimental groups will be examined from each point of view. Each group will be considered separately as follows: (a) Kirk Group, (b) Peabody Group, and (c) Control Group.

Description of Tables

In order to facilitate the investigation of inter- and intraindividual comparisons for the three experimental groups, tables have been prepared which summarise and condense the data from the statistical analyses presented in the appendix. The following tables have been prepared for each one of the three experimental groups:

(i) Comparison of Pre-Test and Post-Test Scaled Scores on ITPA and other criterion tests obtained by children on the Kirk/Peabody/Control Programmes.

(ii) Mean Language Age Gains on ITPA by children on the Kirk/Peabody/Control Programmes.
(iii) Comparison of ITPA mean scaled scores with composite mean scaled score obtained on the final test by children on the Kirk/Peabody/Control Programmes.

(iv) Comparison of ITPA Subtest Final Language Ages obtained by the Kirk/Peabody/Control Group with those of the Normative Group.

(v) Profile of scaled scores, obtained on three occasions, for children on the Kirk/Peabody/Control Programmes.

It should be pointed out that for making comparisons across test scores, or between experimental groups, scaled scores are the most appropriate. A scaled score of 36 (with a S.D. of 6) indicates the mean performance of each and any age group of the referral population on each of the twelve ITPA subtests. These scores are, therefore, comparable to each other; the scaled score for any subtest or any group can be directly compared to any other.

Tables which set out Mean Language Age gains on the ITPA subtests have also been prepared as in (ii) and (iv) above. It should be remembered, however, that psycholinguistic ages (PLAs) in respect of the ITPA subtests do not take into account the difference in variance occurring from test to test and age to age. They cannot, therefore, be compared directly as can scaled scores. They have been included because it is customary on most tests of academic achievement to express performance in age scores. They are useful in that they can be compared with CA to evaluate comparability of level of general psycholinguistic development.

(a) Kirk Group - Intraindividual Differences

Table 13, overleaf, compares the pre-test and post-test scaled scores on the ITPA and other criterion tests in respect of the Kirk
Comparison of Pre-Test and Post-Test Scaled Scores on ITPA and other criterion tests obtained by children on the Kirk Programmen.

<table>
<thead>
<tr>
<th></th>
<th>Mean Scores on Occasion 1</th>
<th>Mean Scores on Occasion 2</th>
<th>Mean Scores on Occasion 3</th>
<th>Gain at end of RT</th>
<th>Gain after RT ended</th>
<th>Total Gain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auditory Reception</td>
<td>26.50</td>
<td>29.25</td>
<td>26.60</td>
<td>2.75</td>
<td>-2.65</td>
<td>0.10</td>
</tr>
<tr>
<td>Visual Reception</td>
<td>25.45</td>
<td>26.35</td>
<td>29.05</td>
<td>0.90</td>
<td>2.70</td>
<td>3.60</td>
</tr>
<tr>
<td>Auditory Association</td>
<td>27.20</td>
<td>30.85</td>
<td>28.95</td>
<td>3.65</td>
<td>-1.90</td>
<td>1.75</td>
</tr>
<tr>
<td>Visual Association</td>
<td>28.30</td>
<td>28.65</td>
<td>29.0</td>
<td>0.35</td>
<td>0.35</td>
<td>0.70</td>
</tr>
<tr>
<td>Verbal Expression</td>
<td>34.65</td>
<td>37.65</td>
<td>36.80</td>
<td>3.0</td>
<td>-0.85</td>
<td>2.15</td>
</tr>
<tr>
<td>Manual Expression</td>
<td>38.35</td>
<td>39.20</td>
<td>38.70</td>
<td>0.85</td>
<td>-0.50</td>
<td>0.35</td>
</tr>
<tr>
<td>Grammatic Closure</td>
<td>28.75</td>
<td>31.45</td>
<td>29.50</td>
<td>2.70</td>
<td>-1.95</td>
<td>0.75</td>
</tr>
<tr>
<td>Visual Closure</td>
<td>36.40</td>
<td>40.70</td>
<td>42.75</td>
<td>4.30</td>
<td>2.05</td>
<td>6.35</td>
</tr>
<tr>
<td>Auditory Sequential</td>
<td>34.65</td>
<td>37.0</td>
<td>37.20</td>
<td>2.35</td>
<td>0.20</td>
<td>2.55</td>
</tr>
<tr>
<td>Visual Sequential</td>
<td>21.80</td>
<td>35.25</td>
<td>35.15</td>
<td>13.45</td>
<td>-0.10</td>
<td>13.35</td>
</tr>
<tr>
<td>Auditory Closure</td>
<td>14.50</td>
<td>31.40</td>
<td>28.05</td>
<td>16.90</td>
<td>-3.35</td>
<td>13.55</td>
</tr>
<tr>
<td>Sound Blending</td>
<td>34.25</td>
<td>36.60</td>
<td>38.40</td>
<td>2.35</td>
<td>1.80</td>
<td>4.15</td>
</tr>
<tr>
<td>Composite PLA (months)</td>
<td>77.0</td>
<td>91.95</td>
<td>100.95</td>
<td>14.95</td>
<td>9.0</td>
<td>23.95</td>
</tr>
<tr>
<td>Mean Scaled Score</td>
<td>30.22</td>
<td>33.63</td>
<td>33.25</td>
<td>3.41</td>
<td>-0.38</td>
<td>3.03</td>
</tr>
<tr>
<td>Automatic Level</td>
<td>28.30</td>
<td>35.40</td>
<td>35.40</td>
<td>7.10</td>
<td>0</td>
<td>7.10</td>
</tr>
<tr>
<td>Representational Level</td>
<td>30.25</td>
<td>32.05</td>
<td>31.30</td>
<td>1.80</td>
<td>-0.75</td>
<td>1.05</td>
</tr>
<tr>
<td>Reception Process</td>
<td>25.98</td>
<td>27.80</td>
<td>27.33</td>
<td>1.82</td>
<td>-0.47</td>
<td>1.35</td>
</tr>
<tr>
<td>Association Process</td>
<td>27.75</td>
<td>29.75</td>
<td>28.98</td>
<td>2.0</td>
<td>-0.77</td>
<td>1.23</td>
</tr>
<tr>
<td>Expression Process</td>
<td>36.35</td>
<td>38.38</td>
<td>37.70</td>
<td>2.03</td>
<td>-0.68</td>
<td>1.35</td>
</tr>
<tr>
<td>Auditory-Vocal</td>
<td>28.55</td>
<td>33.33</td>
<td>32.05</td>
<td>4.80</td>
<td>-1.30</td>
<td>3.50</td>
</tr>
<tr>
<td>Visual-Motor</td>
<td>30.05</td>
<td>33.93</td>
<td>35.10</td>
<td>3.90</td>
<td>1.15</td>
<td>5.05</td>
</tr>
<tr>
<td>Burt-Vernon (years)</td>
<td>4.7</td>
<td>6.7</td>
<td>7.2</td>
<td>2.0</td>
<td>0.50</td>
<td>2.5</td>
</tr>
<tr>
<td>Youngs (years)</td>
<td>-6.0</td>
<td>7.3</td>
<td>7.6</td>
<td>&gt;1.3</td>
<td>0.3</td>
<td>&gt;1.6</td>
</tr>
<tr>
<td>Raven's I.Q.</td>
<td>98.25</td>
<td>107.10</td>
<td>103.30</td>
<td>8.85</td>
<td>-1.80</td>
<td>5.05</td>
</tr>
<tr>
<td>C.A. (months)</td>
<td>91.30</td>
<td>98.85</td>
<td>108.35</td>
<td>7.55</td>
<td>9.50</td>
<td>17.05</td>
</tr>
</tbody>
</table>

\( N = 7.0 \)

All ITPA scores above are scaled scores.

NB

'Gain at end of RT' column = Mean Scores on occasion 2 - Mean scores on occasion 1.

'Gain after RT ended' column = Mean Scores on occasion 3 - Mean scores on occasion 2.

'Total Gain' column = Mean Scores on occasion 3 - Mean scores on occasion 1.
Group. From an inspection of Table 13 the reader will note the following trend. The total gain column, which records the overall gain at the end of the experiment, shows that gains in scaled scores have been made on all 24 criterion tests ranging from Auditory Reception (0.1) to Auditory Closure (13.55). In addition to the large gain in Auditory Closure, other large gains have been achieved in Visual Sequential Memory (13.35), Automatic Level (7.10), Visual Closure (6.35), Visual-Motor Channel (5.05), Sound Blending (4.15), and Visual Reception (3.60).

Much of the total gain has been achieved during the enrichment period, i.e. between occasions C1 - C2. In the post-remedial period (C2 - C3), 9.5 months after remediation ended, small regressions have also taken place which have reduced the overall gain. For the 24 criterion tests in the post-remedial period, regressions have occurred in 14 instances with gains recorded on the 10 remaining tests. The majority of the regressions are rather small, excepting Auditory Reception and Auditory Closure, so that 9.5 months after remediation, much of the gain achieved during enrichment had been retained.

Turning to the Composite PLA, in Table 14, which is an overall indicator of the level of psycholinguistic development, the Kirk Group gained 23.95 months over the experiment during which time the increase in CA was 17.05 months. This indicates that a considerable increase in language performance had taken place as at the start of the experiment the Kirk Group was 14.30 months retarded in language age whilst at the end of the experiment this had been reduced to 7.4 months.

Substantial ITPA subtest language age gains have been achieved in Visual Sequential Memory (40.65 months), Auditory Closure (30.65
### Table 14

Mean Language Age Gains on ITPA subtests by children on the Kirk Programme.

<table>
<thead>
<tr>
<th></th>
<th>Mean LA on Occasion 1</th>
<th>Mean LA on Occasion 2</th>
<th>Mean LA on Occasion 3</th>
<th>Gain at end of RT</th>
<th>Gain after RT ended</th>
<th>Total Gain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auditory Reception</td>
<td>64.75</td>
<td>79.60</td>
<td>83.15</td>
<td>14.85</td>
<td>3.55</td>
<td>18.40</td>
</tr>
<tr>
<td>Visual Reception</td>
<td>68.15</td>
<td>76.0</td>
<td>89.40</td>
<td>7.85</td>
<td>13.40</td>
<td>21.25</td>
</tr>
<tr>
<td>Auditory Association</td>
<td>73.45</td>
<td>85.65</td>
<td>90.50</td>
<td>12.20</td>
<td>4.85</td>
<td>17.05</td>
</tr>
<tr>
<td>Visual Association</td>
<td>71.85</td>
<td>74.95</td>
<td>83.0</td>
<td>3.10</td>
<td>8.05</td>
<td>11.15</td>
</tr>
<tr>
<td>Verbal Expression</td>
<td>85.35</td>
<td>104.60</td>
<td>112.60</td>
<td>19.25</td>
<td>8.0</td>
<td>27.25</td>
</tr>
<tr>
<td>Manual Expression</td>
<td>103.80</td>
<td>112.95</td>
<td>117.90</td>
<td>9.15</td>
<td>4.95</td>
<td>14.10</td>
</tr>
<tr>
<td>Grammatic Closure</td>
<td>76.05</td>
<td>89.60</td>
<td>96.05</td>
<td>13.55</td>
<td>6.45</td>
<td>20.0</td>
</tr>
<tr>
<td>Visual Closure</td>
<td>92.65</td>
<td>110.75</td>
<td>120.15</td>
<td>18.10</td>
<td>9.40</td>
<td>27.50</td>
</tr>
<tr>
<td>Auditory Sequential</td>
<td>85.45</td>
<td>97.90</td>
<td>104.20</td>
<td>12.45</td>
<td>6.30</td>
<td>18.75</td>
</tr>
<tr>
<td>Visual Sequential</td>
<td>58.15</td>
<td>93.05</td>
<td>98.80</td>
<td>34.90</td>
<td>5.75</td>
<td>40.65</td>
</tr>
<tr>
<td>Auditory Closure</td>
<td>50.35</td>
<td>82.50</td>
<td>81.0</td>
<td>32.15</td>
<td>-1.50</td>
<td>30.65</td>
</tr>
<tr>
<td>Sound Blending</td>
<td>83.85</td>
<td>92.35</td>
<td>98.0</td>
<td>8.50</td>
<td>5.65</td>
<td>14.15</td>
</tr>
<tr>
<td>Composite PLA</td>
<td>77.0</td>
<td>91.95</td>
<td>100.95</td>
<td>14.95</td>
<td>9.0</td>
<td>23.95</td>
</tr>
<tr>
<td>C.A. (months)</td>
<td>91.3</td>
<td>98.85</td>
<td>108.35</td>
<td>7.55</td>
<td>9.5</td>
<td>17.05</td>
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<tr>
<td>N = 20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**N.B.**

All language ages above in months.

'Gain at end of RT' column = Mean LA on occasion 2 - Mean LA on occasion 1.

'Gain after RT ended' column = Mean LA on occasion 3 - Mean LA on occasion 2.

'Total Gain' column = Mean LA on occasion 3 - Mean LA on occasion 1.
months), Visual Closure (27.50 months) and Grammatic Closure (20 months). As the Kirk Programmes were designed to ameliorate deficits in Auditory Closure and Visual Sequential Memory function it will be seen that they have been relatively successful in this. The associated large gains in Visual Closure and Grammatic Closure above being evidently due to transfer of training. However, even though large gains in language age have been achieved in Visual Sequential Memory and Auditory Closure, these were not large enough to eradicate completely the deficits in language age of 40.95 months in Auditory Closure, and 33.15 months in Visual Sequential Memory present at the start of the experiment.

Comparing the two levels of the test, the gain in Mean Scaled Score for the Automatic Level (7.10) is much greater than that for the Representational Level (1.05). However, one would expect the Kirk Programmes to have had more impact at the Automatic Level, considering that the training programmes involved Automatic Level functions. Even so, some transfer of training has taken place on to Representational Level processes as is evident from the large gains in language age recorded in Verbal Expression (27.25 months), Visual Reception (21.25 months), Auditory Reception (18.40 months) and Auditory Association (17.05 months). The large gain in Verbal Expression indicates that training given at the Automatic Level of language usage has been effective in improving expressive language competence.

A comparison of the gains in scaled scores for the two channels shows that the programmes have affected the Visual-Motor Channel (5.05) more than the Auditory-Vocal Channel (3.50). Whilst for the three processes, the programmes appear to have had a small but equal influence as is evident from the small gains in respect of Reception (1.35), Association (1.23), and Expression (1.35).
Turning to Table 15 in which deviation scores (obtained by comparing subtest mean scaled scores with the composite mean) have been used as indices of discrepancy of the Kirk Group's psycholinguistic growth, it will be seen that three deviation scores are sufficiently large to reach statistical significance: Visual Closure, Auditory Reception, and Manual Expression. In the case of Visual Closure, the statistically significant deviation score of +10 is sufficiently large to be psychologically significant, as only 2 per cent of average children would achieve a deviation score of this magnitude. This is, therefore, an area of strength in the experimental group's psycholinguistic development. However, the deviation scores in respect of Auditory Reception (-6) and Manual Expression (+6), though statistically significant, are not psychologically significant since 85 per cent and 83 per cent, respectively, of average children would exhibit similar deviation scores. In the remaining subtest areas: Visual Reception, Auditory Association, Visual Association, Verbal Expression, Grammatic Closure, Auditory Sequential Memory, Visual Sequential Memory, Auditory Closure and Sound Blending, the Kirk subject's deviation scores are typical of average children, since between 69-86 per cent of normal children would achieve similar deviation scores. In other words these results do not indicate any substantial intraindividual differences, and the Kirk Group is developing evenly in all the above functions.

This means that the substantial disability in Auditory Closure and the borderline disability in Visual Sequential Memory, diagnosed present at the start of the experiment, have been successfully ameliorated by the Kirk Programmes. However, as this conclusion is derived from the performance of the group, which often masks the performance of individuals within the group, an examination of each individual child's
Comparison of ITPA subtest mean scaled scores with composite mean scaled score, obtained on the final test by children on the Kirk Programmes.

<table>
<thead>
<tr>
<th>Subtest Mean Scaled Score</th>
<th>Deviation Score</th>
<th>Percentage from table</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auditory Reception</td>
<td>27</td>
<td>-6</td>
<td>85</td>
</tr>
<tr>
<td>Visual Reception</td>
<td>29</td>
<td>-4</td>
<td>85</td>
</tr>
<tr>
<td>Auditory Association</td>
<td>29</td>
<td>-4</td>
<td>80</td>
</tr>
<tr>
<td>Visual Association</td>
<td>29</td>
<td>-4</td>
<td>72</td>
</tr>
<tr>
<td>Verbal Expression</td>
<td>37</td>
<td>4</td>
<td>64</td>
</tr>
<tr>
<td>Manual Expression</td>
<td>39</td>
<td>6</td>
<td>83</td>
</tr>
<tr>
<td>Grammatic Closure</td>
<td>30</td>
<td>-3</td>
<td>85</td>
</tr>
<tr>
<td>Visual Closure</td>
<td>43</td>
<td>10</td>
<td>2</td>
</tr>
<tr>
<td>Auditory Sequential</td>
<td>37</td>
<td>4</td>
<td>69</td>
</tr>
<tr>
<td>Visual Sequential</td>
<td>35</td>
<td>2</td>
<td>69</td>
</tr>
<tr>
<td>Auditory Closure</td>
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<td>Sound Blending</td>
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</tr>
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<td>Automatic Level</td>
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<tr>
<td>Representational Level</td>
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<td>-2</td>
<td>&quot;</td>
</tr>
<tr>
<td>Reception Process</td>
<td>27</td>
<td>-6</td>
<td>&quot;</td>
</tr>
<tr>
<td>Association Process</td>
<td>29</td>
<td>-4</td>
<td>&quot;</td>
</tr>
<tr>
<td>Expression Process</td>
<td>38</td>
<td>5</td>
<td>&quot;</td>
</tr>
<tr>
<td>Auditory-Vocal</td>
<td>32</td>
<td>-1</td>
<td>&quot;</td>
</tr>
<tr>
<td>Visual Motor</td>
<td>35</td>
<td>2</td>
<td>&quot;</td>
</tr>
<tr>
<td>Mean Scaled Score</td>
<td>33</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C.A. (months)</td>
<td>108</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

N = 20

NB
1. All scaled scores to the nearest integer.
2. Probability values calculated from standard errors of measurement for scaled scores.
3. Percentage from table column refers to the percentage of the normative group who exhibited this deviation score.
performance in Auditory Closure and Visual Sequential Memory has been made.

At the beginning of the experiment, pre-test scores indicated that every one of the 20 children in the Kirk Group had a substantial disability in Auditory Closure. Whilst at the end of the experiment, post-testing showed that, only 2 children had a substantial disability. Eighteen children with a substantial deficit in Auditory Closure had, therefore, responded to remediation.

In the case of Visual Sequential Memory, pre-testing showed that initially 10 children registered a substantial disability and 7 children a borderline disability. At the end of the experiment, post-test scores showed that none of the subjects exhibited deficits in psycholinguistic functioning. All 20 children had, therefore, responded to remediation.

These individual analyses testify to the effectiveness of the Kirk Programmes. This can also be illustrated by a perusal of the profile of abilities presented graphically on page 247. If one compares the initial profile with the final profile the following features will be observed. Whilst the Representational Level differs quantitatively, qualitatively there has been little change. What can be seen to have taken place at the Representational Level is a small overall increase in language performance. At the Automatic Level, however, a much larger increase in subtest language performance is noticeable, particularly in the areas of Visual Sequential Memory and Auditory Closure. As a consequence the final profile is much flatter than the initial one, indicating that deviations from the mean are less and thereby resulting in even psycholinguistic growth. The profiles also effectively show that much of the overall improvement of the group took place between occasions 1 - 2. Nevertheless, the profiles obtained in respect of
Sound Blending
Auditory Closure
Visual Memory
Auditory Memory
Visual Closure
Grammatic Closure
Manual Expression
Verbal Expression
Visual Association
Auditory Association
Visual Reception
Auditory Reception
occasion 2 and occasion 3 approximate extremely closely, indicating that in the post remedial period the Kirk subjects were maintaining progress at approximately the same rate as their maturational growth.

The above considerations corroborate the effectiveness of the Kirk Programmes. They show that a highly focussed training programme, designed to ameliorate specific deficits can not only achieve this but in a relatively short period of time can promote an improvement of language performance in many linguistic dimensions.

Kirk Group - Interindividual Differences

Table 16, page 249 presents the ITPA subtest final language ages obtained by the Kirk Group relative to the overall performance of the normative children.

At the start of the experiment the Kirk Group was severely retarded on eleven of the twelve ITPA subtests and on Composite PLA. The Composite PLA, being an overall index of the level of psycho-linguistic development, showed that the Kirk Group was approximately 18 months retarded in overall linguistic ability compared with American children in the normative sample. Gross individual sub-test deficits were found in: Auditory Closure (42 months), Visual Sequential Memory (36 months), Auditory Reception (33.2 months), Visual Reception (27.9 months), Visual Association (23.0 months), and Auditory Association (21.1 months). These large deficits in Composite PLA and ITPA subtest performance were ascribed to social-class factors, in particular, comparing English children drawn from unfavourable environments with an American normative group described as being slightly above middle class.

An examination of the differences in language ages between the two groups at the end of the experiment shows that these have been
<table>
<thead>
<tr>
<th></th>
<th>Normative Group</th>
<th>Kirk Group</th>
<th>Initial Difference in language age</th>
<th>Final Difference in language age</th>
<th>Relative Gain of Kirk Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auditory Reception</td>
<td>107.4</td>
<td>83.2</td>
<td>33.2</td>
<td>24.2</td>
<td>9.0</td>
</tr>
<tr>
<td>Visual Reception</td>
<td>106.7</td>
<td>89.4</td>
<td>27.9</td>
<td>17.3</td>
<td>10.6</td>
</tr>
<tr>
<td>Auditory Association</td>
<td>106.4</td>
<td>90.5</td>
<td>21.1</td>
<td>15.9</td>
<td>5.2</td>
</tr>
<tr>
<td>Visual Association</td>
<td>101.4</td>
<td>83.0</td>
<td>23.0</td>
<td>18.4</td>
<td>4.6</td>
</tr>
<tr>
<td>Verbal Expression</td>
<td>109.0</td>
<td>112.6</td>
<td>8.6</td>
<td>-3.6</td>
<td>12.2</td>
</tr>
<tr>
<td>Manual Expression</td>
<td>104.7</td>
<td>117.9</td>
<td>19.3</td>
<td>11.6</td>
<td>7.6</td>
</tr>
<tr>
<td>Grammatic Closure</td>
<td>107.7</td>
<td>96.1</td>
<td>19.3</td>
<td>11.6</td>
<td>7.6</td>
</tr>
<tr>
<td>Visual Closure</td>
<td>104.3</td>
<td>120.2</td>
<td>2.5</td>
<td>-15.9</td>
<td>18.4</td>
</tr>
<tr>
<td>Auditory Sequential</td>
<td>97.9</td>
<td>104.2</td>
<td>6.4</td>
<td>-6.3</td>
<td>12.7</td>
</tr>
<tr>
<td>Visual Sequential</td>
<td>100.6</td>
<td>98.8</td>
<td>36.0</td>
<td>1.8</td>
<td>34.2</td>
</tr>
<tr>
<td>Auditory Closure</td>
<td>100.7</td>
<td>81.0</td>
<td>42.0</td>
<td>19.7</td>
<td>22.3</td>
</tr>
<tr>
<td>Sound Blending</td>
<td>94.9</td>
<td>98.0</td>
<td>36.0</td>
<td>-3.1</td>
<td>7.6</td>
</tr>
<tr>
<td>Composite PLA</td>
<td>105.8</td>
<td>101.0</td>
<td>17.6</td>
<td>4.8</td>
<td>12.8</td>
</tr>
<tr>
<td>C.A.</td>
<td>109.0</td>
<td>108.4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N.</td>
<td>126</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NB

All language ages above in months.

"Initial Difference in language age" column = normative scores - experimental group scores at the start of the experiment.

"Final Difference in language age" column = normative scores - experimental group scores at the end of the experiment.

"Relative Gain of the Kirk Group" column = gain of the experimental group over the experiment relative to the normative group.
reduced for every ITPA subtest. A comparison of the Composite PLA for the two groups shows that the experimental group was only 4.8 months retarded in language age. This indicates a substantial improvement in the level of psycholinguistic development for the experimental group. This is reflected in certain individual subtest performances which can best be illustrated from the post-test scaled scores presented in Table 13. Using the criterion of normative group average of 36 scaled score points, it will be noted that the Kirk subjects achieved higher scores than the normative group in respect of: Visual Closure (42.75), Manual Expression (38.70), Sound Blending (38.40), Auditory Sequential Memory (37.20), Verbal Expression (36.80), and the Expression Process (37.70). Close approximations to the normative average were recorded in Visual Sequential Memory (35.15), Automatic Level (35.40), and the Visual-Motor Channel (35.10). The Mean Scaled Score (33.3) is also within a few points of the normative group average.

Thus in terms of language ages the experimental group's score exceeded normative performance by: Visual Closure (15.9 months), Manual Expression (13.2 months), Auditory Sequential Memory (6.3 months), Sound Blending (3.1 months), and Verbal Expression (3.6 months). Whilst in Visual Sequential Memory the experimental group was only 1.8 months retarded in language age. On the remaining six subtests, the experimental group was still retarded although this had been reduced in every instance, the extent of the deficits in language age ranging from 11.6 - 24.2 months.

Gains in language age over the experiment are recorded on every ITPA subtest ranging from 4.6 - 34.2 months. As a consequence substantial reductions of initial deficits have been made in respect of: Visual
Sequential Memory (34.2 months), Auditory Closure (22.3 months),
Visual Closure (18.4 months), Auditory Sequential Memory (12.7 months),
Verbal Expression (12.2 months) and Visual Reception (10.6 months).

Thus the Kirk Programmes have reduced the initial specific
deficits in Visual Sequential Memory and Auditory Closure. In addition
they have also produced an overall diffuse stimulation as is evident
from the recorded gains on every ITPA subtest. These interindividual
comparisons demonstrate that the Kirk Programmes have successfully
alleviated many of the large ITPA subtest deficits present at the
start of the experiment. At the end of the experiment the general
level of psycholinguistic development of the experimental group was
very similar to that of the normative group, especially at the Automatic
Level of language usage. At the Representational Level the gains in
language age were not as large and substantial differences between the
two groups remained, especially in the areas involving the Reception
and Association Processes.

In evaluating the interindividual comparisons, above, and the
subsequent comparisons that will follow when the Peabody and Control
Programmes are examined, the following reservation should be made. Both
Chase (1972) and Carroll (1972), reviewing the ITPA in the Seventh
Mental Measurement Yearbook, have criticised the standardisation
population as being an unrepresentative sample. According to these
writers, it was drawn from homes slightly above the national average
in income and education, with middle occupational levels slightly over-
represented at the expense of lower levels. These writers consider a
wider sample of children would have been desirable and urge caution
when making comparisons involving lower class groups.
(b) Peabody Group - Intraindividual Differences

Tables 17 and 19, overleaf, have been prepared in respect of the Peabody Group to facilitate intraindividual comparisons. An inspection of Table 17 reveals the following pattern of subtest scores. The total gain column, of gains in scaled scores on the 24 criterion tests at the end of the experiment, indicates that overall gains have been made on 20 subtests with regressions recorded on the remaining 4 subtests.

At the end of the enrichment period (occasions C1 - C2) gains were recorded on each of the 24 tests ranging from 0.10 - 6.0 scaled score units. This indicates that the Peabody instruction had promoted development in every area. Largest subtest gains at the end of the treatment have been registered in Verbal Expression (6.0), Auditory Association (4.95), Visual Association (4.0), Visual Closure (3.60), and Visual Sequential Memory (3.55). Whilst the smallest gains at the end of the treatment are seen in Manual Expression (0.10), Auditory Reception (0.35), and Grammatic Closure (1.15).

However, in the post-remedial period (occasions C2 - C3), ten months after remediation had ended, regressions in scaled score have occurred on 17 subtests, which have resulted in an erosion of gains achieved during the enrichment period. Overall gains are generally of modest size, ranging from 0.95 - 4.65 scaled score units. The largest overall gains have been made in Verbal Expression (4.65), Visual Closure (4.05), Visual Memory (3.70), Sound Blending (3.70), and Auditory Association (2.70). These five subtests have, therefore, profited most from the Peabody stimulation. Overall regressions have occurred in Grammatic Closure (1.45), Auditory Reception (1.30), Manual Expression (0.55), and the Reception Process (0.02). These psycho-linguistic dimensions have, therefore, been most resistant to the Peabody Programmes.
Table 17

Comparison of Pre-Test and Post-Test Scaled Scores on ITPA and other criterion tests obtained by children on the Peabody Program.

<table>
<thead>
<tr>
<th></th>
<th>Mean Scores on Occasion 1</th>
<th>Mean Scores on Occasion 2</th>
<th>Mean Scores on Occasion 3</th>
<th>Gain at end of RT</th>
<th>Gain after RT ended</th>
<th>Total Gain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auditory Reception</td>
<td>29.05</td>
<td>29.4</td>
<td>27.75</td>
<td>0.35</td>
<td>-1.65</td>
<td>-1.30</td>
</tr>
<tr>
<td>Visual Reception</td>
<td>28.65</td>
<td>30.0</td>
<td>29.60</td>
<td>1.35</td>
<td>-0.40</td>
<td>0.95</td>
</tr>
<tr>
<td>Auditory Association</td>
<td>27.30</td>
<td>32.25</td>
<td>30.0</td>
<td>4.95</td>
<td>-2.25</td>
<td>2.70</td>
</tr>
<tr>
<td>Visual Association</td>
<td>26.75</td>
<td>30.75</td>
<td>28.20</td>
<td>4.0</td>
<td>-2.55</td>
<td>1.45</td>
</tr>
<tr>
<td>Verbal Expression</td>
<td>33.40</td>
<td>39.40</td>
<td>38.05</td>
<td>6.0</td>
<td>-1.35</td>
<td>4.65</td>
</tr>
<tr>
<td>Manual Expression</td>
<td>38.55</td>
<td>38.65</td>
<td>38.0</td>
<td>0.10</td>
<td>-0.65</td>
<td>-0.55</td>
</tr>
<tr>
<td>Grammatic Closure</td>
<td>25.30</td>
<td>26.45</td>
<td>23.85</td>
<td>1.15</td>
<td>-2.60</td>
<td>-1.45</td>
</tr>
<tr>
<td>Visual Closure</td>
<td>38.0</td>
<td>41.60</td>
<td>42.05</td>
<td>3.60</td>
<td>0.45</td>
<td>4.05</td>
</tr>
<tr>
<td>Auditory Sequential</td>
<td>31.15</td>
<td>33.30</td>
<td>33.55</td>
<td>2.15</td>
<td>0.25</td>
<td>2.40</td>
</tr>
<tr>
<td>Visual Sequential</td>
<td>24.65</td>
<td>28.20</td>
<td>28.35</td>
<td>3.55</td>
<td>0.15</td>
<td>3.70</td>
</tr>
<tr>
<td>Auditory Closure</td>
<td>11.55</td>
<td>13.45</td>
<td>12.95</td>
<td>1.90</td>
<td>-0.50</td>
<td>1.40</td>
</tr>
<tr>
<td>Sound Blending</td>
<td>31.10</td>
<td>33.35</td>
<td>34.80</td>
<td>2.25</td>
<td>1.45</td>
<td>3.70</td>
</tr>
<tr>
<td>Composite PLA (months)</td>
<td>78.30</td>
<td>93.20</td>
<td>99.65</td>
<td>14.90</td>
<td>6.45</td>
<td>21.35</td>
</tr>
<tr>
<td>Mean Scaled Score</td>
<td>30.31</td>
<td>32.97</td>
<td>31.90</td>
<td>2.66</td>
<td>-1.07</td>
<td>1.59</td>
</tr>
<tr>
<td>Automatic Level</td>
<td>27.0</td>
<td>29.60</td>
<td>29.30</td>
<td>2.60</td>
<td>-0.30</td>
<td>2.30</td>
</tr>
<tr>
<td>Representational Level</td>
<td>30.65</td>
<td>33.45</td>
<td>32.0</td>
<td>2.80</td>
<td>-1.45</td>
<td>1.35</td>
</tr>
<tr>
<td>Reception Process</td>
<td>28.85</td>
<td>29.70</td>
<td>28.83</td>
<td>0.85</td>
<td>-0.87</td>
<td>-0.02</td>
</tr>
<tr>
<td>Association Process</td>
<td>26.90</td>
<td>31.40</td>
<td>28.83</td>
<td>4.50</td>
<td>-2.57</td>
<td>1.93</td>
</tr>
<tr>
<td>Expression Process</td>
<td>35.95</td>
<td>38.98</td>
<td>38.10</td>
<td>3.03</td>
<td>-0.88</td>
<td>2.15</td>
</tr>
<tr>
<td>Auditory-Vocal</td>
<td>27.0</td>
<td>29.85</td>
<td>28.95</td>
<td>2.85</td>
<td>-0.90</td>
<td>1.95</td>
</tr>
<tr>
<td>Visual-Motor</td>
<td>31.40</td>
<td>33.85</td>
<td>33.40</td>
<td>2.45</td>
<td>-0.45</td>
<td>2.0</td>
</tr>
<tr>
<td>Burt-Vernon (years)</td>
<td>4.5</td>
<td>6.0</td>
<td>6.6</td>
<td>1.5</td>
<td>0.6</td>
<td>2.1</td>
</tr>
<tr>
<td>Youngs (years)</td>
<td>-6.0</td>
<td>7.0</td>
<td>7.2</td>
<td>13.0</td>
<td>0.2</td>
<td>13.2</td>
</tr>
<tr>
<td>Raven's I.Q.</td>
<td>96.65</td>
<td>100.55</td>
<td>98.75</td>
<td>3.9</td>
<td>-1.8</td>
<td>2.1</td>
</tr>
<tr>
<td>C.A. (months)</td>
<td>92.85</td>
<td>100.65</td>
<td>110.65</td>
<td>7.8</td>
<td>10.0</td>
<td>17.8</td>
</tr>
</tbody>
</table>

All ITPA scores above are scaled scores. N = 20

NB

'Gain at end of RT' column = Mean Scores on occasion 2 - Mean Scores on occasion 1

'Gain after RT ended' column = Mean Scores on occasion 3 - Mean Scores on occasion 2.

'Total Gain' column = Mean Scores on occasion 3 - Mean Scores on occasion 1.
An examination of Table 18, and in particular the Composite PLA gives an indication of the level of overall psycholinguistic functioning of the Peabody Group. At the end of the experiment a Composite PLA of 99.65 months had been achieved. This indicates that the experimental group was still 11 months retarded in overall language performance compared with the mean CA of 110.65 months. This corresponds to a gain in psycholinguistic development of 21.35 months, during which time the CA of the group increased by 17.8 months. The gain in Composite PLA though substantial was not, therefore, sufficiently large to offset both the initial deficit of 14.50 months in language age together with the 17.8 months increase of the experimental group's chronological growth.

Overall gains expressed in language ages are presented in Table 18 and range from 6.95 - 36.45 months. However, most of these overall gains in language age have been depressed as many children in the experimental group reached the ceiling of certain subtest norms. Despite this, substantial gains in language age are recorded in Verbal Expression (36.45 months), Auditory Association (20.35 months) and Visual Closure (20.10 months). As none of the recorded gains are comparable in magnitude with the gain for Verbal Expression, the underlying rationale of the Peabody Kit, that the primary aim is to stimulate oral language development, would appear to be justified.

Comparing the two levels of the test, after treatment the gain in mean scaled score for the Automatic Level (2.80) was almost identical to that of the Representational Level (2.60). Gains of similar size were also registered for the two channels, i.e. Visual-Motor Channel (2.45), and Auditory-Vocal Channel (2.85). The programmes seem, therefore, to have affected each level and channel to the same extent, thereby
Table 18

Mean Language Age Gains on ITPA subtests by children on the Peabody Programmen.

<table>
<thead>
<tr>
<th></th>
<th>Mean LA on Occasion 1</th>
<th>Mean LA on Occasion 2</th>
<th>Mean LA on Occasion 3</th>
<th>Gain at end of RT</th>
<th>Gain after RT ended</th>
<th>Total Gain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auditory Reception</td>
<td>72.35</td>
<td>80.75</td>
<td>89.60</td>
<td>8.40</td>
<td>9.05</td>
<td>17.45</td>
</tr>
<tr>
<td>Visual Reception</td>
<td>76.30</td>
<td>85.15</td>
<td>91.60</td>
<td>8.85</td>
<td>6.45</td>
<td>15.30</td>
</tr>
<tr>
<td>Auditory Association</td>
<td>74.50</td>
<td>90.10</td>
<td>94.85</td>
<td>15.60</td>
<td>4.75</td>
<td>20.35</td>
</tr>
<tr>
<td>Visual Association</td>
<td>69.20</td>
<td>82.95</td>
<td>81.70</td>
<td>13.75</td>
<td>-1.25</td>
<td>12.50</td>
</tr>
<tr>
<td>Verbal Expression</td>
<td>83.55</td>
<td>116.70</td>
<td>120.0</td>
<td>33.15</td>
<td>3.30</td>
<td>36.45</td>
</tr>
<tr>
<td>Manual Expression</td>
<td>104.80</td>
<td>111.80</td>
<td>115.95</td>
<td>7.0</td>
<td>4.15</td>
<td>11.15</td>
</tr>
<tr>
<td>Grammatic Closure</td>
<td>71.90</td>
<td>83.05</td>
<td>89.70</td>
<td>11.15</td>
<td>6.65</td>
<td>17.80</td>
</tr>
<tr>
<td>Visual Closure</td>
<td>98.75</td>
<td>113.25</td>
<td>118.85</td>
<td>14.50</td>
<td>5.60</td>
<td>20.10</td>
</tr>
<tr>
<td>Auditory Sequential</td>
<td>72.45</td>
<td>83.75</td>
<td>90.85</td>
<td>11.30</td>
<td>7.10</td>
<td>18.40</td>
</tr>
<tr>
<td>Visual Sequential</td>
<td>64.15</td>
<td>72.50</td>
<td>76.25</td>
<td>8.35</td>
<td>3.75</td>
<td>12.10</td>
</tr>
<tr>
<td>Auditory Closure</td>
<td>47.50</td>
<td>51.95</td>
<td>54.45</td>
<td>4.45</td>
<td>2.50</td>
<td>6.95</td>
</tr>
<tr>
<td>Sound Blending</td>
<td>78.35</td>
<td>88.60</td>
<td>93.35</td>
<td>10.25</td>
<td>4.75</td>
<td>15.0</td>
</tr>
<tr>
<td>Composite PLA</td>
<td>78.30</td>
<td>93.20</td>
<td>99.65</td>
<td>14.90</td>
<td>6.45</td>
<td>21.35</td>
</tr>
<tr>
<td>C.A. (months)</td>
<td>92.85</td>
<td>100.65</td>
<td>110.65</td>
<td>7.8</td>
<td>10.0</td>
<td>17.8</td>
</tr>
</tbody>
</table>

N=20

NB

All language ages above in months.

'Gain at end of RT' column = Mean LA on occasion 2 - Mean LA on occasion 1.

'Gain after RT ended' column = Mean LA on occasion 3 - Mean LA on occasion 2.

'Total Gain' column = Mean LA on occasion 3 - Mean LA on occasion 1.
endorsing the claim of the Peabody constructors that the Kit stresses overall language performance rather than the training of isolated processes.

Turning to the psycholinguistic processes the gains obtained were as follows: Reception (0.85), Association (4.50), and Expression (3.03). Whilst expressive performance and associative thinking have increased, the Receptive process has proved highly resistant to stimulation. This seems to indicate that the Peabody instructional programmes are uneven in that they seem to emphasize training associative and expressive abilities to the comparative exclusion of training receptive skills. This may have been inherent in the programmes, or the teachers may have avoided such activities and shown preference for the associative and expressive activities.

Table 19 has been prepared to evaluate the experimental group's profile of abilities by comparing their deviation scores with those of average children. If the deviations are similar to the normative groups they can be considered typical. If the deviations are not similar to the normative groups they are considered atypical. Negative deviation scores indicate liabilities. Positive deviations scores indicate assets. In general, the larger the absolute value of the deviation, the greater the probability that the discrepancy is both statistically and psychologically significant.

From a perusal of Table 19 it will be seen that three positive deviation scores are sufficiently large to reach statistical significance: Visual Closure (+10), Manual Expression (+6) and Verbal Expression (+6). Of these 3 subtests, only the deviation score of Visual Closure is sufficiently large to be psychologically significant, as only 2 percent of average children would achieve a deviation score of this size.
### Table 19

Comparison of ITPA subtest mean scaled scores with composite mean scaled score, obtained on the final test by children on the Peabody Program.

<table>
<thead>
<tr>
<th>Subtest</th>
<th>Subtest Mean Scaled Score</th>
<th>Deviation Score</th>
<th>Percentage from table</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auditory Reception</td>
<td>28</td>
<td>-4</td>
<td>85</td>
<td></td>
</tr>
<tr>
<td>Visual Reception</td>
<td>30</td>
<td>-2</td>
<td>85</td>
<td></td>
</tr>
<tr>
<td>Auditory Association</td>
<td>30</td>
<td>-2</td>
<td>80</td>
<td></td>
</tr>
<tr>
<td>Visual Association</td>
<td>28</td>
<td>-4</td>
<td>72</td>
<td></td>
</tr>
<tr>
<td>Verbal Expression</td>
<td>38</td>
<td>6</td>
<td>64</td>
<td>p &lt; 0.05</td>
</tr>
<tr>
<td>Manual Expression</td>
<td>38</td>
<td>6</td>
<td>83</td>
<td>p &lt; 0.01</td>
</tr>
<tr>
<td>Grammatic Closure</td>
<td>24</td>
<td>-8</td>
<td>9</td>
<td>p &lt; 0.01</td>
</tr>
<tr>
<td>Visual Closure</td>
<td>42</td>
<td>10</td>
<td>2</td>
<td>p &lt; 0.01</td>
</tr>
<tr>
<td>Auditory Sequential</td>
<td>34</td>
<td>2</td>
<td>69</td>
<td></td>
</tr>
<tr>
<td>Visual Sequential</td>
<td>28</td>
<td>-4</td>
<td>69</td>
<td></td>
</tr>
<tr>
<td>Auditory Closure</td>
<td>13</td>
<td>-19</td>
<td>no data available</td>
<td>p &lt; 0.01</td>
</tr>
<tr>
<td>Sound Blending</td>
<td>35</td>
<td>3</td>
<td>&quot;</td>
<td></td>
</tr>
<tr>
<td>Automatic Level</td>
<td>29</td>
<td>-3</td>
<td>&quot;</td>
<td></td>
</tr>
<tr>
<td>Representational Level</td>
<td>32</td>
<td>0</td>
<td>&quot;</td>
<td></td>
</tr>
<tr>
<td>Reception Process</td>
<td>29</td>
<td>-3</td>
<td>&quot;</td>
<td></td>
</tr>
<tr>
<td>Association Process</td>
<td>29</td>
<td>-3</td>
<td>&quot;</td>
<td></td>
</tr>
<tr>
<td>Expression Process</td>
<td>38</td>
<td>5</td>
<td>&quot;</td>
<td></td>
</tr>
<tr>
<td>Auditory-Vocal</td>
<td>29</td>
<td>-3</td>
<td>&quot;</td>
<td></td>
</tr>
<tr>
<td>Visual-Motor</td>
<td>33</td>
<td>0</td>
<td>&quot;</td>
<td></td>
</tr>
<tr>
<td>Mean Scaled Score</td>
<td>32</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C.A. (months)</td>
<td>111</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N = 20</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**NB**

1. All scaled scores to the nearest integer.
2. Probability values calculated from standard errors of measurement for scaled scores.
3. Percentage from table column refers to the percentage of the normative group who exhibited this deviation score.
The experimental group's performance in Visual Closure is, therefore, atypical and suggests an area of strength in their psycholinguistic development. The deviation scores in respect of Manual Expression and Verbal Expression are typical of average children since 83 per cent and 69 per cent, respectively, of average children would exhibit similar deviation scores.

An examination of the negative deviation scores indicates that the deviations of -19 on Auditory Closure and -8 on Grammatic Closure are both large enough to reach statistical and psychological significance. Deviations of this magnitude are atypical and signify areas of discrepant functioning in the experimental group's psycholinguistic growth. In all the remaining subtest areas: Auditory Reception, Visual Reception, Auditory Association, Visual Association, Auditory Sequential Memory, Visual Sequential Memory, and Sound Blending, the Peabody Group's deviation scores are typical of those of average children, since between 69 - 85 per cent of average children would achieve similar deviation scores. The experimental group can be considered, therefore, to be developing evenly in all the above functions.

At the start of the experiment, the experimental group were found to exhibit a substantial disability in Auditory Closure and a borderline disability in Visual Sequential Memory. Whilst the Peabody Programmes have successfully alleviated the borderline deficit in Visual Sequential Memory, they have failed to correct the substantial deficit in Auditory Closure. In addition the Peabody instruction has failed to develop the experimental group's performance in Grammatic Closure function. This subtest area has proved unresponsive to stimulation and the experimental group's performance has deteriorated so that at the end of the experiment a substantial disability was recorded in this function. However, as these conclusions have been obtained from the performance of the group,
which often masks individual performance, an examination of each individual child's performance in Auditory Closure, Visual Sequential Memory, and Grammatic Closure has been carried out. This resulted in the following observations:

At the start of the experiment, pro-testing indicated that every one of the twenty Peabody subjects exhibited a substantial deficit in Auditory Closure. At the end of the experiment, post-testing showed that none of the experimental subjects had responded to the Peabody training, as all twenty children still registered a substantial deficit in this function.

In the case of Visual Sequential Memory, pro-test scores showed that at the start of the experiment 8 children of the experimental group exhibited a borderline disability and 3 children a substantial disability. Whilst at the end of the experiment post-test scores showed only 3 children to have borderline disabilities. The defective psycholinguistic functioning in Visual Sequential Memory had, therefore, been ameliorated by the Peabody training for all but 3 children of the experimental group.

An examination of the effects of training on the Grammatic Closure subtest showed that at the start of the experiment 2 of the experimental children recorded a borderline disability and 5 children a substantial disability. Post-testing showed that at the end of the experiment 3 children registered borderline deficits and 9 children substantial deficits. The Grammatic Closure subtest has, therefore, proved resistant to the Peabody stimulation as, over the experiment, 5 more children of the experimental group recorded deficits in this function.

The overall effects of the Peabody training can also be illustrated by a perusal of the profile of abilities presented graphically on page 260. An inspection of the three profiles, constructed for each occasion when the ITPA was administered to the experimental group, shows that whilst
Profile of scaled scores for children on the Peabody Programmes on three occasions

- Sound Blending
- Auditory Closure
- Visual Memory
- Auditory Memory
- Visual Closure
- Grammatic Closure
- Manual Expression
- Verbal Expression
- Visual Association
- Auditory Association
- Visual Reception
- Auditory Reception

Scaled scores on TAPA Subtests
those three differ quantitatively, qualitatively there has been little change. What can be seen to have taken place, between occasions 1 - 2 is a moderate increase in language performance on all subtests which reflects the treatment, especially in Verbal Expression. A comparison of the profiles for occasion 2 and occasion 3 shows that these approximate closely especially at the Automatic Level, whilst at the Representational Level small regressions have taken place. This indicates that in the post-remedial period, 10 months after remediation had taken place, the experimental group's overall rate of psycholinguistic development had slowed down. The similarity of the three profiles indicates that the Peabody Programme had not altered, to any great extent, the pattern of language abilities that were present at the start of the experiment.

Peabody Group - Interindividual Differences

Table 20 compares the ITPA subtest final language ages achieved by the Peabody subjects with those of the American normative group. A perusal of this table leads to the following observations.

At the start of the experiment the experimental group showed substantial deficits in language age on ten of the twelve ITPA subtests and Composite PLA. The Composite PLA of the Peabody Group indicated that they were 16.3 months retarded in general psycholinguistic development compared with the normative group. Individual subtest deficits ranged from 9.9 - 44.8 months, the largest deficits occurring in Auditory Closure (44.8 months), Visual Sequential Memory (29.9 months), Visual Association (25.6 months), Auditory Reception (25.5 months), and Grammatic Closure (23.4 months). On two ITPA subtests, the Peabody subjects showed relative strength by achieving higher language ages than did the normative group, i.e. Manual Expression (8.5 months) and Visual Closure (3.7 months).
Table 20

Comparison of ITPA subtest Final Language Ages obtained by the Peabody Group with those of the Normative Group.

<table>
<thead>
<tr>
<th></th>
<th>Normative Group</th>
<th>Peabody Group</th>
<th>Initial Difference in language age</th>
<th>Final Difference in language age</th>
<th>Relative Gain of Peabody Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auditory Reception</td>
<td>107.4</td>
<td>89.8</td>
<td>25.5</td>
<td>17.6</td>
<td>7.9</td>
</tr>
<tr>
<td>Visual Reception</td>
<td>106.7</td>
<td>91.6</td>
<td>19.7</td>
<td>15.1</td>
<td>4.6</td>
</tr>
<tr>
<td>Auditory Association</td>
<td>106.4</td>
<td>94.9</td>
<td>20.0</td>
<td>11.5</td>
<td>8.5</td>
</tr>
<tr>
<td>Visual Association</td>
<td>101.4</td>
<td>81.7</td>
<td>25.6</td>
<td>19.7</td>
<td>5.9</td>
</tr>
<tr>
<td>Verbal Expression</td>
<td>109.0</td>
<td>120.0</td>
<td>10.3</td>
<td>-11.0</td>
<td>21.3</td>
</tr>
<tr>
<td>Manual Expression</td>
<td>104.7</td>
<td>116.0</td>
<td>-8.5</td>
<td>-11.3</td>
<td>2.8</td>
</tr>
<tr>
<td>Grammatic Closure</td>
<td>107.7</td>
<td>89.7</td>
<td>23.4</td>
<td>18.0</td>
<td>5.4</td>
</tr>
<tr>
<td>Visual Closure</td>
<td>104.3</td>
<td>118.9</td>
<td>-3.7</td>
<td>-14.6</td>
<td>10.9</td>
</tr>
<tr>
<td>Auditory Sequential</td>
<td>97.9</td>
<td>90.9</td>
<td>19.3</td>
<td>7.0</td>
<td>12.3</td>
</tr>
<tr>
<td>Visual Sequential</td>
<td>100.6</td>
<td>76.3</td>
<td>29.9</td>
<td>24.3</td>
<td>5.6</td>
</tr>
<tr>
<td>Auditory Closure</td>
<td>100.7</td>
<td>54.5</td>
<td>44.8</td>
<td>46.2</td>
<td>-1.4</td>
</tr>
<tr>
<td>Sound Blending</td>
<td>94.9</td>
<td>93.4</td>
<td>9.9</td>
<td>1.5</td>
<td>8.4</td>
</tr>
<tr>
<td>Composite PLA</td>
<td>105.8</td>
<td>99.7</td>
<td>16.3</td>
<td>6.1</td>
<td>10.2</td>
</tr>
<tr>
<td>C.A.</td>
<td>109.0</td>
<td>110.7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>126</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NB

All language ages above in months.

"Initial Difference in language age" column = normative scores - experimental group scores at the start of the experiment.

"Final Difference in language age" column = normative scores - experimental group scores at the end of the experiment.

"Relative Gain of the Peabody Group" column = gain of the experimental group over the experiment relative to the normative group.
A comparison of the Composite PLA for the two groups shows that the experimental group was only 6.1 months retarded in language age at the end of the experiment, which indicates that their overall level of psycholinguistic development was very similar to that of average children of their own age. Individual subtest comparisons are best made by a perusal of Table 17. Using the criterion of normative average as 36 scaled score units, the experimental group achieved higher final scores than the normative group in Verbal Expression (38.05), Manual Expression (38.0), Visual Closure (42.05), and the Expression Process (38.10). Whilst in Sound Blending (34.80), Auditory Sequential Memory (33.55), and the Visual-Motor Channel (33.85), the scores of the two groups approximated closely. But substantially lower scores were registered in Auditory Closure (12.95), Grammatic Closure (23.85), Auditory Reception (27.75), Visual Association (28.20), and Visual Sequential Memory (28.35).

Gains in language age of the Peabody Group, over the experiment, relative to the normative group were achieved on 11 of the ITPA subtests, the exception being in Auditory Closure where an overall regression of 1.4 months was registered. Relative gains ranged from 2.8 - 21.3 months, the greatest of these occurring in Verbal Expression (21.3 months), Auditory Sequential Memory (12.3 months), and Visual Closure (10.9 months).

In terms of language ages the experimental group exceeded normative performance by: Visual Closure (14.6 months), Manual Expression (11.3 months), and Verbal Expression (11.0 months), whilst in Sound Blending the experimental group was only 1.5 months retarded. On the remaining 8 subtests, the Peabody Group was still retarded in language age, the extent of the final deficits ranging from 7.0 - 46.2 months. Despite the overall gains in language age, the experimental group was still
substantially retarded in Auditory Closure (46.2 months), Visual Sequential Memory (24.3 months), Visual Association (19.7 months), and Grammatic Closure (18.0 months), at the end of the experiment.

(c) Control Group – Intraindividual Differences

Tables 21, 22 and 23, overleaf, summarize data relating to the Control Group. Table 21 records pre-test and post-test scaled scores of the Control subjects who received no psycholinguistic training but went through a number programme instead. An inspection of this table leads to the following observations:

At the end of the remedial period, 7.7 months after the start of the experiment, the Control subjects have regressed in scaled score on 15 criterion measures whilst small gains are recorded on the remaining 9 subtests. This trend will be seen to continue during the post-remedial period so that at the end of the experiment overall regressions have accumulated on 16 subtests with overall gains recorded on the remaining 8 measures.

The most useful indicators of the Control Group's general psycholinguistic development over the experiment are the Mean Scaled Score and the Composite PLA. The reader will note that at the end of the experiment the recorded Mean Scaled Score is 2.35 points lower than that at the start of the experiment. This reflects the extent of the experimental group's overall deterioration on the twelve ITPA subtests. In terms of language age, the Composite PLA of 80.55 months obtained by the group at the end of the experiment, when compared with their CA of 108.85 months, shows a substantial deficit of 28.30 months in language development. This corresponds to a gain in Composite PLA of 8.50 months over the experiment during which time the group's CA increased by 17.90 months. The Control Group's deficit in overall
Table 21

Comparison of Pre-Test and Post-Test Scaled Scores on ITPA and other criterion tests obtained by children in the Control Group

<table>
<thead>
<tr>
<th></th>
<th>Mean Scores on Occasion 1</th>
<th>Mean Scores on Occasion 2</th>
<th>Mean Scores on Occasion 3</th>
<th>Gain at end of RT</th>
<th>Gain after RT ended</th>
<th>Total Gain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auditory Reception</td>
<td>25.65</td>
<td>22.55</td>
<td>19.60</td>
<td>-3.10</td>
<td>-2.95</td>
<td>-6.05</td>
</tr>
<tr>
<td>Visual Reception</td>
<td>26.90</td>
<td>23.95</td>
<td>22.0</td>
<td>-2.95</td>
<td>-1.95</td>
<td>-4.90</td>
</tr>
<tr>
<td>Auditory Association</td>
<td>23.60</td>
<td>22.95</td>
<td>21.60</td>
<td>0.65</td>
<td>-1.35</td>
<td>-2.00</td>
</tr>
<tr>
<td>Visual Association</td>
<td>26.80</td>
<td>24.20</td>
<td>25.70</td>
<td>-2.60</td>
<td>1.50</td>
<td>-1.10</td>
</tr>
<tr>
<td>Verbal Expression</td>
<td>33.20</td>
<td>32.35</td>
<td>31.15</td>
<td>0.05</td>
<td>-1.20</td>
<td>-2.05</td>
</tr>
<tr>
<td>Manual Expression</td>
<td>37.0</td>
<td>36.70</td>
<td>35.35</td>
<td>0.30</td>
<td>-1.35</td>
<td>-1.65</td>
</tr>
<tr>
<td>Grammatic Closure</td>
<td>23.05</td>
<td>19.80</td>
<td>14.15</td>
<td>-3.25</td>
<td>-5.65</td>
<td>-8.90</td>
</tr>
<tr>
<td>Visual Closure</td>
<td>35.15</td>
<td>34.15</td>
<td>34.60</td>
<td>-1.0</td>
<td>0.45</td>
<td>-0.55</td>
</tr>
<tr>
<td>Auditory Sequential</td>
<td>30.50</td>
<td>31.10</td>
<td>31.35</td>
<td>0.6</td>
<td>0.25</td>
<td>0.85</td>
</tr>
<tr>
<td>Visual Sequential</td>
<td>20.55</td>
<td>26.75</td>
<td>26.70</td>
<td>6.20</td>
<td>-0.05</td>
<td>6.15</td>
</tr>
<tr>
<td>Auditory Closure</td>
<td>9.90</td>
<td>11.85</td>
<td>12.10</td>
<td>1.95</td>
<td>0.25</td>
<td>2.20</td>
</tr>
<tr>
<td>Sound Blending</td>
<td>29.55</td>
<td>32.50</td>
<td>32.40</td>
<td>2.95</td>
<td>-0.10</td>
<td>2.85</td>
</tr>
<tr>
<td>Composite PLA (months)</td>
<td>72.05</td>
<td>75.30</td>
<td>80.55</td>
<td>3.25</td>
<td>5.25</td>
<td>8.50</td>
</tr>
<tr>
<td>Mean Scaled Score</td>
<td>28.18</td>
<td>27.22</td>
<td>25.83</td>
<td>-0.96</td>
<td>-1.39</td>
<td>-2.35</td>
</tr>
<tr>
<td>Automatic Level</td>
<td>24.70</td>
<td>25.45</td>
<td>24.95</td>
<td>0.75</td>
<td>-0.50</td>
<td>0.25</td>
</tr>
<tr>
<td>Representational Level</td>
<td>29.0</td>
<td>27.10</td>
<td>26.10</td>
<td>-1.90</td>
<td>-1.0</td>
<td>-2.90</td>
</tr>
<tr>
<td>Reception Process</td>
<td>26.43</td>
<td>23.48</td>
<td>21.25</td>
<td>-2.95</td>
<td>-2.23</td>
<td>-5.18</td>
</tr>
<tr>
<td>Association Process</td>
<td>25.73</td>
<td>24.10</td>
<td>24.28</td>
<td>-1.63</td>
<td>0.18</td>
<td>-1.45</td>
</tr>
<tr>
<td>Expression Process</td>
<td>35.18</td>
<td>34.58</td>
<td>33.35</td>
<td>-0.60</td>
<td>-1.23</td>
<td>-1.83</td>
</tr>
<tr>
<td>Auditory-Vocal</td>
<td>25.75</td>
<td>25.0</td>
<td>23.55</td>
<td>-0.75</td>
<td>-1.45</td>
<td>-2.20</td>
</tr>
<tr>
<td>Visual-Motor</td>
<td>29.30</td>
<td>29.25</td>
<td>28.85</td>
<td>-0.05</td>
<td>-0.40</td>
<td>-0.45</td>
</tr>
<tr>
<td>Burt-Vernon (years)</td>
<td>4.4</td>
<td>4.9</td>
<td>5.3</td>
<td>0.5</td>
<td>0.4</td>
<td>0.9</td>
</tr>
<tr>
<td>Young's (years)</td>
<td>-6.0</td>
<td>6.7</td>
<td>6.9</td>
<td>0.7</td>
<td>0.2</td>
<td>0.9</td>
</tr>
<tr>
<td>Raven's I.Q.</td>
<td>97.10</td>
<td>98.15</td>
<td>96.65</td>
<td>1.05</td>
<td>-1.50</td>
<td>-0.45</td>
</tr>
<tr>
<td>C.A. (months)</td>
<td>90.95</td>
<td>98.65</td>
<td>108.85</td>
<td>7.7</td>
<td>10.20</td>
<td>17.9</td>
</tr>
</tbody>
</table>

All ITPA scores above are scaled scores \( N = 20 \)

NB

'Gain at end of RT' column = Mean scores on occasion 2 - Mean scores on occasion 1.

'Gain after RT ended' column = Mean scores on occasion 3 - Mean scores on occasion 2.

'Total Gain' column = Mean Scores on occasion 3 - Mean Scores on occasion 1.
language development has, therefore, increased by 9.4 months during the course of the experiment, in accord with Deutsch's cumulative deficit thesis.

An inspection of subtest data shows that overall regressions in scaled score are registered in Auditory Reception (-6.05), Visual Reception (-4.90), Auditory Association (-2.0), Visual Association (-1.10), Verbal Expression (-2.05), Manual Expression (-1.65), Grammatic Closure (-8.90), and Visual Closure (-0.55).

Whilst overall gains in scaled score have been achieved in Auditory Sequential Memory (0.85), Visual Sequential Memory (6.15), Auditory Closure (2.20), and Sound Blending (2.85). It will be noted that these gains involve Automatic Level processes, no gains being registered on any Representational abilities. This has resulted in a small overall gain for the entire Automatic Level (0.25), however, for the Representational Level subtests, concerned with productive language behaviour, a regression of -2.90 points is registered. As the Control Programme involved no psycholinguistic training, the gains on the Automatic constructs might, in part, reflect the training in phonic analysis or the look and say approaches to reading that the Control children were undergoing in class. The large increase in Visual Sequential Memory performance might also indicate that this aspect of Visual Perception is dependent on maturational factors. These issues will be examined more fully in the next section.

An inspection of the data for the processes reveals that regressions are recorded for all three, with the largest negative result being obtained on the Receptive Process, i.e. Reception Process (-5.18), Association Process (-1.45), and Expression Process (-1.83). Regressions have also occurred on both channels, i.e. Auditory-Vocal Channel (-2.20), and Visual-Motor Channel (-0.45).
Table 22 presents the Control subjects subtest performance in terms of language ages. A perusal of this table shows that at the end of the experiment, the experimental group are retarded in language age on every ITPA subtest, the largest deficits occurring in Auditory Closure (59.20 months), Auditory Reception (40.05 months), Grammatic Closure (38.60 months), and Visual Sequential Memory (36.35 months).

Turning to Table 23 and examining the deviation scores, it will be seen that the Control Group obtained a large positive deviation score of +9 for both Manual Expression and Visual Closure. This represents atypical performance since only 2 – 4 per cent of average children would exhibit a deviation score of this magnitude. These two functions are considered to be areas of strength in the experimental group's linguistic development.

However, negative deviations of -14 on Auditory Closure and -12 on Grammatic Closure are recorded. Deviations of this magnitude are atypical since less than 3 per cent of average children would achieve similar deviation scores. This signifies a substantial disability in these functions in the Control Group's psycholinguistic growth.

In all the remaining subtest areas: Auditory Reception, Visual Reception, Auditory Association, Visual Association, Verbal Expression, Auditory Sequential Memory, Visual Sequential Memory, and Sound Blending, the Control Group's deviation scores are typical of those of average children, since between 64 – 85 per cent of normal children would achieve similar deviation scores. The Control Group can be considered, therefore, to be developing evenly in all these functions.

At the start of the experiment it was shown that the Control Group exhibited a substantial disability in Auditory Closure, and a borderline disability in Visual Sequential Memory. Whilst the substantial deficit in Auditory Closure was still present at the end of the experiment,
Table 22

Mean Language Age Gains on ITPA subtests by children in the Control Group

<table>
<thead>
<tr>
<th>Test</th>
<th>Mean LA on occasion 1</th>
<th>Mean LA on occasion 2</th>
<th>Mean LA on occasion 3</th>
<th>Gain at end of RT</th>
<th>Gain after RT ended</th>
<th>Total Gain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auditory Reception</td>
<td>62.05</td>
<td>62.85</td>
<td>68.8</td>
<td>0.80</td>
<td>3.45</td>
<td>4.20</td>
</tr>
<tr>
<td>Visual Reception</td>
<td>69.90</td>
<td>71.35</td>
<td>74.10</td>
<td>0.75</td>
<td>7.75</td>
<td>4.85</td>
</tr>
<tr>
<td>Auditory Association</td>
<td>67.80</td>
<td>65.50</td>
<td>73.25</td>
<td>-2.90</td>
<td>7.50</td>
<td>4.85</td>
</tr>
<tr>
<td>Visual Association</td>
<td>68.40</td>
<td>81.95</td>
<td>89.75</td>
<td>3.30</td>
<td>4.50</td>
<td>7.80</td>
</tr>
<tr>
<td>Manual Expression</td>
<td>89.75</td>
<td>89.75</td>
<td>102.25</td>
<td>5.0</td>
<td>2.50</td>
<td>7.50</td>
</tr>
<tr>
<td>Grammatic Closure</td>
<td>67.0</td>
<td>68.5</td>
<td>70.25</td>
<td>1.50</td>
<td>1.75</td>
<td>3.25</td>
</tr>
<tr>
<td>Auditory Sequential</td>
<td>94.65</td>
<td>91.55</td>
<td>100.75</td>
<td>3.15</td>
<td>6.05</td>
<td>9.20</td>
</tr>
<tr>
<td>Visual Sequential</td>
<td>55.85</td>
<td>69.35</td>
<td>72.30</td>
<td>13.50</td>
<td>1.70</td>
<td>15.20</td>
</tr>
<tr>
<td>Auditory Closure</td>
<td>44.10</td>
<td>47.95</td>
<td>49.65</td>
<td>3.85</td>
<td>1.70</td>
<td>5.55</td>
</tr>
<tr>
<td>Sound Blending</td>
<td>72.30</td>
<td>79.80</td>
<td>84.6</td>
<td>7.50</td>
<td>4.80</td>
<td>12.30</td>
</tr>
<tr>
<td>Composite PLA</td>
<td>72.05</td>
<td>75.30</td>
<td>80.55</td>
<td>3.25</td>
<td>5.25</td>
<td>8.50</td>
</tr>
<tr>
<td>C.A. (months)</td>
<td>90.95</td>
<td>98.65</td>
<td>108.85</td>
<td>7.70</td>
<td>10.20</td>
<td>17.90</td>
</tr>
</tbody>
</table>

NB

All language ages above in months.

'Gain at end of RT' column = Mean LA on occasion 2 - Mean LA on occasion 1.

'Gain after RT ended' column = Mean LA on occasion 3 - Mean LA on occasion 2.

'Total Gain' column = Mean LA on occasion 3 - Mean LA on occasion 1.
Table 23

Comparison of ITPA subtest mean scaled scores with composite mean scaled score, obtained on the final test by children on the Control Programme.

<table>
<thead>
<tr>
<th>Subtest Mean Scaled Score</th>
<th>Deviation Score</th>
<th>Percentage from table</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auditory Reception</td>
<td>20</td>
<td>-6</td>
<td>85</td>
</tr>
<tr>
<td>Visual Reception</td>
<td>22</td>
<td>-4</td>
<td>85</td>
</tr>
<tr>
<td>Auditory Association</td>
<td>22</td>
<td>-4</td>
<td>80</td>
</tr>
<tr>
<td>Visual Association</td>
<td>26</td>
<td>0</td>
<td>72</td>
</tr>
<tr>
<td>Verbal Expression</td>
<td>31</td>
<td>5</td>
<td>64</td>
</tr>
<tr>
<td>Manual Expression</td>
<td>35</td>
<td>9</td>
<td>2</td>
</tr>
<tr>
<td>Grammatic Closure</td>
<td>14</td>
<td>-12</td>
<td>3</td>
</tr>
<tr>
<td>Visual Closure</td>
<td>35</td>
<td>9</td>
<td>4</td>
</tr>
<tr>
<td>Auditory Sequential</td>
<td>31</td>
<td>5</td>
<td>69</td>
</tr>
<tr>
<td>Visual Sequential</td>
<td>27</td>
<td>1</td>
<td>69</td>
</tr>
<tr>
<td>Auditory Closure</td>
<td>12</td>
<td>-14</td>
<td>no data available</td>
</tr>
<tr>
<td>Sound Blending</td>
<td>32</td>
<td>6</td>
<td>&quot;</td>
</tr>
<tr>
<td>Automatic Level</td>
<td>25</td>
<td>-1</td>
<td>&quot;</td>
</tr>
<tr>
<td>Representational Level</td>
<td>26</td>
<td>0</td>
<td>&quot;</td>
</tr>
<tr>
<td>Reception Process</td>
<td>21</td>
<td>-5</td>
<td>&quot;</td>
</tr>
<tr>
<td>Association Process</td>
<td>24</td>
<td>-2</td>
<td>&quot;</td>
</tr>
<tr>
<td>Expression Process</td>
<td>33</td>
<td>7</td>
<td>&quot;</td>
</tr>
<tr>
<td>Auditory-Vocal</td>
<td>23</td>
<td>-3</td>
<td>&quot;</td>
</tr>
<tr>
<td>Visual-Motor</td>
<td>29</td>
<td>3</td>
<td>&quot;</td>
</tr>
<tr>
<td>Mean Scaled Score</td>
<td>26</td>
<td>&quot;</td>
<td></td>
</tr>
<tr>
<td>C.A. (months)</td>
<td>108</td>
<td>&quot;</td>
<td></td>
</tr>
</tbody>
</table>

N = 20

NB
1. All scaled scores to the nearest integer.
2. Probability values calculated from standard errors of measurement for scaled scores.
3. Percentage from table column refers to the percentage of the normative group who exhibited this deviation score.
the Control Group's improved performance in Visual Sequential Memory had corrected the borderline disability in this function. However, the Control subject's performance in Grammatic Closure had deteriorated markedly over the experiment to such an extent that a substantial disability in this area was recorded on the final test.

The Control Group's profile of abilities, presented graphically overleaf, illustrates the negative effect of the Control Programme. Whilst a small amount of improvement is discernible in the areas of Visual Sequential Memory, Auditory Closure, and Sound Blending, over the remaining subtests there has been a general deterioration in language performance.

**Control Group – Interindividual Differences**

Interindividual comparisons for the Control Group are best facilitated by a perusal of Table 21, page 265 and Table 24, page 272. Using the criterion of 36 scaled score points to indicate normative performance, an inspection of Table 21 indicates that, with the exception of Manual Expression, the Control Group was retarded on every ITPA subtest at the start of the examination. An overall indicator of the extent of the Control subject's retardation is given by the Mean Scaled Score of 28.18, which was 7.82 points below normative group performance before the experiment started.

At the end of the experiment, it will be seen that the Control Group still exhibited lower scores on every ITPA subtest than the normative group. Whilst the experimental group has made progress in Auditory Sequential Memory, Visual Sequential Memory, Auditory Closure, and Sound Blending, overall there has been a general deterioration in the group's performance. This is reflected in the Mean Scaled Score of 25.83 points which was finally some 10.17 points in deficit of normative performance.
Profile of scaled scores for children on the Control Programme for three occasions.

Mean scores on occasion 1
Mean scores on occasion 2
Mean scores on occasion 3

Scaled Scores on TQA Subtests

Sound Blending
Auditory Closure
Visual Memory
Auditory Memory
Visual Closure
Grammatic Closure
Manual Expression
Verbal Expression
Visual Association
Auditory Association
Visual Reception
Auditory Reception
Table 24

Comparison of ITPA subtest Final Language Aces obtained by the Control Group with those of the Normative Group.

<table>
<thead>
<tr>
<th></th>
<th>Normative Group</th>
<th>Control Group</th>
<th>Initial Difference in language age</th>
<th>Final Difference in language age</th>
<th>Relative Gain of Control Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auditory Reception</td>
<td>107.4</td>
<td>68.8</td>
<td>35.8</td>
<td>38.6</td>
<td>-2.8</td>
</tr>
<tr>
<td>Visual Reception</td>
<td>106.7</td>
<td>74.1</td>
<td>26.1</td>
<td>32.6</td>
<td>-6.5</td>
</tr>
<tr>
<td>Auditory Association</td>
<td>106.4</td>
<td>75.4</td>
<td>26.7</td>
<td>31.0</td>
<td>-4.3</td>
</tr>
<tr>
<td>Visual Association</td>
<td>101.4</td>
<td>73.3</td>
<td>26.4</td>
<td>28.1</td>
<td>-1.7</td>
</tr>
<tr>
<td>Verbal Expression</td>
<td>109.0</td>
<td>89.8</td>
<td>12.0</td>
<td>19.2</td>
<td>-7.2</td>
</tr>
<tr>
<td>Manual Expression</td>
<td>104.7</td>
<td>102.3</td>
<td>1.5</td>
<td>2.4</td>
<td>-0.9</td>
</tr>
<tr>
<td>Grammatic Closure</td>
<td>107.7</td>
<td>70.3</td>
<td>28.3</td>
<td>37.4</td>
<td>-9.1</td>
</tr>
<tr>
<td>Visual Closure</td>
<td>104.3</td>
<td>100.8</td>
<td>4.5</td>
<td>3.5</td>
<td>3.0</td>
</tr>
<tr>
<td>Auditory Sequential</td>
<td>97.9</td>
<td>78.9</td>
<td>22.1</td>
<td>19.0</td>
<td>3.1</td>
</tr>
<tr>
<td>Visual Sequential</td>
<td>100.6</td>
<td>72.3</td>
<td>28.2</td>
<td>28.3</td>
<td>9.9</td>
</tr>
<tr>
<td>Auditory Closure</td>
<td>100.7</td>
<td>49.7</td>
<td>48.2</td>
<td>51.0</td>
<td>-2.8</td>
</tr>
<tr>
<td>Sound Blending</td>
<td>94.9</td>
<td>84.6</td>
<td>16.0</td>
<td>10.3</td>
<td>5.7</td>
</tr>
<tr>
<td>Composite PLA</td>
<td>105.8</td>
<td>80.6</td>
<td>22.5</td>
<td>25.2</td>
<td>-2.7</td>
</tr>
<tr>
<td>C.A.</td>
<td>109.0</td>
<td>108.9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>126</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*NB* All language ages above in months.

"Initial Difference in language age" column = normative scores - experimental group scores at the start of the experiment.

"Final Difference in language age" column = normative scores - experimental group scores at the end of the experiment.

"Relative Gain of Control Group" column = gain of experimental group over the experiment relative to the normative group.
A comparison of the Composite PLA's for the two groups shows that at the start of the experiment the Control children were 22.5 months retarded in overall language age; whilst at the end of the experiment the deficit had increased to some 25.2 months. Substantial deficits in psycholinguistic functioning still remained in the areas of Auditory Closure (51.0 months), Auditory Reception (38.6 months), Grammatic Closure (37.4 months), Auditory Association (31.0 months), and Visual Sequential Memory (28.3 months).

The above findings indicate the extent of the Control Group's deterioration in language performance, relative to the normative group, as might be expected from children who received no language training during the experiment.

(iii) Effect of the Programmes on Reading Skills and Non-Verbal IQ

Table 25, overleaf, presents the gains in reading ages and non-verbal intelligence achieved by the three experimental groups during the course of the experiment. The reading ages were assessed on the Burt-Vernon Graded Word Test and the Young's Group Reading Test, and the non-verbal intelligence was assessed on the Raven's Coloured Progressive Matrices Test. Two reading tests were used as criteria as each test measures different reading skills. Thus, the Burt-Vernon Test, being a mechanical reading test, assesses decoding skills. In contrast, the Young's Test measures higher-order reading skills. Two thirds of this test consists of sentence completion exercises, thereby necessitating that children utilize, in addition to decoding skills, syntactic and semantic cues.

It will be seen that both the Kirk and Peabody Group subjects have made substantial improvement on both reading measures, the Kirk Group achieving larger gains on both tests. The Control Group's performance
Table 25  Reading Ages and Non-Verbal I.Q. on three occasions for the three Experimental Groups

<table>
<thead>
<tr>
<th></th>
<th>Burt-Vernon Reading Test</th>
<th></th>
<th>Young's Group Reading Test</th>
<th></th>
<th>Raven's Matrices</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>C1</td>
<td>C2</td>
<td>C3</td>
<td>Total Gain</td>
<td>C1</td>
<td>C2</td>
</tr>
<tr>
<td>Kirk Group</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>4.7</td>
<td>6.7</td>
<td>7.2</td>
<td>2.5</td>
<td>-6.0</td>
<td>7.3</td>
</tr>
<tr>
<td>S.D.</td>
<td>5.04</td>
<td>5.84</td>
<td>8.12</td>
<td></td>
<td>2.77</td>
<td>3.16</td>
</tr>
<tr>
<td>Peabody Group</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>4.5</td>
<td>6.0</td>
<td>6.6</td>
<td>2.1</td>
<td>-6.0</td>
<td>7.0</td>
</tr>
<tr>
<td>S.D.</td>
<td>4.06</td>
<td>8.63</td>
<td>12.87</td>
<td></td>
<td>3.44</td>
<td>4.31</td>
</tr>
<tr>
<td>Control Group</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>4.4</td>
<td>4.9</td>
<td>5.3</td>
<td>0.9</td>
<td>-6.0</td>
<td>6.7</td>
</tr>
</tbody>
</table>
on the other hand is much less than that of the children on the
language programmes.

Thus on the Burt-Vernon Test, the Kirk Group gained 2.5 years
R.A. over the experiment, whilst the Peabody Group gained 2.1 years
R.A. overall. Over the same period the children in the Control Group,
who were drawn from the same classes as children in the Kirk and
Peabody Groups, achieved a gain in R.A. of 0.9 years. The reader
will note that the gain in R.A. for the Control Group is in deficit
when compared with their increase in chronological age (i.e. 17.9
months) over the experiment.

Turning to the Young's Group Reading Test, all three experimental
groups, at the start of the experiment, were below the basal reading
age of 6.0 years on this test. At the end of the experiment, the Kirk
Group achieved a R.A. of 7.6 years, the Peabody Group a R.A. of 7.2 years,
and the Control Group a R.A. of 6.9 years.

Many large individual gains in R.A. have been made by children
in each of the language Groups. For the Kirk subjects, the largest
individual gain in R.A. on the Burt-Vernon Test was 4.2 years, whilst
5 children in the group achieved final R.A.'s greater than 8.0 years.
On the Young's Test the highest recorded individual R.A. was 8.2 years.
For the Peabody subjects, the largest individual gain in R.A. on the
Burt-Vernon Test was 5.7 years, whilst 2 children in the group achieved
final R.A.'s greater than 8 years. On the Young's Test, the highest
recorded individual R.A. was 8.8 years. By contrast, the largest
individual gain recorded on the Burt-Vernon Test for the Control subjects
was 1.8 years, and the highest R.A. achieved on the Young's Test was
7.1 years.
It must be emphasized that, even though the Kirk Experimental Group undertook training activities utilising Keywords, neither the children of this group nor the Peabody children, received any direct instructions in reading skills. The word 'Reading' was deliberately avoided in the context of the lessons in order that the children would be unaware that their reading skills were being investigated.

The clear superiority of subjects receiving psycholinguistic training, over Control subjects, appears to represent a reasonable criterion for assuming the validity of psycholinguistic training procedures. This issue will be discussed in more detail when the results are interpreted in the next section.

Turning to the children's non-verbal intelligence, as measured by the Raven's Matrices Test, the following trend will be observed. At the end of the enrichment period, the gain in IQ points was as follows: Kirk Group (8.85), Peabody Group (3.90), Control Group (1.05). During the post-remedial period regressions in IQ scores took place for each of the experimental groups, thereby reducing the size of the overall gain. Thus the non-verbal intelligence of the Kirk subjects increased by 5.05 I.Q. points overall, whilst the Peabody Group achieved a smaller overall gain of 2.10 I.Q. points. In contrast to this, the Control Group's non-verbal intelligence remained relatively constant over the experiment, a small regression of -0.45 I.Q. points being recorded overall.

This appears to suggest that a relationship exists between increase in psycholinguistic ability and increase in non-verbal intelligence. Again, the implications of this will be examined in the following section.
INTERPRETATION AND DISCUSSION OF RESULTS

PART II
Interpretation and Discussion of Results

The aims of the experiment set out in the Problem on page 19 and with which Part II of this study is concerned, have been restated below:

(i) To conduct a method's experiment to investigate the effectiveness of two distinct approaches to the alleviation of psycholinguistic disabilities, (a) in the short term, and (b) in the long term. The first of these approaches based on the Kirk Programmes, and the second on the Peabody Language Development Kits.

(ii) To determine the effectiveness of the remedial work on psycholinguistic abilities, non-verbal intelligence, and on related aspects of language such as articulation and reading skills.

Each of the above aims will be examined in turn in the light of the experimental findings.

The relationship between both the Kirk and Peabody Programmes and the various criterion measures is a key theoretical issue that is crucial to the interpretation of the results. The rationale and construction of both the Kirk and Peabody Programmes has already been presented. However, before the differential effect of the programmes on the criterion measures in (i) and (ii) above can be meaningfully assessed the content of each language programme must be examined in detail. The nature of each language programme will be scrutinized followed by a summary of the salient features of each.
Comparison of the input from the Kirk and Peabody Programmes

Having identified two particular areas of deficit in Visual Sequential Memory and Auditory Closure in Part I of this study, the writer constructed the Kirk remediation programmes aimed at alleviating the children's weaknesses in these functions. When constructing these programmes the writer followed very carefully the general guidelines and specific suggestions contained in "Psycholinguistic learning disabilities: diagnosis and remediation" (Kirk and Kirk, 1971). Tables 29 and 30 (Appendix E pp. 442-443) list the activities that comprise the Visual Sequential Memory and Auditory Closure programmes together with the pages of Kirk and Kirks' 1971 book that justify the inclusion of each particular activity. The following principles provided by the Kirks, which form the central thesis of their remedial strategy, were also drawn upon:

a) Train the deficient areas (p. 121).

b) It is necessary to use the assets and also train the deficits (p. 121).

c) Remedial programmes aim, therefore, to stimulate the functioning of those abilities in which the child is below par (p. 122).

d) Use multisensory presentation appropriately (p. 124).

e) Most learning is intersensory. Thus, the judicious use of multisensory presentations and cross-modality techniques are valuable in remediation (p. 127).

f) Remediate pre-requisite deficits first (p. 127).

g) Make provision for utilising feedback (p. 128). Specific reference to Fernald's approach to reading is made (p. 129).

h) Develop abilities functionally (p. 130).

i) Individualise instruction.
The Kirk's offer guidelines for the development of remedial procedures for each of the twelve different functions measured by the ITPA. Suggestions relating to Visual Sequential Memory (pp. 181-185) make unambiguous reference to sequences of "objects, letters and words......" (p. 181). Training strategies listed by the Kirks include, "Rehearsal", "Grouping", "Verbalisation", "Motor Response" (writing), and "Making the stimulus meaningful by using Representational level processes" (p. 183). Advice on remedial programmes for poor readers who exhibit Visual Sequential Memory deficit recommends that the child is given familiarity with letters and words, rather than teaching visual discrimination of abstract, meaningless symbols. They advise an adaptation of the Fernald Kinaesthetic method which has been shown to increase Visual Sequential Memory. The Fernald method is a system of training memory for words, not in the abstract, but directly with words and phrases needed by the child in learning to read. This procedure encompasses important variables in learning. First, integrating the visual input with the motor experience strengthens the learning process by the addition of another sensory channel. Second, by writing and using a motor movement, attention is focussed on the visual task. Although the method has been called "Kinaesthetic", its more important function may be that of training Visual Sequential Memory and attention to detail, since the emphasis of the method is to write words from memory. In a recent book, in which Kirk is the senior author, this approach is referred to as process-task training, or as aptitude-task interaction (Kirk and Gallagher, 1979, pp. 317-318). The process-task approach integrates remediation of the process dysfunction (Visual Sequential Memory) with the task development as analysed (reading ability). Essentially this model assesses the abilities and
disabilities of the children (intraindividual differences), makes
task analyses of the skills to be learned, and prescribes remediation
in the functions and skills to be developed. This dialectic system
it is claimed, permits the teacher to assess, programme, instruct
and evaluate the child's psycholinguistic characteristics in the
same system as his skill competencies. From an inspection of the
writer's Visual Sequential Memory programmes (Vol II pp 1-40) it will
be seen that the programmes are a faithful attempt at operationalising
the Kirks' general guidelines for remediation.

Turning to the Auditory Closure programmes, in relation to the
suggestions for Auditory Closure remediation the principles given by
the Kirks are the same as for any area of deficit. However, the
specific guidelines (pp. 154-158) are somewhat confounded with those
relating to Grammatic Closure and Sound Blending, thereby acknowledging
the interdependence of these functions. Again it will be seen that the
writer's Auditory Closure programme (Vol II pp. 41-83) is in harmony
with the Kirks' suggestions.

The above discussion illustrates that the writer's Visual Sequential
Memory/Auditory Closure remedial programme is defensible according to
the Kirks' suggestions for remedial programmes. However, in following
their advice, it must be emphasised that there is a discrepancy between
the Kirks' theorising based on the ITPA communication model, and the
principles and suggestions for remediation put forward by the Kirks.
The principles and specifics of remediation recommended by the Kirks
do not necessarily derive from the ITPA theoretical model. The gap
between the theoretical model and the wide range of remedial activities
recommended by the Kirks, is crucial, and has very important implications
for the interpretation of the results.

For example, the poor readers in this study following assessment were
found to have disabilities in Auditory Closure and Visual Sequential Memory. According to the clinical model of the communication theory these are both Automatic level functions. The Kirks' theorising is to organise remedial programmes which focus on the specific developmental disabilities in Auditory Closure and Visual Sequential Memory. However, the Kirks' specific guidelines for the remediation of the above functions do not utilise activities drawn only from the Automatic Level of Organisation. Whilst the Kirks' theorising emphasises the importance of identifying and rectifying the observed deficits by getting the child to work primarily but not exclusively on the deficits, their suggestions for remedial activities are not restricted to such narrowly defined areas. The rectification of psycholinguistic deficits in practice is brought about by an integrative and not a discrete approach which does not eliminate the use of abilities other than the one needing development. This results in programmes of great complexity of psychological processes. The complex nature of the writer's Visual Sequential Memory/Auditory Closure is illustrated in Table 31 (Appendix E p. 444). This table consists of a matrix in which each activity of the Kirk Programme has been classified under four dimensions: "mode of pupil's response"; "level of pupil's response"; "process"; and "content of pupil's response". Ticks in the columns have been entered as appropriate. An inspection of Table 31 shows that the Kirk (VSM/AC) programme is a multi-mode (visual, auditory, Kinaesthetic), multi-level (automatic, representational), and multi-process (receptive, associative, expressive) psycholinguistic programme with a conscious emphasis on the remediation of sequencing and closure functions. In addition the Kirk programme also includes activities in receptive (listening and reading) and expressive (writing and speaking) language skills.
It is clear that the earlier assumption, that the Kirk Programme focussed only on the training of specific psycholinguistic sub-skills, cannot be accepted. The variety of practical suggestions for remedial activities suggested by the Kirks allows a vast range of programmes to be developed. It is far from clear how the theoretical model on which the ITPA is based can support this range. Although the ITPA occupies a prominent position in the Kirk model, the emphasis really is upon attacking diagnosed language deficits with the test instrument assisting only in the discrimination of the deficit area. In contrast to their theorising, the Kirks' practical remedial strategy appears to acknowledge that most learning is intersensory and that no one method can successfully teach all children. The most effective remediation, therefore, attempts to integrate the disability with other abilities. Their model is essentially an eclectic one which integrates the process dysfunction with task analyses of skills to be learned.

In order to contrast the Peabody Programmes with those of the Kirk, Tables 32 and 33 (Appendix E pp. 445-446) have been prepared. The PDLK model was built on Osgood's linguistic theory and influenced by the receptive-associative-expressive model of the ITPA. The PDLK stresses an overall language and verbal intelligence training programme, rather than specific training in psycholinguistic processes. This is illustrated in Table 33 where the activities that make up the 24 lessons of Peabody Programmes have been classified according to the ITPA sub-tests which are sampled. Whilst the programmes include activities involving all twelve ITPA subtests, they load most heavily on Auditory Reception, Auditory Association, and Verbal Expression. This is in line with the claim of the PDLK constructors that, 'emphasized is reception, expression, and especially conceptualization'. As with the Kirk Programmes, the Peabody activities have been classified under the four dimensions:
'modality', 'level', 'process', and 'content of pupil's response'. From Table 32 it will be seen that the Peabody Programme is a multi-modal, multi-level, multi-process programme with a conscious emphasis on the oral verbal aspects of language.

If we compare the Kirk and Peabody Programmes in terms of whether the activities are Expressive/Receptive and Oral/Textual, it will be seen that the Kirk Programme includes speaking, listening, reading, and writing. In contrast, the Peabody Programme being oral-verbal concentrates on speaking and listening, but no reading or writing training is given. It is a major difference between the programmes whether the inclusion of reading and writing activities differentially improves the deficient psycholinguistic functions and reading attainments of the pupils.

Summary of the salient features of the Kirk and Peabody Programmes

1. Whilst the Kirks' theorising emphasises the importance of identifying and rectifying psycholinguistic disabilities, their guidelines and suggestions for remedial activities are not restricted to such narrowly defined areas. Although the ITPA functions are independent, remediation does not eliminate other functions when remediating the major disability or disabilities. The Kirks believe that the most effective remediation attempts to integrate the disability with other abilities. Following the Kirks' guidelines, the writer's programme to rectify the disabilities in Auditory Closure and Visual Sequential Memory, leads to a multi-mode, multi-level, multi-process early reading programme with a conscious emphasis on sequencing and closure functions. It is a process-task approach which integrates remediation of the process dysfunction (e.g. Visual Sequential Memory) directly in the task
that is required (e.g. reading ability).

2. The Peabody Programme is also a multi-mode, multi-level, multi-process programme which emphasizes the Oral-verbal nature of language. Whilst the activities comprising the Peabody Programme tap all of the twelve ITPA subtests, Auditory Reception, Auditory Association and Verbal Expression are the functions which are utilised most.

3. The Kirk Programme is a complete language programme insofar as it gives training in receptive (listening and reading) and expressive (speaking and writing) language skills. In contrast, the Peabody Programme being oral-verbal focuses on listening and speaking only. It is an important difference between the programmes whether the inclusion of reading and writing activities differentially improves the deficient psycho-linguistic functions and reading attainment of the pupils.

**Comparison of the effectiveness of the Kirk and Peabody Programmes**

A considerable amount of data, of both a statistical and psychological nature, has been presented in respect of the two language programmes. Thus the statistical analyses have shown:

1. Children on the Kirk Programmes performed significantly better than children on the Peabody Programmes in respect of: Grammatic Closure ($p < .05$), and Burt-Vernon Reading Test ($p < .05$). These findings being independent of schools and occasions.
Children on the Kirk Programmes performed significantly better than children on the Peabody Programmes on:
Visual Sequential Memory (p<.05), Auditory Closure (p<.01),
Automatic Level of ITPA (p<.01), Auditory -Vocal Channel (p<.01),
and Young's Group Reading Test (p<.05).
The above effects, whilst independent of schools, were not independent of occasions. An examination of the significant programmes x occasions interaction showed that they were only valid over occasions C1 - C2 (i.e. gains as a result of remediation). The differences between occasions C2 - C3 (post-remedial period) were clearly not significant.

No significant differences were found between the two groups in respect of:
Auditory Reception, Visual Reception, Auditory Association,
Visual Association, Verbal Expression, Manual Expression,
Visual Closure, Auditory Sequential Memory, Sound Blending,
Composite PLA, Mean Scaled Score, Representational Level,
Reception Process, Association Process, Expression Process,

The statistical findings presented above show that the Kirk Group performed significantly better than the Peabody subjects on seven of the twenty four criterion tests used in the experiment. On no test did the Peabody Group achieve a significantly higher score than the Kirk Group. A perusal of Table 26 overleaf, which
### Table 26
Comparison of gains made by children on Kirk, Peabody, and Control Programmes.

<table>
<thead>
<tr>
<th></th>
<th>Kirk Programmes</th>
<th>Peabody Programmes</th>
<th>Control Programmes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Auditory Reception</td>
<td>2.75</td>
<td>-3.65</td>
<td>-0.10</td>
</tr>
<tr>
<td>Visual Reception</td>
<td>0.90</td>
<td>2.70</td>
<td>3.60</td>
</tr>
<tr>
<td>Auditory Association</td>
<td>3.65</td>
<td>-1.90</td>
<td>1.75</td>
</tr>
<tr>
<td>Visual Association</td>
<td>0.35</td>
<td>0.35</td>
<td>0.70</td>
</tr>
<tr>
<td>Verbal Expression</td>
<td>3.0</td>
<td>-0.85</td>
<td>2.15</td>
</tr>
<tr>
<td>Manual Expression</td>
<td>0.85</td>
<td>-0.50</td>
<td>0.35</td>
</tr>
<tr>
<td>Grammatic Closure</td>
<td>2.70</td>
<td>-1.95</td>
<td>0.75</td>
</tr>
<tr>
<td>Visual Closure</td>
<td>4.30</td>
<td>2.05</td>
<td>6.35</td>
</tr>
<tr>
<td>Auditory Sequential</td>
<td>2.35</td>
<td>0.20</td>
<td>2.55</td>
</tr>
<tr>
<td>Visual Sequential</td>
<td>13.45</td>
<td>0.10</td>
<td>13.35</td>
</tr>
<tr>
<td>Auditory Closure</td>
<td>16.90</td>
<td>-3.35</td>
<td>13.55</td>
</tr>
<tr>
<td>Sound Blending</td>
<td>2.35</td>
<td>1.80</td>
<td>4.15</td>
</tr>
<tr>
<td>Composite PLA (months)</td>
<td>14.95</td>
<td>9.0</td>
<td>23.95</td>
</tr>
<tr>
<td>Mean Scaled Score</td>
<td>3.41</td>
<td>-0.38</td>
<td>3.03</td>
</tr>
<tr>
<td>Automatic Level</td>
<td>7.10</td>
<td>0</td>
<td>7.10</td>
</tr>
<tr>
<td>Representational Level</td>
<td>1.80</td>
<td>-0.75</td>
<td>1.05</td>
</tr>
<tr>
<td>Reception Process</td>
<td>1.82</td>
<td>-0.47</td>
<td>1.35</td>
</tr>
<tr>
<td>Association Process</td>
<td>2.0</td>
<td>-0.77</td>
<td>1.23</td>
</tr>
<tr>
<td>Expression Process</td>
<td>2.03</td>
<td>-0.68</td>
<td>1.35</td>
</tr>
<tr>
<td>Auditory-Vocal</td>
<td>4.80</td>
<td>-1.30</td>
<td>3.50</td>
</tr>
<tr>
<td>Visual-Motor</td>
<td>3.90</td>
<td>1.15</td>
<td>5.05</td>
</tr>
<tr>
<td>Burt-Vernon (years)</td>
<td>2.0</td>
<td>0.5</td>
<td>2.5</td>
</tr>
<tr>
<td>Youngs (years)</td>
<td>1.3</td>
<td>0.3</td>
<td>1.6</td>
</tr>
<tr>
<td>Raven's I.Q.</td>
<td>8.85</td>
<td>-3.80</td>
<td>5.05</td>
</tr>
<tr>
<td>C.A. (months)</td>
<td>7.55</td>
<td>9.50</td>
<td>17.05</td>
</tr>
</tbody>
</table>

N: 10

**NB**
1. Gain made at the end of remedial teaching
2. Gain made during the post-remedial period
3. Total Gain

All Gains in ITPA scaled scores
compares the overall gains made by the three experimental groups at the end of the experiment, shows that the Kirk Group achieved higher overall gains than the Peabody Group on 17 criterion tests. A comparison of the final Mean Scaled Score for each experimental group provides the best index of their overall ITPA subtest performance. This shows that over the experiment the Mean Scaled Score of the Kirk Group increased by 3.03 points, as compared with an increase of 1.59 points for the Peabody Group. Thus at the end of the experiment, the Mean Scaled Score of the Kirk Group (33.30) was much nearer the normative mean (36.0), than that of the Peabody Group (31.90).

In terms of language ages, the Composite PLA of the Kirk Group at the end of the experiment was 4.8 months below that of the normative group whilst the Peabody Group's final Composite PLA was 6.1 months in deficit. An inspection of the final ITPA subtest language ages, presented in Table 27, shows that the Kirk Group exhibited higher language ages than the Peabody subjects on eight of the twelve ITPA subtests. At the beginning of the experiment a large discrepancy in language performance was found between the Experimental Group children (75.8 months) and the Normative Group (94.6 months). This was thought to be a consequence of social and cultural factors by comparing English children, drawn from an unfavourable environment, with an American normative group described as being slightly above middle-class. The Kirk Programmes have, therefore, been more successful at alleviating many of these social effects.

Other meaningful comparisons can be obtained by examining the
Table 27

Comparison of the Final Language Ages achieved by the children on the Kirk, Peabody, and Control Programmes with those of the Normative Group.

<table>
<thead>
<tr>
<th></th>
<th>Normative Group</th>
<th>Kirk Group</th>
<th>Peabody Group</th>
<th>Control Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auditory Reception</td>
<td>107.4</td>
<td>83.2</td>
<td>89.8</td>
<td>68.8</td>
</tr>
<tr>
<td>Visual Reception</td>
<td>106.7</td>
<td>89.4</td>
<td>91.6</td>
<td>74.1</td>
</tr>
<tr>
<td>Auditory Association</td>
<td>106.4</td>
<td>90.5</td>
<td>94.9</td>
<td>75.4</td>
</tr>
<tr>
<td>Visual Association</td>
<td>101.4</td>
<td>83.0</td>
<td>81.7</td>
<td>73.3</td>
</tr>
<tr>
<td>Verbal Expression</td>
<td>109.0</td>
<td>112.6</td>
<td>120.0</td>
<td>89.8</td>
</tr>
<tr>
<td>Manual Expression</td>
<td>104.7</td>
<td>117.9</td>
<td>116.0</td>
<td>102.3</td>
</tr>
<tr>
<td>Grammatic Closure</td>
<td>107.7</td>
<td>96.1</td>
<td>89.7</td>
<td>70.3</td>
</tr>
<tr>
<td>Visual Closure</td>
<td>104.3</td>
<td>120.2</td>
<td>118.9</td>
<td>100.8</td>
</tr>
<tr>
<td>Auditory Sequential</td>
<td>97.9</td>
<td>104.2</td>
<td>90.9</td>
<td>78.9</td>
</tr>
<tr>
<td>Visual Sequential</td>
<td>100.6</td>
<td>98.8</td>
<td>76.3</td>
<td>72.3</td>
</tr>
<tr>
<td>Auditory Closure</td>
<td>100.7</td>
<td>81.0</td>
<td>54.5</td>
<td>49.7</td>
</tr>
<tr>
<td>Sound Blending</td>
<td>94.9</td>
<td>98.0</td>
<td>93.4</td>
<td>84.6</td>
</tr>
<tr>
<td>Composite PLA</td>
<td>105.8</td>
<td>101.0</td>
<td>99.7</td>
<td>80.6</td>
</tr>
<tr>
<td>Chronological Age</td>
<td>109.0</td>
<td>108.4</td>
<td>110.7</td>
<td>108.9</td>
</tr>
<tr>
<td>N</td>
<td>126</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
</tbody>
</table>

NB All language ages above in months
deviation scores for each experimental group (Tables 15, 19). An inspection of the Kirk Group's deviation scores at the end of the experiment showed that there were no deficits in psycholinguistic growth and that the experimental group's performance on the ITPA subtests was typical of average children, with the exception of Visual Closure which was considered to be an area of strength. This meant that the substantial disability in Auditory Closure and the borderline disability in Visual Sequential Memory, diagnosed as present at the start of the experiment, had been successfully ameliorated by the Kirk training. When the Peabody Group's deviation scores were similarly examined they also exhibited relative strength in the area of Visual Closure. Unlike the Kirk Group, however, two areas of discrepant psycholinguistic functioning, in Auditory Closure and Grammatic Closure, were recorded at the end of the experiment.

Whilst the Peabody training had corrected the initial borderline disability in Visual Sequential Memory, it had failed to ameliorate the initial substantial discrepancy in Auditory Closure as a substantial disability in this function remained at the end of the experiment. The programmes had also failed to prevent a deterioration in the experimental group's performance in Grammatic Closure, as a substantial disability was finally recorded in this function.

The graphical profiles of abilities, overleaf, constructed for each experimental group at the beginning and end of the experiment, show clearly each group's progress during the course of the experiment. The reader will note that at the start of the experiment there is
IPA Profiles showing mean scaled scores for the experimental groups at the beginning of the experiment.

- Sound Blending
- Auditory Closure
- Visual Memory
- Auditory Memory
- Visual Closure
- Grammatic Closure
- Manual Expression
- Verbal Expression
- Visual Association
- Auditory Association
- Visual Reception
- Auditory Reception

Scaled scores on IPA subjects.
ITPA profiles showing mean scaled scores for the experimental groups at the end of the experiment.
little difference between the Kirk or Peabody profiles. However, at the end of the experiment, the profiles differ considerably. What can be seen to have taken place is that, at the Automatic Level of language use, the Kirk Group has achieved a much higher overall level of psycholinguistic functioning than the Peabody subjects. At the Representational Level, however, the level of psycholinguistic functioning is virtually identical for both groups. The change in the pattern of subtest scores for the Kirk Group at the Automatic Level has produced a final profile much flatter than the final Peabody profile. This means that the Kirk Group's subtest deviations from the mean are smaller and, therefore, indicates more even psycholinguistic development. Whilst the Peabody training has successfully raised the overall level of psycholinguistic development of the group, it had not changed to any great extent the basic language patterns that were characteristic at the start of the experiment. The basic linguistic impairment in Auditory Closure remained, as well as a substantial deficit in Grammatic Closure which was finally exhibited.

In the Literature Review the controversies regarding psycholinguistic training were presented. In particular, the practice of assessing psycholinguistic processes thought to underlie academic achievement, and prescribing process-orientated training on the basis of these findings, was examined. The review showed that the process training approach has been under fire from a number of critics (Mann, 1971; Larsen, 1976; Newcomer and Hammill, 1976).

The research evidence, set out above, demonstrates the superiority of the Kirk Programmes to the Peabody training both at ameliorating psycholinguistic disabilities and promoting superior overall language performance. The superiority of the Kirk approach cannot, however, be attributed solely to process-orientated remediation although there is
some qualified support for this approach. It has already been emphasized that in the Kirk approach the assessment and the remediation model are not parallel. Whilst the focus of the Kirk training was on the alleviation of the specific disabilities in Auditory Closure and Visual Sequential Memory, this was brought about in practice by an integrated remedial programme which incorporated abilities other than the ones needing development.

The reader is reminded that the Kirk Programmes were in two parts: (a) an oral programme, conducted by the teacher, designed to train specific areas of Auditory Closure and Visual Sequential Memory, and (b) a written programme, completed by the children, based on the oral programme in (a) above. As the Fernald Method, using letters and words, was used to train Visual Sequential Memory, and as the children's programmes also utilised key words and phrases, in effect the process disabilities were being remediated directly by reading acquisition skills. It is more correct, therefore, to describe the Kirk Programme as a process-task approach involving both process and task training in the same remedial package. It is not possible to evaluate how much of the superiority of the Kirk method is attributable to the training of the defective processes, or to the direct skill training in reading. While it may be speculated that specific psycholinguistic processes facilitate reading, the reverse could also be true. There is a possibility that psycholinguistic skills such as Auditory Closure and Visual Sequential Memory are developed by, or concurrently with, the reading skill.

Whilst it is difficult to evaluate the outcomes of the Kirk approach, nevertheless, there is support for a diagnostic-remedial approach to children's learning problems. There is support for the ITPA as a test of differential diagnosis to identify the deficient processes and the
use of an integrated remedial strategy to attack the deficits. The
fact that the remedial activities are not necessarily based on the
ITPA model does not invalidate the Kirk model, provided that the
eclectic nature of the programmes is recognised and no unjust
claims are made that they are of a discrete rather than an integrative
nature. As Johnson and Morasky remind one, "Adopting a behavioural
deficit approach does not necessarily limit the proponent to one
specific programme or tight theoretical system. Although some
behavioural deficit practitioners limit themselves to a fairly closed
remedial conceptual system, a reasonable eclecticism would be more
typical" (Johnson & Morasky, 1980, p. 91).

Added weight to these findings is provided from an earlier study
conducted by the writer (Naylor, 1973). In this earlier study, the
same experimental effects to the ones found in this experiment were
obtained; the only differences being ones of degree.

Comparison of children on the Language Programmes with the Control Group

The performance of the children on the Language Programmes (i.e.
Kirk and Peabody Groups combined) was compared with that of the Control
Group. The statistical analyses showed:

1. Children on the Language Programmes performed significantly
   better than the Control subjects in respect of:
   (a) Visual Sequential Memory (p < .05), this finding being
       independent of schools and occasions.
   (b) Auditory Reception (p < .01), Visual Reception (p < .05),
       Auditory Association (p < .01), Visual Association (p < .01),
Verbal Expression (p<.01), Grammatic Closure (p<.01),
Visual Closure (p<.05), Auditory Closure (p<.01),
Composite PLA (p<.01), Mean Scaled Score (p<.01),
Automatic Level (p<.01), Representational Level (p<.01),
Reception Process (p<.01), Association Process (p<.01),
Expression Process (p<.01), Auditory-Vocal Channel (p<.01),
Visual-Motor Channel (p<.01), Burt-Vernon Reading Test (p<.01),
and Young's Group Reading Test (p<.01).

The effects on (b) above, whilst independent of schools, were not independent of occasions. An examination of the Programmes x Occasions interaction showed that they were only valid over occasions C1 - C2 (i.e. gains as a result of remediation); the differences between occasions C2 - C3 (post-remedial period) were clearly not significant.

2. No significant differences were recorded between the performance of the two groups on the following tests:

The above analyses show that the children on the Language Programmes performed significantly better on twenty of the twenty four criterion tests. Whilst the Language Group made substantial progress in language skills the untrained Control subjects deteriorated overall.
An inspection of Table 26, page 286 shows the extent of the deterioration of the Control Group on the criterion tests during the experiment. The reader will note that, at the end of the enrichment period, the Control Group had regressed on most measures, this trend continuing during the post-remedial period so that at the end of the experiment overall regressions were exhibited on sixteen of the twenty-four subtests. This is reflected in a regression of -2.35 points in Mean Scaled Score which provides a composite index of the Control subjects' psycholinguistic functioning. Thus, at the end of the experiment, the Mean Scaled Scores of the Language Groups were significantly closer to the standardisation sample than that of the Control Group, i.e. Kirk Group (33.25), Peabody Group (31.90), Control Group (25.83).

In terms of language ages, a comparison of the Composite PLA's for the experimental groups shows their relative progress over the experiment: Kirk Group (100.95 months), Peabody Group (99.65 months), Control Group (80.55 months). These language ages corresponding to gains over the entire experiment as follows: Kirk Group (23.95 months), Peabody Group (21.35 months), Control Group (8.50 months). However, the C.A. of the Control subjects increased by 17.9 months during the experiment, thereby indicating that their overall language development was 9.4 months in deficit at the end of the experiment, in accordance with the cumulative deficit hypothesis.

ITPA subtest final language ages of the three experimental groups, together with those of the normative group, are presented in Table 27.
A perusal of this table shows that, unlike the two Language Groups who both exceeded normative performance in some areas, the Control subjects were substantially retarded on every subtest, two exceptions being in Manual Expression and Visual Closure where they, like the Language Groups, showed relative strength.

Although the Control Group regressed on most measures, relatively large overall gains in scaled score points were achieved in Visual Sequential Memory (6.15), Sound Blending (2.85), and Auditory Closure (2.20). As the Control subjects received no language training, one attributes much of this improvement to the classroom training that the children were receiving in the teaching of reading. Thus, the gains in Sound Blending and Auditory Closure might reflect the training in phonics that the children were undergoing in class. Part of the large gain in Visual Sequential Memory might be due to "look-say" methods; the teaching of phonics which emphasizes the sequence of letters and their sounds in a word might also improve Visual Sequential Memory. It is also probable that some of the gain in Visual Sequential Memory might arise because it is dependent upon maturational factors. Vernon (1971) reports that, there is a tendency for many perceptual deficiencies to decrease with age even with backward readers. Another explanation might be the cause/effect relationship between Visual Sequential Memory and reading. This is a complex issue which will be discussed later when the relationship between remediation and reading skills is examined.

The above findings, comparing trained and non-trained groups, demonstrate the clear superiority of the children on the Language Programmes over the Control subjects and is a reasonable criterion
for assuming the validity of psycholinguistic training procedures. In their review of studies, which attempted to train psycholinguistic abilities using the ITPA as criterion of improvement, Hammell and Larsen (1974) concluded that the effectiveness of psycholinguistic training had not been conclusively demonstrated. The present findings are markedly at variance with this conclusion and serious doubt is cast upon the statement that psycholinguistic training is non-validated. Although some subtests and constructs appear more amenable to intervention, practically all areas of psycholinguistic functioning were enhanced by the training programmes. The findings provide strong support for the efficacy of psycholinguistic training and show that the average child receiving training is much better off than the untrained child.

**Effectiveness of the Remedial Teaching**

The effectiveness of the remedial teaching was assessed by comparing post-test scores with pre-test scores for all the criterion tests.

In order to make meaningful comparisons between pre-test and post-test scores, all significant effects involving the occasions (C) variable were partitioned into two components:

\[
\text{(i) } \left( \frac{C_3 + C_2 - C_1}{2} \right) \\
\text{(ii) } (C_3 - C_2)
\]
The first component \( \frac{C_3 + C_2}{2} - C_1 \) enables one to compare the post-test means obtained on occasions C2 and C3 combined, with the pre-test means obtained on occasion C1. It is therefore an indication of the effectiveness of the remedial teaching in the short and long term combined.

The second component \( C_3 - C_2 \) provides information about what has taken place in the post-remedial period, approximately 10 months after remediation had ended. It is based on the difference of mean scores obtained on occasion C3 and occasion C2. It indicates the trend in the post-remedial period, whether further significant gains have been made, or whether regressions have occurred.

The findings comparing the post-test mean for occasions C3 and C2 combined with the pre-test mean for occasion C1 were as follows:

1. Post-test means combined were significantly greater than pre-test means in respect of the following measures:

   (a) Auditory Sequential Memory \((p<.01)\), Sound Blending \((p<.01)\), and Raven's Matrices \((p<.05)\).

   The above effects were independent of schools and programmes.

   (b) Auditory Association \((p<.01)\), Verbal Expression \((p<.01)\), Visual Closure \((p<.01)\), Visual Sequential Memory \((p<.01)\), Auditory Closure \((p<.01)\), Composite PLA \((p<.01)\), Mean Scaled Score \((p<.05)\), Automatic Level \((p<.01)\), Association Process \((p<.01)\), Expression Process \((p<.01)\), Auditory-Vocal Channel \((p<.01)\), Visual-Motor Channel \((p<.01)\), Burt-Vernon Reading Test \((p<.01)\), and Young's Group Reading Test \((p<.01)\).
The significant effects in (b) above, though independent of
schools were not independent of programmes as a significant
programmes x occasions interactions occurred for all. On
examination of this interaction it was shown that:

(i) Significant differences, between post-test and pre-test
means, were valid for the Kirk Group on all the subtests
in (b) above.

(ii) Significant differences, between post-test and pre-test
means, were valid for the Peabody Group on all the above
subtests in (b) above, with the exception of Visual
Sequential Memory, Auditory Closure, and the Automatic
Level.

(iii) The differences between post-test and pre-test means for
the Control Group did not reach significance on any of the
subtests in (b) above, and a regression was recorded in 11
instances.

2. No significant differences between post-test means combined and
pre-test means were found in respect of:
Auditory Reception, Visual Reception, Visual Association,
Manual Expression, Grammatic Closure, Representational Level,
and Reception Process.

The most important feature of the above analyses is the significant
Programmes x Occasions interaction indicating that for many of the
measures there was a differential effect of programmes on occasions.
An examination of this interaction showed that the gains achieved by the Kirk stimulation reached significance for seventeen of the twenty four criterion tests. An inspection of Table 26, page 286 shows that, at the end of the initial treatment period, gains were obtained on all criterion tests ranging from (0.35 - 16.90) scaled score points. Understandably, the largest gains were recorded in Auditory Closure (16.90) and Visual Sequential Memory, which might be expected as the Kirk Programmes were specifically directed towards training these functions. The reader will also note the considerable improvement in language performance in other areas, indicating that there had been a bonus of apparent improvement in subtests other than those to which specific attention had been directed. In particular, moderate sized gains have been made on some Representational Level processes as is evident from the gains in Auditory Association (3.65) and Verbal Expression (3.0). This transfer effect from Automatic to Representational processes will be examined in more detail in the next section. Thus, at the end of remediation, the Kirk Group's Mean Scaled Score (33.63) approximated that of the standardisation sample. In terms of language ages, the experimental group's Composite PUA increased by 14.95 months whilst the chronological growth was 7.55 months.

Turning to the Peabody Programmes, at the end of remediation gains were obtained on all twenty four measures, significance being reached in fourteen instances. The extent of the Peabody stimulation ranged from (0.10 - 6.0) scaled score points, the largest gains being obtained in Verbal Expression (6.0), Auditory Association (4.95), Visual Association (4.0), and the Association Process (4.50). This indicates that the Programmes had been particularly successful in improving
verbal expressive and associational abilities. However, in the areas of Auditory Closure, Visual Sequential Memory, and the Automatic Level, the Peabody scores did not reach significance as did those of the Kirk Group. Thus, at the end of remediation, the Mean Scaled Score (32.97) of the Peabody Group was significantly closer to that of the normative group. Further, the experimental group's Composite PLA had increased by 14.90 months whilst their chronological growth was 7.8 months.

In contrast to the language groups, who made progress in all areas, the Control subjects lost ground during remediation, which is not surprising from children receiving no language training. Thus, at the end of remediation, regressions on scaled score were recorded on fifteen measures ranging from (0.05 - 3.25) scaled score points, the largest regressions occurring in Grammatic Closure (3.25), and Auditory Reception (3.10). However, gains were recorded in the Automatic Level processes of Visual Sequential Memory (6.20), Sound Blending (2.95), and Auditory Closure (1.95). This probably reflects the classroom training that the children were undergoing related to the teaching of reading. Thus, at the end of the initial treatment, the Control Group's Mean Scaled Score (27.22) had regressed significantly from that of the normative group. Furthermore, their increase in Composite PLA (3.25 months) was not sufficiently large to offset the chronological growth (7.7 months), indicating that the Control Programme had not arrested the cumulative deficit.

These findings above confirm the effectiveness of the intervention programmes. They show that a short-term intervention of twelve week's duration can achieve a substantial improvement on a large number of linguistic dimensions.
Of equal interest was the stability of the scores in the post-remedial period, i.e. approximately 10 months after remediation ended. This was investigated by comparing the final post-test means (occasion C3) with those obtained at the end of remediation (occasion C2). The findings relating to the \((C3 - C2)\) variable were as follows:

1. Post-remedial gains were significant in respect of:
   
   (a) Composite PLA \((p<.01)\), and Burt-Vernon Reading Test \((p<.01)\).
   These findings being independent of schools and programmes.

   (b) Young's Group Reading Test \((p<.01)\).
   The above effect was independent of schools but not of programmes. An examination of the programmes x occasions interaction showed that it was only valid for the Kirk and Peabody Programmes.

2. Post-remedial regressions in mean scaled score were significant in respect of:

   (a) Auditory Association \((p<.05)\), Verbal Expression \((p<.05)\), Association Process \((p<.01)\), Expression Process \((p<.05)\), and the Auditory-Vocal Channel \((p<.01)\). These findings being independent of schools and programmes.

   (b) Grammatic Closure \((p<.05)\).
   The above effect was independent of schools but not of programmes. An examination of the programmes x occasions interaction showed that the significant regression was only valid for the Control Programme.

3. There were no significant post-remedial differences recorded for any of the remaining fifteen criterion tests.
The findings from the above analyses indicate that each of the
three experimental groups recorded significant regression scores on
six measures during the post-remedial period. An inspection of
Table 26 p. 286 shows that, whilst the performance of each experimental
group tended to decline against the test norms, the rate of decline
in language performance varied across the three groups.

Thus in the post-remedial period the Kirk Group regressed on
fourteen of the twenty-four measures, the extent of which ranged from
(0.10 - 3.65) scaled score points. Of particular interest are the
stability of the scores in the areas of Auditory Closure and Visual
Sequential Memory as the Kirk stimulation had been specifically
directed towards improving these functions. Even though regressions
in Visual Sequential Memory (0.10) and Auditory Closure (3.35) occurred,
nearly all the large gains achieved during enrichment in these functions
has been maintained. It will be noted that ten gains were recorded
in the post-remedial period, three of which reached significance. The
experimental group were, therefore, progressing in some areas after
treatment. As one would expect them to be, the post-remedial gains
were generally much smaller than those achieved during treatment. The
overall long term effect of the Kirk training, however, is a decline
in the level of language performance which is reflected in the small
regression in the experimental group's Mean Scaled Score (0.38). This
is also shown by the Composite PIA which increased by 9.0 months language
age whilst the chronological growth was 9.5 months. Thus, the rate of
regression for the Kirk Group was relatively small i.e. a loss of
0.50 months language age for every 9.50 months chronological growth.

An evaluation of the Peabody scores also shows a decline in the
Group's language performance on many measures, with a greater accelerated
rate of decline than that of the Kirk Group. In the post-remedial period
seventeen regression scores, ranging from (0.30 - 2.57) scaled score points occurred. In most instances the regression scores were smaller in magnitude than the gains achieved during enrichment so that, at the end of the experiment, overall gains on twenty measures were recorded. A regression of 1.07 points in the Peabody Group's Mean Scaled Score indicates the extent of the group's decline in language performance. In terms of language age, the experimental group's Composite PLA increased by 6.45 months whilst their chronological growth was 10.0 months. Therefore, at the end of the experiment, the Peabody subjects were losing ground at a rate of 3.55 months in language age for every 10 months chronological growth.

Regarding the Control Group, their declining trend of language performance which was observed during treatment continued through the post-remedial period, sixteen regressions being recorded. The extent of the experimental group's decline in language performance is indicated by a regression in the Mean Scaled Score of 1.39 points. The Composite PLA also shows that at the end of the experiment the Control subjects were losing ground at the rate of 4.95 months in language age for every 10.20 months chronological growth. This rate of decline in psycholinguistic functioning being greater than that of either of the treatment groups. Thus, over the experiment, the Control Group's Mean Scaled Score declined by 5.38 points relative to the Kirk Groups, and 3.94 points relative to the Peabody Groups. Expressed in terms of language ages, whilst the Kirk Group's overall growth of Composite PLA was 23.95 months, and that of the Peabody Group's 21.35 months, the Control Group's increase was only 8.50 months.

The Mean Scaled Scores of the three experimental groups, taken
on three occasions, have been graphed overleaf. The graph shows concisely the psycholinguistic development of each experimental group during the experiment. The reader will note the superior language performance of the treatment groups over the Control subjects. The Control Group's gradual rate of decline in psycholinguistic functioning can be seen from the negatively accelerated slope. The Kirk Group's even psycholinguistic growth in the post-remedial period is indicated by the horizontal line between C2-C3. However, the Peabody Group's performance between C2-C3 will be seen to approximate that of the Control Groups.

The above findings confirm the validity of psycholinguistic training procedures. In particular, the Kirk approach of training has been shown to be superior to the more diffuse Peabody stimulation.

One can derive some encouragement from these results for many evaluation studies of intervention programmes have concluded that the programmes are not successful in stimulating scholastic performance and cognitive development and that early advantages are soon lost (Cicirelli et al, 1969; Jensen, 1972; Tizard, 1974). A common finding has been that after the children leave the programmes, there is a "fade-out" or "leveling-off" in performance so that, after six months to a year in regular class, the scholastic performance of treated and untreated groups is generally indistinguishable. Jensen (1972) has been very sceptical about the magnitude of some of the gains reported in some American studies. The evidence from America, as put forward by Jensen, seems to be that whilst massive compensatory programmes have produced no appreciable gains in IQ or achievement, the majority of small scale experiments have produced significant
gains. Thus, the crucial variable seems to be one of scale. Jensen argues that mammoth programmes have not been adequately pinpointed to meet the fine-grained cultural and cognitive needs of children, and therefore cannot be expected to produce gains that undoubtedly result from more intensive and more carefully focussed programmes, which are lavished upon small groups of children by a team of experts.

The findings from this study support Jensen's views, as they have shown that an integrated programme such as the Kirk, designed with the specific needs of a particular group of children in mind, has improved language performance more than the diffuse type Peabody Programmes. Furthermore, the findings also show that the Kirk scores have been maintained better, in the post-remedial period, than either those of the Peabody of Control Group.

Whilst expressing satisfaction that the language performance of both treatment groups has been shown to be superior to that of the Control Groups ten months after remediation, one would want to examine the stability of the scores in the longer term before one could evaluate objectively the success of the experiment.
(iii) The effects of the remedial work on psycholinguistic abilities, reading skills, and non-verbal intelligence

The second aim of this study, as defined in the Problem, is to examine in detail some of the treatment effects. Of particular interest are the effects of the remedial work on: (a) psycholinguistic abilities, (b) reading skills, and (c) non-verbal intelligence. Each area will be taken in turn.

(a) Psycholinguistic Abilities

The effect of the Peabody stimulation was as follows. Although some subtests and constructs appear more amenable to intervention, all areas of psycholinguistic functioning were enhanced by the training. Most encouraging were the receptiveness to intervention of Verbal Expression and the Associational constructs. The findings indicate considerable support for the Peabody rationale. Thus, the large gains in Verbal Expression and the Associational subtests justifies the Peabody constructor's claim that the primary purpose of the Kit is to stimulate oral language development and verbal intelligence. Also, the striking similarity of the gains recorded on both of the levels of ITPA, and both of the channels, validates the constructor's claim that the Kit stresses overall language performance rather than the training of isolated processes. However, the Receptive construct proved resistant to treatment as little improvement was made on either subtest. This seems to indicate that the Peabody Programmes are uneven in that they emphasize the training of associational and expressive abilities to the exclusion of training receptive skills. Thus, at the end of training, the Peabody Group made significant improvement in Mean Scaled Score compared with the Control Group. However, even though the training promoted a higher overall level of language performance, it did not
alter to any great extent the pattern of language abilities that were present at the start of the experiment.

By contrast, the Kirk training was a diagnostic-remedial approach designed to ameliorate the specific disabilities in Auditory Closure and Visual Sequential Memory. However, as has been shown, the Kirk approach does not eliminate the use of other functions when remediating the major disabilities. This results in a varied and diversified remedial programme which has produced a diffuse effect across the whole profile of abilities. As one might expect, the largest gains are found at the Automatic Level as, irrespective of means, this was the focus of the Kirk training. Impressive gains in both Auditory Closure and Visual Sequential Memory testify to the effectiveness of the programmes in helping poor readers organize their perceptions more efficiently, extend their memory capacity, develop automatic responses and internalise the redundancies from their experience. Relatively large gains in other Automatic functions of Grammatic Closure, Visual Closure, and Sound Blending probably occur because of the interrelatedness of these subtests with Auditory Closure. There is no such thing as the absolute isolation of abilities and the difficulty of designing programmes in Auditory Closure that are uncontaminated with other functions has already been discussed.

Moderate sized gains in scaled score points were also recorded in some Representational Level processes, e.g. Auditory Association (3.65), Verbal Expression (3.0), and Auditory Reception (2.75). Whilst one might attribute part of these gains to a positive transfer effect from Automatic to Representational Level processes, this is thought unlikely, and a more likely explanation is to be found in the contaminatory nature of the Kirk input.
As the Kirk Programmes utilised words, phrases and sentences the experimental group was given training in representational and expressive processes. An inspection of Table 31 p. 444 shows that practically all of the 24 programmes gave training in these processes. As the Visual Sequential Memory programme was largely based on the first 200 Key Words, representational and expressive ability was held to a very low level in this part of the Kirk training. However, the Auditory Closure programmes, which gave training in automatic language, utilised sentences, some of which were of a complicated syntactical structure and were more heavily loaded in expressive language skills. It seems reasonable to conclude that the large gain in Verbal Expression arises from this.

Considering the gain in Auditory Reception, both the Visual Sequential Memory and Auditory Closure programmes gave training in this function, as in every lesson the child was required to listen carefully to the teacher prior to repeating a word, phrase, or sentence. The chief offender in this respect was the Auditory Closure programme.

Turning to the large gain in Auditory Association, one must attribute much of this to the Auditory Closure programme. Lesson 8 (Related Sequences), Lesson 10 (Evoking Paired Response), and Lesson 11 (Phrase and Sentence Completion), are all contaminated heavily with associative ability. Again, this illustrates the difficulty of designing programmes which are of a homogeneous, "single ability", character and which are free of contaminatory effects.

The above results demonstrate the superiority of the Kirk approach in training psycholinguistic abilities to that of the Peabody stimulation. This suggests that a diagnostic-remedial approach, which integrates the disabilities with other abilities, is more effective than
the diffuse type Peabody approach. It has been emphasized that the Kirk remediation involves both 'child' analysis as well as 'task' analysis. In this approach the ITPA is first used to isolate the disability areas, which is followed by an analysis of the sequence of skills required by the task. The process and task are then integrated in the same remedial procedure to produce the best interaction. In terms of research design, however, such an integrated approach with its interplay of process and task training is difficult to evaluate. It must be recognised that the improvement in Auditory Closure and Visual Sequential Memory and other abilities could owe more to the task training component of the input than the process training component, and that psycholinguistic abilities are developed by, or concurrently with, the reading skill.

(b) Reading Skills

Both the Kirk and Peabody Groups have improved substantially in reading attainment as measured on the Burt-Vernon and Young's Group Reading Tests. On both measures, the children receiving language training performed significantly better than the Control subjects. Thus, over the experiment on the Burt-Vernon Test, the Kirk Group gained 2.5 years RA, the Peabody Group 2.1 years RA, and the Control Group 0.9 years RA. Whilst on the Young's Test, the Kirk Group's overall gain in RA exceeded 1.6 years, the Peabody Group's gain exceeded 1.2 years, whilst the Control Group's gain exceeded 0.9 years.

At the start of the research, the experimental group's RA on Burt-Vernon of 4.5 years indicated that they had not mastered the primary word-recognition skills. The magnitude of the gains achieved by both language groups on the Burt-Vernon Test suggests that they had
successfully acquired the initial decoding skills at the end of the experiment. Whilst the skills and processes in reading words are a first consideration in the development of reading ability which form the foundation for the acquisition of more advanced skills, simple word recognition is an inadequate model of reading. In many quarters the ability to predict meanings and outcomes in a reading passage is regarded as the single most important skill (Goodman, 1968; Smith, 1971). A more meaningful measure of assessing reading ability, according to this view, is provided by the Young's Group Reading Test. As the Young's Test is a sentence completion task it assesses the development of intermediate reading skills. In addition to word-recognition skills, the children must make increasing use of their knowledge of probabilities and structural rules which give pattern to language and the context that surrounds the word. In turn this skill will make mechanical word-recognition an increasingly redundant skill. The gains achieved on the Young's Test by the two language groups indicates that intermediate reading skills were developing. This means that the children were beginning to make use of contextual and linguistic cues and that their reading was becoming a matter of comprehension more than mechanics.

The above findings demonstrate that a structured language approach based on the FDLK has had a positive effect on reading attainment. The FDLK does not rely on the differential diagnosis of the child's strengths and weaknesses but the aim is to expose the child to an overall language stimulation. Current work on psycholinguistics is not incorporated into
the Peabody Programmes, instead they consist of carefully sequenced activities based on the ITPA psycholinguistic model. Whilst the Programmes do not claim to be a language experience approach to reading, nevertheless they have firmly in-built to the daily lessons a reading readiness component, namely activities to develop auditory and visual discrimination and sequencing skills. It appears that as a by-product of focussed attention to language the Peabody subjects' reading attainment improved. This supports the view that language and communication skills are important precursors to effective reading. This implies that a certain attainment in language functioning is a requisite for success in learning to read. Psycholinguists such as Smith and Goodman continually emphasise that reading cannot be separated from the language process and claim that the rules by which children learn oral language also apply to reading. According to these writers, oral language is a productive language process whilst reading is a receptive process, and that these different aspects of language interrelate. It therefore seems reasonable to argue that if the children's expressive language performance improved as a result of training, this would promote an improvement in their receptive performance.

As with other areas investigated in this study the Kirk Group performed significantly better than the Peabody Group on both of the reading measures. Whilst this finding supports the diagnostic remedial approach to children's learning problems it does not provide unqualified support for process orientated training. Because of the multivariate complexity of the Kirk input it is difficult to evaluate the outcomes of the Kirk approach and definitive conclusions cannot be drawn.

As has been demonstrated, in training the defective processes of Auditory Closure and Visual Sequential Memory, Kirk recommends a direct
teaching approach. Kirk refers to this as a process-task approach in which the process and the task are integrated in the same remedial procedure. Although the primary stress of the remedial teaching is on the training of the deficient processes, the content of the remediation is just as important. Kirk believes that the content of the remedial teaching should be of academic value to the child otherwise precious time is wasted. Thus, in training the Visual Sequential Memory process, Kirk advocates the use of the Fernald Method. This is a multisensory approach which involves training the defective memory process directly, through the use of letters, words and phrases, rather than in isolation using geometric shapes and nonsense words.

Whilst the writer's Visual Sequential Memory Programme gives training in automatic type tasks which involve memorization, repetition, over-learning, and drill, because the training is based on letters, words and phrases, it also gives training in reading. The Visual Sequential Memory Programme might also be regarded as an early reading acquisition programme, as an important aim was to establish a sight vocabulary by improving the children's memory capacity for key words. Similarly the Auditory Closure Programme, which gives extensive training in the auditory-vocal area of language with its emphasis on the development of automatic habits, might also be considered a language-experience approach to reading.

An important consideration when considering the Kirk training is the children's own contribution. The reader is again reminded that the first part of the Kirk treatment was an oral programme conducted by the teacher in which the children were given training in specific areas of Auditory Closure and Visual Sequential Memory function. Whilst the second part consisted of a written programme completed by the children,
based on the oral programme. In this written programme the children were given considerable practice in reading and writing activities. This inclusion of reading and writing activities constitutes a very important difference between the Kirk and Peabody treatments. Because the Peabody training is based on the oral-verbal nature of language the children received only training in listening and speaking. In contrast, the Kirk stimulation is a complete language programme, insofar as it incorporates training in receptive language skills (listening and reading) and expressive language skills (speaking and writing). It seems reasonable to speculate, therefore, that much of the Kirk Group's superiority in reading performance is attributable to the reading and writing activities.

In evaluating the effect of the Kirk input the obvious question at this point is, "Which component of the input is more important, the process-training part or the task-orientated component?" However, because of the complexity and integrated nature of the Kirk schedule, this question cannot be answered objectively.

One might speculate that, because the Kirk training is based so heavily on reading activities such as: letter and word recognition, listening comprehension ability, sound blending, spelling, copying and writing, the balance of evidence supports a task-orientated approach to remediation. This would be in sympathy with a holistic view of the nature of language, and would suggest that the best way to improve reading attainment is through instruction in reading.

One might counter this view by arguing that the content of the Kirk training is only used as a means to an end, which is the training of the deficient processes. This argument would support a sub-skill hypothesis concerning the nature of language as the improvement in reading ability would be attributed to the alleviated deficits.
In Part I of this study it was concluded that Auditory Closuro and Visual Sequential Memory appear to be correlated with reading disability. However, being correlates of reading disability in no way assures a cause-effect relationship. While it may be speculated that psycholinguistic skills facilitate reading, the reverse could also be true. There is also a strong possibility that these abilities are developed by, or concurrently with, the reading skill. The effects of the specific training of the two defective processes upon the development of reading skills is not determined by this study. It has not been demonstrated unequivocally that the development of these processes is a pre-requisite to improved reading performance.

The research, however, does firmly support a diagnostic-remedial approach in which teaching methods and programme content are adapted to children's specific learning characteristics. The effectiveness of the Kirk training shows that the best aspects of many approaches can be integrated into an individualised remedial programme. It seems that there are several strengths to this method. One of the most important being that it allows one to relate remedial activities and remedial goals to curriculum activities and goals. Another asset would seem to be that the generalization of results does not have to be established. Since the problem behaviour is being worked with directly, it is not necessary to demonstrate that remedial activities generalize to the problem itself. The superiority of the Kirk training might mean that in reference to most cases of reading disability we are dealing with both process deficiencies and content deficiencies. Our real problem is a lack of information about both the task of reading and the learner's processes.
The controversy about whether reading should be taught as a holistic process or through a subskill approach has been discussed in the literature review (pp. 43-44). Those who favour the holistic approach (Goodman, 1972; Smith, 1973) claim that by fractionating the reading process into subskills the essential meaning deriving aspect of reading is destroyed. According to this view much early reading instruction is mistakenly based on the graphic features of language such as lower reading and decoding skills, with little emphasis on intermediate language skills and higher comprehension based skills which the successful reader must eventually attain. On the other hand, those who favour the subskill approach argue that prior to mastering a complex, higher-order skill, numerous prerequisite subskills such as auditory/visual discrimination and auditory/visual memory must first be acquired (Gagne, 1969; Guthrie, 1973; Samuels, 1975; Morris, 1974).

Chall (1978) reviewing reading research during the last decade reports that there has been a shift away from visual/perceptual evaluation and remediation. She concludes from this review that direct training of reading and writing skills achieve better results than the training of the underlying psychological processes. Oversimplified, reading and writing is the way to help the pupil acquire both reading skills and their psycholinguistic underpinnings such as those functions tested by the ITPA. But is this partially a swing of educational fashion? A recent account of experimental work in Britain on multi-sensory teaching of children with reading difficulties explores the importance of both visual and verbal memory in reading and some effects of tracing as a teaching aid (Hulme, 1981).

In the writer's opinion, the tendency to accept either the "top down" model or the "subskill" antithesis of language development is not justified in our present state of knowledge.

In this experiment, the Kirk Programme did produce gains in reading attainment, Auditory Closure and Visual Sequential Memory not achieved by the
general Peabody oral language programme. To clarify whether it was some specific components of the Kirk Programme that produced this, one would need to present a general language programme containing as many reading and writing activities as were incorporated into the Kirk Programme. In the present study, specificity (in theory) versus generality of treatment is confounded by this variable, thereby presenting a point of interpretation requiring a further experiment if this is to be resolved.
Gains in non-verbal intelligence as measured by the Raven's Matrices Test were made by both language groups over the experiment. At the end of the treatment the Kirk Group gained 8.85 IQ points, whilst the Peabody Group gained 3.9 points. However, when the children left the programmes, the well known "fading" of the IQ gains acquired during the enrichment took place, so that at the end of the experiment the Kirk group had gained 5.05 points overall, and the Peabody Group 2.1 points. By contrast, the Control Group's IQ scores remained relatively constant over the experiment, as is indicated by the small regression of 0.45 points overall.

Reports on the Head Start Project and other American Studies indicate that initial gains of 5 to 10 points in IQ were a common finding. The amount of gain is related to several factors but the intensity and specificity of the instructional aspects of the programmes seem to make a difference (Hawkridge et al, 1968; Heber, 1968). In general, highly focussed programmes with an intensive instruction in specific skills produced larger gains than the more broadly based diffuse enrichment programmes.

Jensen (1972) has written critically about American enrichment programmes and their effect on scholastic attainment. Jensen claims that many of the studies showing authentic gains have used tests as criterion which are relatively high in cultural loading. In these cases the gains might not consist of actual improvement of cognitive skill but rather the acquisition of simple information. Jensen argues that no studies have demonstrated gains in relatively non-cultural or non-verbal tests like Cattell's Culture Fair Tests and Raven's Progressive Matrices. If one accepts the premise that the Raven's Matrices is non-cultural, how can the moderate sized gains obtained in this experiment on this test be explained? Perhaps
a satisfactory explanation has been put forward by Jensen (1968) in his study of verbal mediational processes.

Jensen argues that not only does the child who has an impoverished verbal background have a more restricted vocabulary and, especially, a narrower and simpler syntax for purposes of communicating with others, but in all probability he has what Jensen calls a "higher threshold" for verbal mediation. Thus the child, as a result of his experiential background is less able to solve problems by verbal mediation than would be true of the child with greater language experience. The potential importance of this background for learning cannot be overestimated in view of the fact that the problems whose solutions are facilitated by verbal mediation are not limited to verbal problems or problems verbally stated (Vygotsky, 1962; Luria, 1963). In many so-called non-verbal tasks, verbalisation plays an integral role, and many non-verbal problems are solved with the use of verbal mediation. Jensen claims that the subject who does not verbalise spontaneously is severely handicapped in a non-verbal test such as the Raven's Progressive Matrices and in tasks such as the picture completion subtest of the WISC, and the object assembly test.

In view of what has been said about social class and verbal learning, it seems reasonable to hypothesize that children from a lower-class environment will have a higher threshold for the elicitation of spontaneous verbalisation in nominally non-verbal problem situations.

It has been shown that both the Kirk and Peabody Programmes have increased the overall level of language functioning of the experimental children who were attending EPA schools. In addition many of the teaching strategies utilised in the Programmes encouraged overt verbalisation (e.g. as in the training of Visual Memory). This increased language facility of the children together with the special training
given, are thought therefore, if Jensen is right, to have lowered their threshold for the elicitation of the verbal response, resulting in a better performance on the Raven's Matrices Test.

Evaluation of the Kirk/ITPA Model

The ITPA has many weaknesses. It was called a psycholinguistic test because it was concerned with psychological functions of information processing, perception, and memory as well as the use of linguistic codes. The term may not now be an adequate designation of the test, but it was suitable in 1961 before linguists developed their own use of the term.

The ITPA has been critically reviewed by writers who argue that its diagnostic, predictive and programming values are questionable and that its validity and reliability have not been conclusively established. The principal value of any assessment device that is used in schools depends upon the extent to which it relates to academic achievement. No matter how accurately standardised a test may be, it is relatively worthless to teachers unless its results can be used to improve children's capacity to perform such basic school activities as reading, spelling and arithmetic.

At least two essential assumptions form the basis of psycholinguistic training such as the Kirk Model: (a) that assumed deficiencies in psychological processes can be reliably and validly assessed, and (b) that remediation of these processes will produce a positive, beneficial transfer effect to basic school subjects.

In Part I of this study a distinctive profile of subtest deficits in Auditory Closure and Visual Sequential Memory was identified. Almost identical profiles of subtest patterns were obtained in two earlier studies (Naylor, 1972; 1973). The first assumption in (a) above is,
therefore, strongly supported and it is concluded that Auditory Closure and Visual Sequential Memory appear to have diagnostic validity for reading.

In Part II of this study it was demonstrated that the Kirk training had successfully alleviated the specific disabilities in Auditory Closure and Visual Sequential Memory, and that the experimental group had improved significantly in reading attainment. However, because of the complex nature of the Kirk input this cannot be taken as providing unequivocal support for the second fundamental premise in (b) above.

Throughout his theoretical writings Kirk has emphasised the concept of intraindividual differences and the importance of the ITPA as a test of differential diagnosis to delineate areas that need remedial work. However, whilst Kirk's theorising stresses the importance of identifying and rectifying psycholinguistic deficits, remedial activities based on his suggestions are not restricted to such a narrow band of discrete behaviour. Instead, Kirk advocates the use of a multivariate remedial programme which is based on performance objectives in reading as well as on the behavioural characteristics of the child. Such a complex input schedule limits definitive statements and conclusions that the research worker would like to draw. Because the Kirk training incorporated both process and task training in the same remedial procedure the second assumption in (b) above cannot be supported. Whilst one might attribute the improvement in reading performance to the specific training of the two defective processes, the reverse could also be true. There is, also, a strong possibility that psycholinguistic abilities such as Auditory Closure and Visual Sequential Memory are developed by the reading skill. It cannot be demonstrated unequivocally, therefore,
that the development of these processes is a pre-requisite to improved reading attainment.

There is support, however, for a diagnostic approach to remediation in which teaching methods and materials are adapted to groups of children's specific learning characteristics. This is evident as the Kirk approach has been shown to be far superior to conventional classroom teaching on a generalised, global basis where there is no attention to the children's unique learning characteristics in relation to the school tasks they must learn. However, in arguing in support of a diagnostic-remedial approach one must again reiterate the inconsistencies between the theoretical views of Kirk and the remedial activities he advocates. Although the ITPA occupies a prominent position in the Kirk model, once the test instrument has been used to delineate the deficit areas, the remedial activities that follow do not derive from the ITPA model. Whatever Kirk in his theoretical writings might say to the contrary, the assessment and the remediation model are not parallel. This in no way invalidates the Kirk approach, provided one acknowledges the multivariate nature of the schedule, and does not assume that remediation is based solely on the training of isolated processes. As all learning is intersensory, Kirk evidently believes that selective eclecticism, carefully organised, is preferable to more narrowly defined procedures.

No blanket remedial programme can be made for all children with learning disabilities. To do so would be to deny that individual learning characteristics exist in children. The relevance of the Kirk training indicates that the best aspects of many approaches can be integrated into an effective group remediation programme. As new levels of knowledge are reached there is a new emphasis on the manner in which multiple factors impinge one on another in methodology.
evaluation, programming, and research. In the past too much effort has been expended in assessing the solitary learner via formal evaluation methods, and too little effort in designing or organising the task for that learner. As our knowledge of the interaction between learner and task increases this will lead to better instructional programming.

Limitations of the Research

The ITPA as the major test instrument of this study has already been extensively evaluated in the literature review, and the 'pros' and 'cons' of its educational and statistical validity have been presented. The limitations discussed below, therefore, are those arising from the research design and not the dependent variable.

The experimental findings might be thought inconclusive because of the relatively small sample size (i.e. N = 60). In this respect the amount of time that would be spent carrying out the testing programme was important in determining the optimum sample size. This research being a longitudinal study, time as well as treatments is an independent variable. Three occasions (C1, C2, C3) were chosen in the design to explore the nature of the differential response. This meant that the testing programme had to be undertaken three times. With a test instrument like the ITPA a relatively long period of time is required to administer the test and experience has shown that one can only test four children in any one day. As the writer carried out the testing programme unassisted, alongside his professional duties, sixty children was considered the optimum sample size that could be utilised. This meant 180 administrations of the ITPA which
alone took 45 days to complete. Another limiting factor is that, as the sample size increases, this reduces the number of schools that could be used in the experiment. As the sample was drawn from a population of poor readers of the 7+ age group, only those schools that could meet the criterion of poor readers (i.e. 15) could be considered.

As the writer administered the testing programme himself this leaves one open to the criticism of experimenter bias. This is particularly important in a comparative methods experiment such as this study. Whilst experimenter bias was controlled as far as the programmes were concerned by getting teachers to teach the programmes, it was not possible to control experimenter bias regarding the test administration. Even though the writer tried to administer the tests consistently and impartially, the fact remains that any experimenter is subject to influences, in many instances of which he is unaware, which can bias the data so as to obtain a directional effect.

Another point of criticism could be made regarding the design of the experiment, which is sometimes referred to as a repeated measure design. This type of design is frequently criticised because of the practice effect obtained by administering a test on more than one occasion. The critics of this type of design point out that on the first occasion the test is administered the children are 'cold' i.e. unfamiliar with the test procedure and the administrator. As a result the performance of the child often suffers and the obtained score is an underestimate of his true ability. On subsequent administrations, in addition to a practice effect, the child being more familiar with procedure and tester would, it is argued, achieve a higher score. With a repeated measures design, and where extreme groups are used,
regression to the mean is also a source of error. This arises whenever a test is repeated as there is rarely perfect correlation between the two administrators. Since the rank order is not identical on every occasion of testing under achievers, such as the poor readers in this study, would tend to improve their scores on the second occasion. These influences are a source of error as they affect the size of the gains that are often attributed to the treatments.

Another major problem with test-related programmes is the risk of a certain amount of circular validation when a particular assessment instrument, such as the ITPA, is the major means to check on the effectiveness of a programme built to use materials derived from the same test instrument or its theoretical model. This problem affects the Peabody Programmes more than the Kirk. It has been demonstrated that as far as the Kirk training is concerned the assessment and the remediation model are not parallel. However, as the Peabody activities are based on the ITPA rationale they are open to the criticism of circular validation.

The experiment might also be criticised because the sex of the pupils was not included as a variable in the design. While it is acknowledged that sex differences of poor readers are important, it was not feasible to include the sex of pupils as a variable for the following reasons. In almost any population of poor readers boys generally outnumber girls by something of the ratio 3 : 1, or 4 : 1. The experimental sample of 60 pupils, which was randomly selected, comprised 45 boys and 15 girls. The random allocation of pupils to treatment groups is shown in Table 28 (Appendix D p. 433). This shows that the methods x sex cross classification cells contain unequal and disproportionate numbers of boys/girls, and that two of
the methods x schools x sex cells contain no girls. One could have deliberately assigned pupils to treatments to ensure equal or proportionate numbers of pupils in the various subgroups or cells, but this would have violated the assumption of independent selection. Because of this disproportion in the subgroup numbers the interaction of methods x sexes, which would have been interesting to investigate, was not undertaken. In practice one can only handle a number of variables in an experiment. Generally there is much to be said for keeping the designs reasonably simple. Complex designs are impressive on paper but not always easy to put into practice and the interpretation of results is by no means simple. This applies particularly to 'anovar' factorial designs. When the number of factors exceeds three, the number and variety of different effects increases rapidly. With four factors, in addition to four main effects, there are six first-order interactions, four second-order interactions, and one third-order interaction. Thus as the number of factors in an experiment is increased, one also increases the probability that second-order and third-order interactions will be statistically significant, which in turn limits the scope of any conclusions that can be drawn from first-order interactions and main effects.

If the experiment were to be repeated the design could be improved in the following way. The Kirk and Peabody Groups would be replaced by Group A and Group B. Group A would then receive the Kirk training and this would be followed by the Peabody training, whilst Group B would receive the Peabody training followed by the Kirk training. This would enable the researcher to examine the Programmes x Occasions interaction on two occasions instead of one, with each group receiving both language programmes. It is far better to replicate the experiment over different conditions in this way, than to use the same total
number of children in a single experiment inevitably under a single condition. This would increase the complexity of the analysis, however, and extend the length of the experiment. If this procedure were followed the study would become a Programmes (3) x Schools (4) x Occasions (4) factorial experiment.

Another experiment might also be designed to objectively evaluate the Kirk treatment effects. It has been emphasized that the Kirk Programme was a multivariate approach in which there was an interaction between the process and the task training. Because of this process-task interaction it has not been possible in this experiment to evaluate the extent to which each component was responsible for changes in the dependent variable. In another enquiry there might be two language groups, Group A and Group B. Group A would receive the Kirk Programme whilst Group B would receive training consisting of all the reading and writing activities incorporated in the Kirk Programme. In this way meaningful comparisons would be made between the process task approach of the Kirk treatment and direct skill training. This would result in more productive research as the researcher would be able to evaluate the outcomes of the Kirk training and possibly some promising hypotheses would emerge.
SUMMARY OF CONCLUSIONS
Summary of the Conclusions

Some of the specific conclusions reached in the experiment are summarised below:

1. Pretesting showed the experimental group had the following characteristics:

<table>
<thead>
<tr>
<th>Test</th>
<th>Mean (X)</th>
<th>Standard Deviation (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CA</td>
<td>91.6</td>
<td>3.97</td>
</tr>
<tr>
<td>Burt-Vernon RA</td>
<td>4.5</td>
<td>0.47</td>
</tr>
<tr>
<td>Raven's IQ</td>
<td>97.3</td>
<td>9.45</td>
</tr>
<tr>
<td>Composite PLA</td>
<td>75.8</td>
<td>6.85</td>
</tr>
</tbody>
</table>

Thus, at the start of the experiment considerable discrepancies existed between:

   \[
   \text{CA} - \text{RA} = 3.1 \text{ years}; \quad \text{CA} - \text{LA} = 15.8 \text{ months}; \quad \text{MA} - \text{LA} = 13.3 \text{ months.}
   \]

2. Compared with the American normative group:

   (a) the experimental group's ITPA subtest Mean Scaled Score showed deficits in:
       - Auditory Closure \((p<.01)\),
       - Visual Sequential Memory \((p<.01)\),
       - Grammatic Closure \((p<.05)\),
       - and Auditory Association \((p<.05)\).

   No significant differences were observed on any of the eight remaining subtests although the experimental group's scores were lower on every subtest with the exception of Manual Expression where their performance approximated to that of the normative group.

   (b) the experimental group was almost 19 months retarded in Composite PLA and was retarded in language age on every ITPA subtest \((p<.01)\) with the exception of Manual Expression and Visual Closure where their performance approximated to that of the normative group.
3. An examination of intraindividual differences showed that the psycholinguistic growth of the experimental group was developing evenly in respect of all ITPA subtests: levels of organisation of test; channels of communication; and psychological processes, with the exception of:

(a) Auditory Closure, where a large substantial deficit was observed and Visual Sequential Memory where a borderline deficit was exhibited indicating discrepant psycholinguistic functioning in these areas.

(b) Manual Expression and Visual Closure where large positive deviation scores were recorded indicating that these were areas of strength.

4. Almost identical psycholinguistic profiles were obtained in two previous studies conducted by the writer involving comparable experimental groups drawn from parallel infant referral populations. It was argued, therefore, that this provides support for the diagnostic validity of the ITPA. In particular Auditory Closure and Visual Sequential Memory appear to have diagnostic validity for reading in this particular population of poor readers.

5. It was hypothesised that there was a correlative relationship between the psycholinguistic disabilities in Auditory Closure and Visual Sequential Memory, and the lack of reading attainment. A programme of training to ameliorate these disabilities was designed.

6. After the programme of remediation had taken place it was found:

(a) that the Kirk Experimental Group achieved higher overall gains than the Peabody Group on seventeen criterion tests, seven of
which reached significance. On no test did the Peabody Group achieve a significantly higher score than the Kirk Group.

(b) that at the end of the experiment the Mean Scaled Score of the Kirk Group (33.30) was nearer the normative mean (36.0) than that of the Peabody Group (31.90).

(c) that in the post-remedial period the Mean Scaled Score of the Kirk Group regressed by 0.38 points whilst that of the Peabody Group regressed by 1.07 points, indicating that the ITPA subtest scores of the Kirk Group had been maintained better than those of the Peabody Group.

(d) that the Kirk Programmes had successfully ameliorated the basic deficits in Auditory Closure and Visual Sequential Memory, and there were no deficits in the group's psycholinguistic functioning. Whilst the Peabody Programmes had successfully corrected the borderline disability in Visual Sequential Memory, they had failed to ameliorate the substantial disability in Auditory Closure. Furthermore, the programmes had failed to prevent a deterioration in the experimental group's performance in Grammatic Closure as a substantial disability was recorded in this function.

(e) that the Kirk Group achieved larger gains in reading age on the: Burt-Vernon Test (2.5 years), and the Young's Group Reading Test (1.6 years); than the Peabody Group: Burt-Vernon Test (2.1 years), and Young's Group Reading Test (1.2 years).

(f) that the Kirk Group achieved larger gains in non-verbal IQ: 5.05 IQ points, than the Peabody Group: 1.05 IQ points.
An examination of the nature of the Kirk input showed that it was a multi-level, multi-channel, multi-process remedial programme which integrated both process and task training in the same remedial procedure. Because of the complexity of the process-task interaction it was not possible to evaluate the extent to which each component was responsible for changes in the dependent variable. The superior treatment effects in (6) above could not, therefore, be attributed to the training of isolated processes, and no definitive conclusions could be drawn about the outcome of the Kirk training. There was, however, some support for a diagnostic approach to remediation in which teaching methods and materials are adapted to children's specific learning characteristics.

When the scores of the children on the Language Programmes (i.e. Kirk and Peabody Groups combined) were compared with those of the Control Group, it was found that they performed significantly better on twenty of the twenty-four measures. Whilst the Language Group made substantial progress in language skills the untrained Control subjects deteriorated overall. Thus, at the end of the experiment, the Control Group's Mean Scaled Score declined by 5.38 points relative to the Kirk Group and 3.94 points relative to the Peabody Group. This clear superiority of subjects receiving psycholinguistic training over Control subjects was considered experimental verification for the effectiveness of psycholinguistic training procedures.
9. No significant Programmes x Schools (A x B) interactions occurred in respect of any of the twenty-four measures. As the school variable was made a "random" effect, in the design of the experiment, and teachers within the schools administered the programmes, the results from this study can be generalised to similar populations to the one of this study (i.e. First year junior school pupils with severe reading difficulties attending schools characterized by a considerable degree of social deprivation).
Appendices

Appendix A - Analysis of Variance Data Sheets .......... 334 - 404
Appendix B - Rationale of PLDK ......................... 405 - 408
Appendix C - Rationale of ITPA ......................... 409 - 431
Appendix D - Score Data on Criterion Tests ............ 432 - 441
Appendix E - Nature of Input from Kirk and Peabody Programmes ................................ 442 - 446
Appendix F - Attendance Records of Experimental Group .. 447 - 450
APPENDIX A

Analysis of Variance Data Sheets
### Analysis 1

**Auditory Reception**

Programmes (A) x Schools (B) x Occasions (C)

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1210.72</td>
<td>2</td>
<td>605.36</td>
<td>7.75</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>B</td>
<td>182.34</td>
<td>3</td>
<td>60.78</td>
<td>&lt; 1</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>306.18</td>
<td>2</td>
<td>153.09</td>
<td>3.93</td>
<td></td>
</tr>
<tr>
<td>A x B</td>
<td>321.73</td>
<td>6</td>
<td>53.62</td>
<td>&lt; 1</td>
<td></td>
</tr>
<tr>
<td>A x C</td>
<td>237.85</td>
<td>4</td>
<td>59.46</td>
<td>3.04</td>
<td>&lt; 0.05</td>
</tr>
<tr>
<td>B x C</td>
<td>233.59</td>
<td>6</td>
<td>38.93</td>
<td>1.98</td>
<td></td>
</tr>
<tr>
<td>A x B x C</td>
<td>166.24</td>
<td>12</td>
<td>13.85</td>
<td>&lt; 1</td>
<td></td>
</tr>
<tr>
<td>Pupils (P) within A x B</td>
<td>3745.47</td>
<td>48</td>
<td>78.03</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residual (PxC) within A x B</td>
<td>1880.13</td>
<td>96</td>
<td>19.58</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>8284.25</td>
<td>179</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Analysis 1

Auditory Reception

Further Analysis of Significant Effects

(i) Breakdown of Methods (A) Variation

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1 - A2</td>
<td>80.03</td>
<td>1</td>
<td>80.03</td>
<td>1.02</td>
<td></td>
</tr>
<tr>
<td>A1 + A2 - A3</td>
<td>1130.69</td>
<td>1</td>
<td>1130.69</td>
<td>14.49</td>
<td>&lt;0.01</td>
</tr>
</tbody>
</table>

2 Pupils (P) within AB 3745.47 48 78.03

(ii) Breakdown of (A x C) Interaction Variation

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A1 - A2) x C</td>
<td>33.62</td>
<td>2</td>
<td>16.81</td>
<td>&lt;1</td>
<td></td>
</tr>
<tr>
<td>(A1 + A2 - A3) x C</td>
<td>204.23</td>
<td>2</td>
<td>102.12</td>
<td>5.21</td>
<td>&lt;0.01</td>
</tr>
</tbody>
</table>

2 Residual (PxC) within A x B 1880.13 96 19.58
## Auditory Reception

Mean Scores on three occasions for the Experimental Groups

<table>
<thead>
<tr>
<th>Programmes</th>
<th>School B1</th>
<th>School B2</th>
<th>School B3</th>
<th>School B4</th>
<th>Schools Combined</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>C1</td>
<td>C2</td>
<td>C3</td>
<td>C1</td>
<td>C2</td>
</tr>
<tr>
<td><strong>A1</strong> (Kirk)</td>
<td>Mean</td>
<td>27.2</td>
<td>33.2</td>
<td>27.4</td>
<td>25.6</td>
</tr>
<tr>
<td></td>
<td>S.D.</td>
<td>1.93</td>
<td>4.95</td>
<td>5.61</td>
<td>8.14</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>5</td>
<td></td>
<td>5</td>
<td></td>
</tr>
<tr>
<td><strong>A2</strong> (Peabody)</td>
<td>Mean</td>
<td>30.6</td>
<td>27.8</td>
<td>26.0</td>
<td>25.0</td>
</tr>
<tr>
<td></td>
<td>S.D.</td>
<td>4.31</td>
<td>3.31</td>
<td>3.03</td>
<td>0.4</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>5</td>
<td></td>
<td>5</td>
<td></td>
</tr>
<tr>
<td><strong>A3</strong> (Controls)</td>
<td>Mean</td>
<td>26.6</td>
<td>25.4</td>
<td>20.8</td>
<td>25.4</td>
</tr>
<tr>
<td></td>
<td>S.D.</td>
<td>3.66</td>
<td>4.22</td>
<td>7.16</td>
<td>1.62</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>5</td>
<td></td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>
Analysis 2

Visual Reception

Programmes (A) x Schools (B) x Occasions (C)

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>790.93</td>
<td>2</td>
<td>395.47</td>
<td>4.62</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>B</td>
<td>798.73</td>
<td>3</td>
<td>266.24</td>
<td>3.11</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>1.63</td>
<td>2</td>
<td>0.82</td>
<td></td>
<td>&lt;1</td>
</tr>
<tr>
<td>AxB</td>
<td>356.76</td>
<td>6</td>
<td>59.46</td>
<td></td>
<td>&lt;1</td>
</tr>
<tr>
<td>AxC</td>
<td>401.44</td>
<td>4</td>
<td>100.36</td>
<td>4.67</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>BxC</td>
<td>122.46</td>
<td>6</td>
<td>20.41</td>
<td>1.50</td>
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</tr>
<tr>
<td>AxBxC</td>
<td>258.20</td>
<td>12</td>
<td>21.51</td>
<td>1.58</td>
<td></td>
</tr>
<tr>
<td>Pupils (P) within AxB</td>
<td>4110.09</td>
<td>48</td>
<td>85.62</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residual (PxC) within AxB</td>
<td>1310.31</td>
<td>96</td>
<td>13.64</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>8150.55</td>
<td>179</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Visual Reception

Further Analysis of Significant Effects

#### (i) Breakdown of Methods (A) Variation

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1 - A2</td>
<td>182.53</td>
<td>1</td>
<td>182.53</td>
<td>2.13</td>
<td></td>
</tr>
<tr>
<td>A1 + A2 - A3</td>
<td>608.40</td>
<td>1</td>
<td>608.40</td>
<td>7.10</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>2 Pupils (P) within AB</td>
<td>4110.09</td>
<td>48</td>
<td>85.62</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### (ii) Breakdown of (A x C) Interaction Variation

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A1 - A2) x C</td>
<td>56.12</td>
<td>2</td>
<td>28.06</td>
<td>1.37</td>
<td></td>
</tr>
<tr>
<td>(A1 + A2 - A3) x C</td>
<td>345.32</td>
<td>2</td>
<td>200.72</td>
<td>9.63</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>2 A x B x C</td>
<td>258.20</td>
<td>12</td>
<td>20.41</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Visual Reception

**Mean Scores on three occasions for the Experimental Groups**

<table>
<thead>
<tr>
<th>Programmes</th>
<th>School B1</th>
<th>School B2</th>
<th>School B3</th>
<th>School B4</th>
<th>Schools Combined</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A1 (Kirk)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>25.8</td>
<td>28.6</td>
<td>34</td>
<td>26.0</td>
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<td>S.D.</td>
<td>6.55</td>
<td>8.89</td>
<td>7.40</td>
<td>4.73</td>
<td>5.46</td>
</tr>
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<td>N</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td><strong>A2 (Peabody)</strong></td>
<td></td>
<td></td>
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</tr>
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<td>Mean</td>
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<td><strong>A3 (Controls)</strong></td>
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### Analysis 3

**Auditory Association**

Programmes (A) x Schools (B) x Occasions (C)

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
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<th>p</th>
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<td>49.91</td>
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<td>8.33</td>
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<td>Pupils (P) within A x B</td>
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<td>Residual (PxC) within A x B</td>
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### Analysis 3

**Auditory Association**

Further Analysis of Significant Effects

#### (i) Breakdown of Methods (A) Variation

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<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
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<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1 - A2</td>
<td>21.68</td>
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<tr>
<td>A1 + A2 - A3</td>
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<td>1800.07</td>
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<td>&lt;0.01</td>
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<tr>
<td>2</td>
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<td>Pupils (P) within A x B</td>
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<td>63.61</td>
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#### (ii) Breakdown of Occasions (C) Variation

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<tr>
<td>C2 - C3</td>
<td>100.83</td>
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<td>C2 + C3 - C1</td>
<td>120.18</td>
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<td>14.42</td>
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<tr>
<td>2</td>
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<tr>
<td>B x C</td>
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#### (iii) Breakdown of (A x C) Interaction Variation

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<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F</th>
<th>p</th>
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<tr>
<td>(A1 - A2) x C</td>
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<td>(A1 + A2 - A3) x C</td>
<td>190.58</td>
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<td>95.29</td>
<td>9.07</td>
<td>&lt;0.01</td>
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<td></td>
</tr>
<tr>
<td>A x B x C</td>
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#### (iv) Breakdown of (A x C) Interaction Variation

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<th>Mean Square</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>A x (C3 - C2)</td>
<td>4.12</td>
<td>2</td>
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<td>&lt;1</td>
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</tr>
<tr>
<td>A x (C3 + C2 - C1)</td>
<td>195.50</td>
<td>2</td>
<td>97.75</td>
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<td>&lt;0.01</td>
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<tr>
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<td></td>
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<td></td>
<td></td>
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<tr>
<td>A x B x C</td>
<td>126.02</td>
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<td>10.50</td>
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## Auditory Association

### Mean Scores on three occasions for the Experimental Groups

<table>
<thead>
<tr>
<th>Programmes</th>
<th>School B1</th>
<th>School B2</th>
<th>School B3</th>
<th>School B4</th>
<th>Schools Combined</th>
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<tbody>
<tr>
<td></td>
<td>C1</td>
<td>C2</td>
<td>C3</td>
<td>C1</td>
<td>C2</td>
</tr>
<tr>
<td><strong>A1</strong> (Kirk)</td>
<td>30.2</td>
<td>33.2</td>
<td>31.8</td>
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<td>4.87</td>
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<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td><strong>A2</strong> (Peabody)</td>
<td>29.2</td>
<td>34.2</td>
<td>31.4</td>
<td>28.8</td>
<td>33.8</td>
</tr>
<tr>
<td>Mean</td>
<td>3.06</td>
<td>2.56</td>
<td>4.12</td>
<td>2.79</td>
<td>2.64</td>
</tr>
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<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td><strong>A3</strong> (Controls)</td>
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### Visual Association

Programmes (A) x Schools (B) x Occasions (C)

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
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<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
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<td>370.28</td>
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<td>185.14</td>
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<td>&lt;0.01</td>
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<td>364.47</td>
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<td>121.49</td>
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<td>10.35</td>
<td>2</td>
<td>5.18</td>
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<td>&lt;1</td>
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<td>114.12</td>
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<td>19.02</td>
<td>19.02</td>
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</tr>
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<td>65.91</td>
<td>6</td>
<td>10.99</td>
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<tr>
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<td>154.35</td>
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<td>12.86</td>
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<tr>
<td>Pupils (P) within A x B</td>
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<td>30.08</td>
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Analysis 4

Visual Association

Further Analysis of Significant Effects

(i) Breakdown of Methods (A) Variation

<table>
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<tr>
<td>( A_2 - A_3 )</td>
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<td>Pupils (P) within A x B</td>
<td>1443.83</td>
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<td>30.08</td>
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(ii) Breakdown of (A x C) Interaction Variation

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<th>Mean Square</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>((A_1 - A_2) \times C)</td>
<td>74.31</td>
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<td>((A_1 + A_2 - A_3) \times C)</td>
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<td>12.86</td>
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<td>School B2</td>
<td>School B3</td>
<td>School B4</td>
<td>Schools Combined</td>
</tr>
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<td>------------</td>
<td>-----------</td>
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<td>-----------</td>
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<td>-----------------</td>
</tr>
<tr>
<td></td>
<td>C1</td>
<td>C2</td>
<td>C3</td>
<td>C1</td>
<td>C2</td>
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<td></td>
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<td></td>
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</tr>
<tr>
<td>(Kirk)</td>
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<td><strong>A2</strong></td>
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<tr>
<td>(Peabody)</td>
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<td>34.0</td>
<td>30.8</td>
<td>26.4</td>
</tr>
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<td></td>
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<tr>
<td><strong>A3</strong></td>
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### Analysis 5

#### Verbal Expression

Programmes (A) x Schools (B) x Occasions (C)

<table>
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<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F</th>
<th>p</th>
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<tbody>
<tr>
<td>A</td>
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</tr>
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<td>&lt;0</td>
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<td>310.94</td>
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<td>77.74</td>
<td>18.03</td>
<td>&lt;0.01</td>
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<td></td>
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</tr>
<tr>
<td>Residual (PxC) within A x B</td>
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<td></td>
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<tr>
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## Analysis 5

### Verbal Expression

#### Further Analysis of Significant Effects

#### (i) Breakdown of Methods (A) Variation

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<th>F</th>
<th>p</th>
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<td>783.22</td>
<td>23.49</td>
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<tr>
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<td>2</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pupils (P) within A x B</td>
<td>1599.96</td>
<td>48</td>
<td>33.33</td>
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<td></td>
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</table>

#### (ii) Breakdown of Occasions (C) Variation

<table>
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<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F</th>
<th>p</th>
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</thead>
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<td>10.58</td>
<td>&lt;0.05</td>
</tr>
<tr>
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<td>184.90</td>
<td>50.79</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>B x C</td>
<td>21.86</td>
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#### (iii) Breakdown of (A x C) Interaction Variation

<table>
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<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A1 - A2) x C</td>
<td>51.65</td>
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<td>25.83</td>
<td>5.99</td>
<td>&lt;0.05</td>
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#### (iv) Breakdown of (A x C) Interaction Variation

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<td>C2</td>
<td>C3</td>
<td>C1</td>
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<td>A2</td>
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Analysis 6

Manual Expression

Programmes (A) x Schools (B) x Occasions (C)

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<th>Degrees of Freedom</th>
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## Manual Expression

### Mean Scores on three occasions for the Experimental Group

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<th>School B3</th>
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<td>C1</td>
<td>C2</td>
<td>C3</td>
<td>C1</td>
<td>C2</td>
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<td>A1 (Kirk)</td>
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<td>S.D.</td>
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<td>5</td>
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<tr>
<td>A2 (Peabody)</td>
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<td></td>
</tr>
<tr>
<td>Mean</td>
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<td>37.2</td>
<td>37.2</td>
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<td>A3 (Controls)</td>
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### Analysis 7

**Grammatic Closure**

Programmes (A) x Schools (B) x Occasions (C)

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<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
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<td>954.78</td>
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<td>218.40</td>
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</table>
Analysis 7

Grammatic Closure

Further Analysis of Significant Effects

(i) Breakdown of Methods (A) Variation

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<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
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<th>p</th>
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<td>A1 - A2</td>
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<tr>
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(ii) Breakdown of Methods (C) Variation

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<td>C2 - C3</td>
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(iii) Breakdown of (A x C) Interaction Variation

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(iv) Breakdown of (A x C) Interaction Variation

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## Analysis 8

### Visual Closure

Programmes (A) x Schools (B) x Occasions (C)

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</table>

TOTAL | 6778.32 | 179 |
## Visual Closure

### Further Analysis of Significant Effects

#### (i) Breakdown of Methods (A) Variation

<table>
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<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F</th>
<th>p</th>
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</thead>
<tbody>
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<td>A1 - A2</td>
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<td>A x B</td>
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#### (ii) Breakdown of Occasions (C) Variation

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</tr>
<tr>
<td>Residual (PxC) within A x B</td>
<td>1260.69</td>
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#### (iii) Breakdown of (A x C) interaction Variation

<table>
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<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F</th>
<th>p</th>
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<tbody>
<tr>
<td>(A1 - A2) x C</td>
<td>27.80</td>
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<td>1260.69</td>
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#### (iv) Breakdown of (A x C) Interaction Variation

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<th>Degrees of Freedom</th>
<th>Mean Square</th>
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<td>Residual (PxC) within A x B</td>
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<td>(Peabody)</td>
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### Analysis 9

**Auditory Sequential Memory**

Programmes (A) x Schools (B) x Occasions (C)

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<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
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<td>B</td>
<td>128.09</td>
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<td>C</td>
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<td>66.82</td>
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<td><strong>TOTAL</strong></td>
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### Analysis 9

**Auditory Sequential Memory**

Further Analysis of Significant Effects

(i) Breakdown of Occasions (C) Variation

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
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<th>p</th>
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<td>C3 - C2</td>
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<tr>
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<td>313.29</td>
<td>96</td>
<td>3.26</td>
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## Auditory Sequential Memory

### Mean Scores on three occasions for the Experimental Groups

<table>
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<tr>
<th>Programmes</th>
<th>School B1</th>
<th>School B2</th>
<th>School B3</th>
<th>School B4</th>
<th>Schools Combined</th>
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<td>C2</td>
<td>C3</td>
<td>C1</td>
<td>C2</td>
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<tr>
<td><strong>A1</strong></td>
<td></td>
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<tr>
<td>(Kirk)</td>
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<td></td>
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<tr>
<td>Mean</td>
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<td><strong>A2</strong></td>
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<td>(Peabody)</td>
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</tr>
<tr>
<td>(Controls)</td>
<td></td>
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<tr>
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### Analysis 10

**Visual Sequential Memory**

Programmes (A) x Schools (B) x Occasions (C)

<table>
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<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F</th>
<th>p</th>
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</thead>
<tbody>
<tr>
<td>A</td>
<td>1120.18</td>
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<td>560.09</td>
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<td>B</td>
<td>53.91</td>
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<td>17.97</td>
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<td>&lt;1</td>
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<tr>
<td>C</td>
<td>2392.18</td>
<td>2</td>
<td>1196.09</td>
<td>114.23</td>
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<tr>
<td>A x B</td>
<td>353.02</td>
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<td>58.83</td>
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<td>A x C</td>
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<td>A x B x C</td>
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<tr>
<td>Pupils (P) within A x B</td>
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<td>Residual (PxC) within A x B</td>
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Analysis 10

Visual Sequential Memory

Further Analysis of Significant Effects

(i) Breakdown of Methods (A) Variation

<table>
<thead>
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<th>Source of Variation</th>
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<th>Degrees of Freedom</th>
<th>Mean Square</th>
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<th>p</th>
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<tbody>
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<td>$A_1 - A_2$</td>
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<td>$A_1 + A_2 - A_3$</td>
<td>716.85</td>
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<tr>
<td></td>
<td>2</td>
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<tr>
<td>$A \times B$</td>
<td>353.02</td>
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<td>58.83</td>
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(ii) Breakdown of Occasions (C) Variation

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<td>$C_2 + C_3 - C_1$</td>
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<td>$A \times C$</td>
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(iii) Breakdown of (A x C) Interaction Variation

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<th>Mean Square</th>
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<th>p</th>
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<tr>
<td>$(A_1 - A_2) \times C$</td>
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<td>$(A_1 + A_2 - A_3) \times C$</td>
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<td>11.44</td>
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(iv) Breakdown of (A x C) Interaction Variation

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<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
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<td>12</td>
<td>11.44</td>
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### Visual Sequential Memory

Mean Scores on three occasions for the Experimental Groups

<table>
<thead>
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<th>Programmes</th>
<th>School B1</th>
<th>School B2</th>
<th>School B3</th>
<th>School B4</th>
<th>Schools Combined</th>
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<td>C2</td>
<td>C3</td>
<td>C1</td>
<td>C2</td>
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<td>5</td>
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<td>A2 (Peabody)</td>
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<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>A3 (Controls)</td>
<td>Mean</td>
<td>22.2</td>
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<td>29.0</td>
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Further Analysis of Significant Effects

(i) Breakdown of Methods (A) Variation

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F</th>
<th>p</th>
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<td>599.60</td>
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(ii) Breakdown of Methods (C) Variation

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<th>Degrees of Freedom</th>
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<th>p</th>
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</thead>
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<tr>
<td>Residual (PxC) within A × B</td>
<td>1193.64</td>
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(iii) Breakdown of (A × C) Interaction Variation

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<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A1 - A2) × C</td>
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<td>634.58</td>
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<td>(A1 + A2 - A3) × C</td>
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<td></td>
</tr>
<tr>
<td>Residual (PxC) within A × B</td>
<td>1193.64</td>
<td>96</td>
<td>12.43</td>
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(iv) Breakdown of (A × C) Interaction Variation

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>A × (C3 - C2)</td>
<td>72.15</td>
<td>2</td>
<td>36.08</td>
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<tr>
<td>A × (C3 + C2 - C1)</td>
<td>1588.37</td>
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<tr>
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<td>2</td>
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<tr>
<td>Residual (PxC) within A × B</td>
<td>1193.64</td>
<td>96</td>
<td>12.43</td>
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### Auditory Closure

Mean Scores on three occasions for the Experimental Groups

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<tr>
<th>Programmes</th>
<th>School B1</th>
<th>School B2</th>
<th>School B3</th>
<th>School B4</th>
<th>Schools Combined</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>C1</td>
<td>C2</td>
<td>C3</td>
<td>C1</td>
<td>C2</td>
</tr>
<tr>
<td><strong>A1</strong> (Kirk)</td>
<td>Mean</td>
<td>16.0</td>
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<td>30.6</td>
<td>16.8</td>
</tr>
<tr>
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<td>S.D.</td>
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<td>5</td>
<td>5</td>
</tr>
<tr>
<td><strong>A2</strong> (Peabody)</td>
<td>Mean</td>
<td>11.2</td>
<td>13.6</td>
<td>12.6</td>
<td>12.4</td>
</tr>
<tr>
<td></td>
<td>S.D.</td>
<td>4.35</td>
<td>3.38</td>
<td>4.63</td>
<td>2.33</td>
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<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td><strong>A3</strong> (Controls)</td>
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<td>12.0</td>
<td>13.0</td>
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<td>7.6</td>
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<td>3.79</td>
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</table>
Analysis 12

Sound Blending

Programmes (A) x Schools (B) x Occasions (C)

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>760.18</td>
<td>2</td>
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</tr>
<tr>
<td>B</td>
<td>443.48</td>
<td>3</td>
<td>147.83</td>
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</tr>
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<td>C</td>
<td>403.15</td>
<td>2</td>
<td>201.58</td>
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<tr>
<td>A x B</td>
<td>825.87</td>
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</tr>
<tr>
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<td>1.10</td>
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</tr>
<tr>
<td>B x C</td>
<td>36.23</td>
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<td>A x B x C</td>
<td>58.47</td>
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<tr>
<td>Pupils (p) within A x B</td>
<td>3220.78</td>
<td>48</td>
<td>67.10</td>
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</tr>
<tr>
<td>Residual (PxC) within A x B</td>
<td>438.82</td>
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</tr>
<tr>
<td>TOTAL</td>
<td>6208.33</td>
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Analysis 12

Sound Blending

Further Analysis of Significant Effects

(i) Breakdown of Occasions (C) Variation

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>C3 - C2</td>
<td>33.08</td>
<td>1</td>
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<td>5.47</td>
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<tr>
<td>C2 + C3 - C1</td>
<td>370.07</td>
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<tr>
<td>B x C</td>
<td>36.23</td>
<td>6</td>
<td>6.04</td>
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</table>
### Sound Blending

Mean Scores on three occasions for the Experimental Groups

<table>
<thead>
<tr>
<th>Programmes</th>
<th>School B1</th>
<th>School B2</th>
<th>School B3</th>
<th>School B4</th>
<th>Schools Combined</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>C1</td>
<td>C2</td>
<td>C3</td>
<td>C1</td>
<td>C2</td>
</tr>
<tr>
<td>A1 (Kirk)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>40.2</td>
<td>43.2</td>
<td>43.8</td>
<td>31.4</td>
<td>33.2</td>
</tr>
<tr>
<td>S.D.</td>
<td>4.49</td>
<td>3.54</td>
<td>4.17</td>
<td>4.72</td>
<td>4.62</td>
</tr>
<tr>
<td>N</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>A2 (Peabody)</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>30.8</td>
<td>34.0</td>
<td>35.0</td>
<td>33.6</td>
<td>34.8</td>
</tr>
<tr>
<td>S.D.</td>
<td>2.64</td>
<td>1.27</td>
<td>2.10</td>
<td>3.44</td>
<td>4.92</td>
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<td>N</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>A3 (Controls)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>29.8</td>
<td>33.6</td>
<td>33.8</td>
<td>31.6</td>
<td>32.6</td>
</tr>
<tr>
<td>S.D.</td>
<td>3.6</td>
<td>3.14</td>
<td>3.71</td>
<td>3.32</td>
<td>5.57</td>
</tr>
<tr>
<td>N</td>
<td>5</td>
<td>5</td>
<td>5</td>
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</table>
**Analysis 13**

**Composite PLA**

Programmes (A) x Schools (B) x Occasions (C)

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>8080.35</td>
<td>2</td>
<td>4040.18</td>
<td>23.59</td>
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<tr>
<td>B</td>
<td>1591.38</td>
<td>3</td>
<td>530.46</td>
<td>3.09</td>
<td>&lt;0.05</td>
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<tr>
<td>C</td>
<td>9819.05</td>
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<td>4909.53</td>
<td>206.54</td>
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<tr>
<td>AxB</td>
<td>721.47</td>
<td>6</td>
<td>120.25</td>
<td>&lt;1</td>
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</tr>
<tr>
<td>AxC</td>
<td>1567.05</td>
<td>4</td>
<td>261.18</td>
<td>23.38</td>
<td>&lt;0.01</td>
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<tr>
<td>BxC</td>
<td>142.64</td>
<td>6</td>
<td>23.77</td>
<td>2.37</td>
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</tr>
<tr>
<td>AxBxC</td>
<td>134.06</td>
<td>12</td>
<td>11.17</td>
<td>1.12</td>
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</tr>
<tr>
<td>Pupils (P) within AxB</td>
<td>8222.22</td>
<td>48</td>
<td>171.29</td>
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<td></td>
</tr>
<tr>
<td>Residual (PxC) within AxB</td>
<td>958.18</td>
<td>96</td>
<td>9.98</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>31236.40</strong></td>
<td><strong>179</strong></td>
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</tbody>
</table>
### Analysis 13

**Composite PLA**

**Further Analysis of Significant Effects**

(i) **Breakdown of Methods (A) Variation**

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1 - A2</td>
<td>5.21</td>
<td>1</td>
<td>5.21</td>
<td>&lt;1</td>
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</tr>
<tr>
<td>A1 + A2 - A3</td>
<td>8075.14</td>
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<td>8075.14</td>
<td>47.14</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pupils (P) within A x B</td>
<td>8222.22</td>
<td>48</td>
<td>171.29</td>
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<td></td>
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</tbody>
</table>

(ii) **Breakdown of Methods (C) Variation**

<table>
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<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>C3 - C2</td>
<td>1428.30</td>
<td>1</td>
<td>1428.30</td>
<td>60.80</td>
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<tr>
<td>C2 + C3 - C1</td>
<td>8390.75</td>
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<td>8390.75</td>
<td>352.99</td>
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<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B x C</td>
<td>142.64</td>
<td>6</td>
<td>23.77</td>
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<td></td>
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</table>

(iii) **Breakdown of (A x C) Interaction Variation**

<table>
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<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A1 - A2) x C</td>
<td>44.21</td>
<td>2</td>
<td>22.10</td>
<td>1.98</td>
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</tr>
<tr>
<td>(A1 + A2 - A3) x C</td>
<td>1522.84</td>
<td>2</td>
<td>761.42</td>
<td>68.16</td>
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<tr>
<td>2</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>A x B x C</td>
<td>134.06</td>
<td>12</td>
<td>11.17</td>
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(iv) **Breakdown of (A x Q) Interaction Variation**

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<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>A x (C3 - C2)</td>
<td>73.35</td>
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<td>36.68</td>
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<td>A x (C3 + C2 - C1)</td>
<td>1493.70</td>
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<td>746.85</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>A x B x C</td>
<td>134.06</td>
<td>12</td>
<td>11.17</td>
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</table>
## Composite PLA

Mean Scores on three occasions for the Experimental Group

<table>
<thead>
<tr>
<th>Programmes</th>
<th>School B1</th>
<th>School B2</th>
<th>School B3</th>
<th>School B4</th>
<th>Schools Combined</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1 (Kirk)</td>
<td>C1</td>
<td>C2</td>
<td>C3</td>
<td>C1</td>
<td>C2</td>
</tr>
<tr>
<td>Mean</td>
<td>79.4</td>
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<td>106.4</td>
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</tr>
<tr>
<td>S.D.</td>
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<td>3.60</td>
<td>6.92</td>
<td>5.91</td>
<td>8.01</td>
</tr>
<tr>
<td>N</td>
<td>5</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A2 (Peabody)</td>
<td>Mean</td>
<td>81.2</td>
<td>96.2</td>
<td>103.2</td>
<td>75.2</td>
</tr>
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<td>S.D.</td>
<td>4.79</td>
<td>6.15</td>
<td>6.68</td>
<td>6.49</td>
<td>5.71</td>
</tr>
<tr>
<td>N</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A3 (Controls)</td>
<td>Mean</td>
<td>77.2</td>
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<td>84.6</td>
<td>75.2</td>
</tr>
<tr>
<td>S.D.</td>
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<td>3.35</td>
<td>3.92</td>
<td>3.06</td>
<td>1.62</td>
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</table>
## Analysis 14

### Mean Scaled Score

Programmes (A) x Schools (B) x Occasions (C)

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1001.52</td>
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<td>500.76</td>
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</tr>
<tr>
<td>B</td>
<td>180.08</td>
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<td>60.02</td>
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</tr>
<tr>
<td>C</td>
<td>86.74</td>
<td>2</td>
<td>43.37</td>
<td>9.07</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>AxB</td>
<td>100.37</td>
<td>6</td>
<td>16.72</td>
<td>1</td>
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</tr>
<tr>
<td>AxC</td>
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<td>4</td>
<td>44.88</td>
<td>39.03</td>
<td>&lt;0.01</td>
</tr>
<tr>
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<td>28.67</td>
<td>6</td>
<td>4.78</td>
<td>4.50</td>
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</tr>
<tr>
<td>AxBxC</td>
<td>13.83</td>
<td>12</td>
<td>1.15</td>
<td>1.08</td>
<td></td>
</tr>
<tr>
<td>Pupils (P) within AxB</td>
<td>1019.84</td>
<td>48</td>
<td>21.25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residual (PxC) within AxB</td>
<td>101.24</td>
<td>96</td>
<td>1.06</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>2711.82</strong></td>
<td><strong>179</strong></td>
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</tbody>
</table>
Analysis 14

Mean Scaled Score

Further Analysis of Significant Effects

(i) Breakdown of Methods (A) Variation

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1 - A2</td>
<td>12.16</td>
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<td>12.16</td>
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<td></td>
</tr>
<tr>
<td>A1 + A2 - A3</td>
<td>989.36</td>
<td>1</td>
<td>989.36</td>
<td>46.55</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Pupils (P) within A x B</td>
<td>1019.84</td>
<td>48</td>
<td>21.25</td>
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<td></td>
</tr>
</tbody>
</table>

(ii) Breakdown of Occasions (C) Variation

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>C2 - C3</td>
<td>26.88</td>
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<td>26.88</td>
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<td></td>
</tr>
<tr>
<td>C2 + C3 - C1</td>
<td>59.86</td>
<td>1</td>
<td>59.86</td>
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<tr>
<td>B x C</td>
<td>28.67</td>
<td>6</td>
<td>4.78</td>
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</table>

(iii) Breakdown of (A x C) Interaction Variation

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A1 - A2) x C</td>
<td>10.30</td>
<td>2</td>
<td>5.15</td>
<td>4.48</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>(A1 + A2 - A3) x C</td>
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<tr>
<td>A x B x C</td>
<td>13.83</td>
<td>12</td>
<td>1.15</td>
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<td></td>
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</tbody>
</table>

(iv) Breakdown of (A x C) Interaction Variation

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>A x (C3 - C2)</td>
<td>5.33</td>
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<tr>
<td>A x (C3 + C2 - C1)</td>
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<tr>
<td>A x B x C</td>
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<td>12</td>
<td>1.15</td>
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</tr>
</tbody>
</table>
## Mean Scaled Score

Mean Scores on three occasions for Experimental Groups

<table>
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<th>Programmes</th>
<th>School B1</th>
<th>School B2</th>
<th>School B3</th>
<th>School B4</th>
<th>Schools Combined</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>C1</td>
<td>C2</td>
<td>C3</td>
<td>C1</td>
<td>C2</td>
</tr>
<tr>
<td><strong>A1</strong> (Kirk)</td>
<td>Mean</td>
<td>31.4</td>
<td>35.42</td>
<td>35.1</td>
<td>30.58</td>
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<tr>
<td></td>
<td>S.D.</td>
<td>1.68</td>
<td>1.72</td>
<td>1.28</td>
<td>3.03</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>5</td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td><strong>A2</strong> (Peabody)</td>
<td>Mean</td>
<td>30.58</td>
<td>33.72</td>
<td>32.62</td>
<td>29.08</td>
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<tr>
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<td></td>
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<td>5</td>
</tr>
<tr>
<td><strong>A3</strong> (Controls)</td>
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<td>29.92</td>
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<td>0.84</td>
<td>1.43</td>
<td>1.54</td>
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Analysis 15

Automatic Level

Programmes (A) x Schools (B) x Occasions (C)

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<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1918.15</td>
<td>2</td>
<td>959.08</td>
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<tr>
<td>B</td>
<td>133.67</td>
<td>3</td>
<td>44.56</td>
<td>1.86</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>449.08</td>
<td>2</td>
<td>224.54</td>
<td>95.55</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>A x B</td>
<td>109.05</td>
<td>6</td>
<td>18.18</td>
<td>&lt;1</td>
<td></td>
</tr>
<tr>
<td>A x C</td>
<td>305.12</td>
<td>4</td>
<td>76.28</td>
<td>50.18</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>B x C</td>
<td>14.12</td>
<td>6</td>
<td>2.35</td>
<td>1.55</td>
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</tr>
<tr>
<td>A x B x C</td>
<td>18.21</td>
<td>12</td>
<td>1.52</td>
<td>1.00</td>
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</tr>
<tr>
<td>Pupils (P) within A x B</td>
<td>1145.50</td>
<td>48</td>
<td>23.86</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residual (PxC) within A x B</td>
<td>146.10</td>
<td>96</td>
<td>1.52</td>
<td></td>
<td></td>
</tr>
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</table>

TOTAL 4239.00 179
Further Analysis of Significant Effects

(i) Breakdown of Methods (A) Variation

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1 - A2</td>
<td>576.41</td>
<td>1</td>
<td>576.41</td>
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<td>&lt;0.01</td>
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<tr>
<td>A1 + A2 - A3</td>
<td>1341.74</td>
<td>1</td>
<td>1341.74</td>
<td>56.23</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Pupils (P) within A x B</td>
<td>1145.50</td>
<td>48</td>
<td>23.86</td>
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<td></td>
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</tbody>
</table>

(ii) Breakdown of Occasions (C) Variation

<table>
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<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
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<th>p</th>
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</thead>
<tbody>
<tr>
<td>C2 - C3</td>
<td>2.42</td>
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<td>2.42</td>
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<tr>
<td>C2 + C3 - C1</td>
<td>446.66</td>
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<td>446.66</td>
<td>190.07</td>
<td>&lt;0.01</td>
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<tr>
<td>B x C</td>
<td>14.12</td>
<td>6</td>
<td>2.35</td>
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(iii) Breakdown of (A x C) Interaction Variation

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A1 - A2) x C</td>
<td>142.91</td>
<td>2</td>
<td>71.46</td>
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<tr>
<td>(A1 + A2 - A3) x C</td>
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<td>81.11</td>
<td>53.36</td>
<td>&lt;0.01</td>
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<tr>
<td>Residual (P x C) within A x B</td>
<td>146.10</td>
<td>96</td>
<td>1.52</td>
<td></td>
<td></td>
</tr>
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</table>

(iv) Breakdown of (A x C) Interaction Variation

<table>
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<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>A x (C3 - C2)</td>
<td>1.0</td>
<td>2</td>
<td>0.50</td>
<td>&lt;1</td>
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</tr>
<tr>
<td>A x (C3 + C2 - C1)</td>
<td>304.12</td>
<td>2</td>
<td>152.06</td>
<td>100.04</td>
<td>&lt;0.01</td>
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<tr>
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<td>146.10</td>
<td>96</td>
<td>1.52</td>
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<td></td>
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## Table: Automatic Level

Mean scores on three occasions for the Experimental Group

<table>
<thead>
<tr>
<th>Programmes</th>
<th>School B1</th>
<th>School B2</th>
<th>School B3</th>
<th>School B4</th>
<th>Schools Combined</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>C1</td>
<td>C2</td>
<td>C3</td>
<td>C1</td>
<td>C2</td>
</tr>
<tr>
<td>A1 (Kirk)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>30.4</td>
<td>37.8</td>
<td>37.2</td>
<td>28.4</td>
<td>36.4</td>
</tr>
<tr>
<td>S.D.</td>
<td>2.8</td>
<td>2.04</td>
<td>1.83</td>
<td>3.2</td>
<td>3.38</td>
</tr>
<tr>
<td>N</td>
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<td></td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>A2 (Peabody)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>25.8</td>
<td>29.6</td>
<td>29.4</td>
<td>26.8</td>
<td>29.6</td>
</tr>
<tr>
<td>S.D.</td>
<td>1.72</td>
<td>2.06</td>
<td>2.42</td>
<td>2.71</td>
<td>3.01</td>
</tr>
<tr>
<td>N</td>
<td>5</td>
<td></td>
<td></td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>A3 (Controls)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>26.0</td>
<td>27.4</td>
<td>25.6</td>
<td>25.6</td>
<td>26.2</td>
</tr>
<tr>
<td>S.D.</td>
<td>3.16</td>
<td>2.33</td>
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</tbody>
</table>
## Analysis 16

### Representational Level

Programmes (A) x Schools (B) x Occasions (C)

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>732.05</td>
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<td>366.03</td>
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<tr>
<td>B</td>
<td>197.80</td>
<td>3</td>
<td>65.93</td>
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</tr>
<tr>
<td>C</td>
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<td>2</td>
<td>19.76</td>
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<td>&lt;1</td>
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<td>39.61</td>
<td>17.07</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>B x C</td>
<td>25.20</td>
<td>6</td>
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<td>2.74</td>
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</tr>
<tr>
<td>A x B x C</td>
<td>27.80</td>
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<td>2.32</td>
<td>1.51</td>
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</tr>
<tr>
<td>Pupils (P) within A x B</td>
<td>1150.00</td>
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<td>23.96</td>
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<td></td>
</tr>
<tr>
<td>Residual (PxC) within A x B</td>
<td>146.40</td>
<td>96</td>
<td>1.53</td>
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</tr>
<tr>
<td><strong>TOTAL</strong></td>
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<td><strong>179</strong></td>
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</tbody>
</table>
Analysis 16

Representational Level

Further Analysis of Significant Effects

(i) Breakdown of Methods (A) Variation

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
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<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1 - A2</td>
<td>20.83</td>
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<td>20.83</td>
<td>&lt;1</td>
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<tr>
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<td>711.22</td>
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<tr>
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<td>48</td>
<td>20</td>
<td>23.96</td>
<td></td>
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</table>

(ii) Breakdown of (A x C) Interaction Variation

<table>
<thead>
<tr>
<th>Source of Variation</th>
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<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
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<tr>
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<td>5.27</td>
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<td>76.58</td>
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<td>&lt;0.01</td>
</tr>
<tr>
<td>2</td>
<td>27.80</td>
<td>12</td>
<td>2.32</td>
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<td></td>
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<tr>
<td>Programmes</td>
<td>School B1</td>
<td>School B2</td>
<td>School B3</td>
<td>School B4</td>
<td>Schools Combined</td>
</tr>
<tr>
<td>------------</td>
<td>----------</td>
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<td>----------</td>
<td>----------</td>
<td>-----------------</td>
</tr>
<tr>
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<td>C1</td>
<td>C2</td>
<td>C3</td>
<td>C1</td>
<td>C2</td>
</tr>
<tr>
<td>A1 (Kirk)</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>31.2</td>
<td>34.2</td>
<td>33.8</td>
<td>30.2</td>
<td>30.4</td>
</tr>
<tr>
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<td>1.94</td>
<td>3.19</td>
<td>2.80</td>
</tr>
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<td>5</td>
</tr>
<tr>
<td>A2 (Peabody)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>32.0</td>
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<td>33.2</td>
<td>29.6</td>
<td>33.0</td>
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<td>2.24</td>
<td>1.90</td>
</tr>
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</tr>
<tr>
<td>A3 (Controls)</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>30.8</td>
<td>29.2</td>
<td>27.6</td>
<td>29.6</td>
<td>28.2</td>
</tr>
<tr>
<td>S.D.</td>
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<td>1.74</td>
<td>1.33</td>
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</tbody>
</table>
### Analysis 17

**Reception Process**

Programmes (A) x Schools (B) x Occasions (C)

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>892.52</td>
<td>2</td>
<td>446.26</td>
<td>7.92</td>
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<tr>
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<td>327.93</td>
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<td>109.31</td>
<td>1.94</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>61.52</td>
<td>2</td>
<td>30.76</td>
<td>2.28</td>
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</tr>
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<td>&lt;1</td>
</tr>
<tr>
<td>A x C</td>
<td>253.82</td>
<td>4</td>
<td>63.46</td>
<td>7.04</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>B x C</td>
<td>81.06</td>
<td>6</td>
<td>13.51</td>
<td>1.50</td>
<td></td>
</tr>
<tr>
<td>A x B x C</td>
<td>81.77</td>
<td>12</td>
<td>6.81</td>
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<td>&lt;1</td>
</tr>
<tr>
<td>Pupils (P) within A x B</td>
<td>2704.45</td>
<td>48</td>
<td>56.34</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residual (PxC) within A x B</td>
<td>865.55</td>
<td>96</td>
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<td><strong>TOTAL</strong></td>
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</table>
## Reception Process

Further Analysis of Significant Effects

### (i) Breakdown of Methods (A) Variation

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F</th>
<th>p</th>
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<tbody>
<tr>
<td>A1 - A2</td>
<td>131.25</td>
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<tr>
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<td>Pupils (P) within A x B</td>
<td>2704.45</td>
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### (ii) Breakdown of (A x C) Interaction Variation

<table>
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<th>Degrees of Freedom</th>
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<th>p</th>
</tr>
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<tbody>
<tr>
<td>(A1 - A2) x C</td>
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<tr>
<td>(A1 + A2 - A3) x C</td>
<td>243.82</td>
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<td>121.91</td>
<td>13.53</td>
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<tr>
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<td>865.55</td>
<td>96</td>
<td>9.01</td>
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Reception Process

Mean Scores on three occasions for the Experimental Groups

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<tr>
<th>Programmes</th>
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<th>School B2</th>
<th>School B3</th>
<th>School B4</th>
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<tbody>
<tr>
<td></td>
<td>C1</td>
<td>C2</td>
<td>C3</td>
<td>C1</td>
<td>C2</td>
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<td>A1 (Kirk)</td>
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<td>24.8</td>
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<td>A2 (Peabody)</td>
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<td>Mean</td>
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<td>29.9</td>
<td>28.8</td>
<td>26.5</td>
<td>29.1</td>
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<td>S.D.</td>
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<td>A3 (Controls)</td>
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### Analysis 18

**Association Process**

Programmes (A) x Schools (B) x Occasions (C)

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
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<th>p</th>
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<tbody>
<tr>
<td>A</td>
<td>718.26</td>
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<td>359.13</td>
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<tr>
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<td>364.22</td>
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<td>C</td>
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<td>Pupils (P) within A x B</td>
<td>1370.44</td>
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<td>28.55</td>
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</tr>
<tr>
<td>Residual (PxC) within A x B</td>
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### Further Analysis of Significant Effects

#### (i) Breakdown of Methods (A) Variation

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<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1 - A2</td>
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<tr>
<td>A1 + A2 - A3</td>
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<td>716.85</td>
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<tr>
<td>Pupils (P) within A x B</td>
<td>1370.44</td>
<td>48</td>
<td>28.55</td>
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</table>

#### (ii) Breakdown of Occasions (C) Variation

<table>
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<th>Source of Variation</th>
<th>Sum of Squares</th>
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<tbody>
<tr>
<td>C2 - C3</td>
<td>33.61</td>
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<td>48.08</td>
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<tr>
<td>Residual (PxC) within A x B</td>
<td>410.86</td>
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<td>4.28</td>
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#### (iii) Breakdown of (A x C) Interaction Variation

<table>
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<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A1 - A2) x C</td>
<td>33.26</td>
<td>2</td>
<td>16.63</td>
<td>1.93</td>
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<td>(A1 + A2 - A3) x C</td>
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<tr>
<td>A x B x C</td>
<td>103.14</td>
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#### (iv) Breakdown of (A x C) Interaction Variation

<table>
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<th>Source of Variation</th>
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<th>Degrees of Freedom</th>
<th>Mean Square</th>
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<th>P</th>
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</thead>
<tbody>
<tr>
<td>A x (C3 - C2)</td>
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<td>A x (C3 + C2 - C1)</td>
<td>155.74</td>
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<td>8.60</td>
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</tr>
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<td>School B2</td>
<td>School B3</td>
<td>Schools Combined</td>
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<td>-----------</td>
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<td>-----------</td>
<td>-----------------</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C1</td>
<td>C2</td>
<td>C3</td>
<td>C1</td>
<td>C2</td>
</tr>
<tr>
<td>Mean</td>
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<td></td>
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<td>29.2</td>
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<td>29.4</td>
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<td></td>
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<td>5</td>
</tr>
</tbody>
</table>

**Note:** The table shows mean scores on three occasions for the experimental groups. The programmes include different schools and their combined averages. The mean scores are presented for different tests such as (Kirk) and (Peabody). The table includes the number of participants (N) for each group.
## Analysis 19

**Expression Process**

### Programmes (A) x Schools (B) x Occasions (C)

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F</th>
<th>p</th>
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</thead>
<tbody>
<tr>
<td>A</td>
<td>412.94</td>
<td>2</td>
<td>206.47</td>
<td>9.70</td>
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</tr>
<tr>
<td>B</td>
<td>43.01</td>
<td>3</td>
<td>14.34</td>
<td>&lt;1</td>
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</tr>
<tr>
<td>C</td>
<td>67.35</td>
<td>2</td>
<td>33.68</td>
<td>11.78</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>A x B</td>
<td>46.35</td>
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<td>7.73</td>
<td>&lt;1</td>
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<td>A x C</td>
<td>106.71</td>
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<td>26.68</td>
<td>16.78</td>
<td>&lt;0.01</td>
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<tr>
<td>B x C</td>
<td>17.17</td>
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<td>2.86</td>
<td>1.79</td>
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<td>21.28</td>
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<td>Residual (PxO) within A x B</td>
<td>152.47</td>
<td>96</td>
<td>1.59</td>
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<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>1867.00</strong></td>
<td><strong>179</strong></td>
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</table>
### Analysis 19

**Expression Process**

Further Analysis of Significant Effects

(i) Breakdown of Methods (A) Variation

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1 - A2</td>
<td>1.21</td>
<td>1</td>
<td>1.21</td>
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<tr>
<td>A1 + A2 - A3</td>
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<td>1</td>
<td>411.73</td>
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<td>2</td>
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<tr>
<td>Pupils (P) within A x B</td>
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(ii) Breakdown of Occasions (C) Variation

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<th>Source of Variation</th>
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<th>P</th>
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</thead>
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<tr>
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<td>B x C</td>
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(iii) Breakdown of (A x C) Interaction Variation

<table>
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<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
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<td></td>
<td></td>
</tr>
<tr>
<td>Residual (PxC) within A x B</td>
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<td>96</td>
<td>1.59</td>
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(iv) Breakdown of (A x C) Interaction Variation

<table>
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<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F</th>
<th>P</th>
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</thead>
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<tr>
<td>Residual (PxC) within A x B</td>
<td>152.47</td>
<td>96</td>
<td>1.59</td>
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<tr>
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<td>School B2</td>
<td>School B3</td>
<td>School B4</td>
<td>Schools Combined</td>
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</tr>
<tr>
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<td>C1</td>
<td>C2</td>
<td>C3</td>
<td>C1</td>
<td>C2</td>
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<tr>
<td>A1</td>
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<td>5</td>
</tr>
<tr>
<td>A2</td>
<td></td>
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<td>(Peabody)</td>
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<td>A3</td>
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## Analysis 20

### Auditory Vocal Channel

Programmes (A) x Schools (B) x Occasions (C)

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F</th>
<th>p</th>
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<td>A</td>
<td>1299.55</td>
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<tr>
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<td>151.18</td>
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<td>50.39</td>
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<td>C</td>
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<td>79.44</td>
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<tr>
<td>Pupils (P) within A x B</td>
<td>1334.23</td>
<td>48</td>
<td>27.80</td>
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</tr>
<tr>
<td>Residual (PxC) within A x B</td>
<td>144.57</td>
<td>96</td>
<td>1.51</td>
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<td><strong>TOTAL</strong></td>
<td><strong>3467.67</strong></td>
<td><strong>179</strong></td>
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Further Analysis of Significant Effects

(i) Breakdown of Methods (A) Variation

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<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
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<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1 - A2</td>
<td>221.42</td>
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<tr>
<td>A1 + A2 - A3</td>
<td>1078.13</td>
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<td>1078.13</td>
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<td>2 Pupils (P) within A x B</td>
<td>1334.23</td>
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(ii) Breakdown of Occasions (C) Variation

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<th>p</th>
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<td>C2 - C3</td>
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<td>C2 + C3 - C1</td>
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<td>114.46</td>
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</tr>
<tr>
<td>B x C</td>
<td>18.29</td>
<td>6</td>
<td>3.05</td>
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(iii) Breakdown of (A x C) Interaction Variation

<table>
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<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F</th>
<th>p</th>
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<tbody>
<tr>
<td>(A1 - A2) x C</td>
<td>21.21</td>
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<td>(A1 + A2 - A3) x C</td>
<td>201.39</td>
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<td>Residual (P x C) within A x B</td>
<td>144.57</td>
<td>96</td>
<td>1.51</td>
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(iv) Breakdown of (A x C) Interaction Variation

<table>
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<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F</th>
<th>p</th>
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<tbody>
<tr>
<td>A x (C3 - C2)</td>
<td>1.61</td>
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<tr>
<td>A x (C3 + C2 - C1)</td>
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<td>1.51</td>
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<td>Programme</td>
<td>School B1</td>
<td>School B2</td>
<td>School B3</td>
<td>School B4</td>
<td>Schools Combined</td>
</tr>
<tr>
<td>-----------</td>
<td>-----------</td>
<td>-----------</td>
<td>-----------</td>
<td>-----------</td>
<td>-----------------</td>
</tr>
<tr>
<td>A1</td>
<td>Mean</td>
<td>S.D.</td>
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<td>Mean</td>
<td>S.D.</td>
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<tr>
<td></td>
<td>31.2</td>
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<td>37.0</td>
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<tr>
<td>A2</td>
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<td>Mean</td>
<td>S.D.</td>
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<td>29.4</td>
<td>2.47</td>
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<td>A3</td>
<td>Mean</td>
<td>S.D.</td>
<td>N</td>
<td>Mean</td>
<td>S.D.</td>
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<td>26.4</td>
<td>2.33</td>
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<td>24.4</td>
<td>2.35</td>
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</table>
**Analysis 21**

**Visual Motor Channel**

Programmes (A) \times Schools (B) \times Occasions (C)

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>585.90</td>
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<td>292.95</td>
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<td>&lt;0.01</td>
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<tr>
<td>B</td>
<td>88.19</td>
<td>3</td>
<td>29.39</td>
<td>1.43</td>
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</tr>
<tr>
<td>C</td>
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<td>92.60</td>
<td>19.37</td>
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<tr>
<td>A \times B</td>
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<td>&lt;1</td>
</tr>
<tr>
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<tr>
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<td>4.78</td>
<td>2.52</td>
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<tr>
<td>A \times B \times C</td>
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<td>Pupils (P) within A \times B</td>
<td>983.96</td>
<td>48</td>
<td>20.50</td>
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</tr>
<tr>
<td>Residual (PxC) within A \times B</td>
<td>182.84</td>
<td>96</td>
<td>1.90</td>
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<td></td>
</tr>
</tbody>
</table>

**TOTAL** | 2356.95       | 179                |...|
Visual-Motor Channel

Further Analysis of Significant Effects

(i) Breakdown of Methods (A) Variation

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F</th>
<th>p</th>
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</thead>
<tbody>
<tr>
<td>A1 - A2</td>
<td>0.68</td>
<td>1</td>
<td>0.68</td>
<td>1</td>
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<tr>
<td>A1 + A2 - A3</td>
<td>585.22</td>
<td>1</td>
<td>585.22</td>
<td>28.54</td>
<td>&lt;0.01</td>
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<tr>
<td>2</td>
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<tr>
<td>Pupils (P) within A x B</td>
<td>983.96</td>
<td>48</td>
<td>20.50</td>
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</table>

(ii) Breakdown of Occasions (C) Variation

<table>
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<th>Source of Variation</th>
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<th>p</th>
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</thead>
<tbody>
<tr>
<td>C3 - C2</td>
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<td>C2 + C3 - C1</td>
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<td>36.68</td>
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<tr>
<td>2</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B x C</td>
<td>28.63</td>
<td>6</td>
<td>4.78</td>
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(iii) Breakdown of (A x C) Interaction Variation

<table>
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<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
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<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A1 - A2) x C</td>
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<td>59.48</td>
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<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residual (PxC) within A x B</td>
<td>182.84</td>
<td>96</td>
<td>1.90</td>
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</table>

(iv) Breakdown of (A x C) Interaction Variation

<table>
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<tr>
<th>Source of Variation</th>
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<th>Mean Square</th>
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<th>p</th>
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</thead>
<tbody>
<tr>
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<tr>
<td>2</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Residual (PxC) within A x B</td>
<td>182.84</td>
<td>96</td>
<td>1.90</td>
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</table>
### Visual-Motor Channel

Mean Scores on three occasions for the Experimental Groups

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<th>Programmes</th>
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<th>School B2</th>
<th>School B3</th>
<th>School B4</th>
<th>Schools Combined</th>
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<tbody>
<tr>
<td></td>
<td>C1</td>
<td>C2</td>
<td>C3</td>
<td>C1</td>
<td>C2</td>
</tr>
<tr>
<td>A1 (Kirk)</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>Mean</td>
<td>29.8</td>
<td>34.2</td>
<td>35.8</td>
<td>30.6</td>
<td>33.2</td>
</tr>
<tr>
<td>S.D.</td>
<td>2.99</td>
<td>3.19</td>
<td>2.32</td>
<td>2.50</td>
<td>2.23</td>
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<td>N</td>
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<td></td>
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<td>5</td>
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<td>A2 (Peabody)</td>
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<td></td>
<td></td>
<td></td>
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<td>35.2</td>
<td>29.6</td>
<td>32.0</td>
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<td>S.D.</td>
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<td>3.12</td>
<td>2.40</td>
<td>4.22</td>
<td>2.97</td>
</tr>
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<td>5</td>
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<tr>
<td>A3 (Controls)</td>
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<td></td>
</tr>
<tr>
<td>Mean</td>
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<td>30.4</td>
<td>30.2</td>
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</table>
## Burt-Vernon Reading Test

### Programmes (A) x Schools (B) x Occasions (C)

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
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<th>p</th>
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</thead>
<tbody>
<tr>
<td>A</td>
<td>5733.70</td>
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</tr>
<tr>
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<tr>
<td>Pupils (P) within A x B</td>
<td>6868.26</td>
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<td>Residual (PxC) within A x B</td>
<td>1819.34</td>
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<td>18.95</td>
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<td></td>
</tr>
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<td>TOTAL</td>
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</table>
Burt-Vernon Reading Test

Further Analysis of Significant Effects

(i) Breakdown of Methods (A) Variation

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F</th>
<th>P</th>
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</thead>
<tbody>
<tr>
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<td>A1 + A2 - A3</td>
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<td>5085.03</td>
<td>35.53</td>
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</tr>
<tr>
<td>Pupils (P) within A x B</td>
<td>6868.26</td>
<td>48</td>
<td>143.08</td>
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</table>

(ii) Breakdown of Occasions (C) Variation

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<th>Source of Variation</th>
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<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F</th>
<th>P</th>
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</thead>
<tbody>
<tr>
<td>C3 - C2</td>
<td>725.22</td>
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<td>725.22</td>
<td>38.27</td>
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<td>C2 + C3 - C1</td>
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<td>9828.21</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Residual (P x C) within A x B</td>
<td>1819.34</td>
<td>96</td>
<td>18.95</td>
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<td></td>
</tr>
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</table>

(iii) Breakdown of (A x C) Interaction Variation

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A1 - A2) x C</td>
<td>173.60</td>
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<td>86.80</td>
<td>3.54</td>
<td></td>
</tr>
<tr>
<td>(A1 + A2 - A3) x C</td>
<td>1443.47</td>
<td>2</td>
<td>721.74</td>
<td>29.45</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A x B x C</td>
<td>294.17</td>
<td>12</td>
<td>24.51</td>
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</tbody>
</table>

(iv) Breakdown of (A x C) Interaction Variation

<table>
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<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>A x (C3 - C2)</td>
<td>32.45</td>
<td>2</td>
<td>16.23</td>
<td>&lt;1</td>
<td></td>
</tr>
<tr>
<td>A x (C3 + C2 - C1)</td>
<td>1584.62</td>
<td>2</td>
<td>792.31</td>
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<td>&lt;0.01</td>
</tr>
<tr>
<td>2</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A x B x C</td>
<td>294.17</td>
<td>12</td>
<td>24.51</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Programmes</td>
<td>School B1</td>
<td>School B2</td>
<td>School B3</td>
<td>School B4</td>
<td>Schools Combined</td>
</tr>
<tr>
<td>------------</td>
<td>-----------</td>
<td>-----------</td>
<td>-----------</td>
<td>-----------</td>
<td>-----------------</td>
</tr>
<tr>
<td></td>
<td>C1</td>
<td>C2</td>
<td>C3</td>
<td>C1</td>
<td>C2</td>
</tr>
<tr>
<td><strong>A1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Kirk)</td>
<td>Mean</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>9.2</td>
<td>30.6</td>
<td>36.4</td>
<td>8.0</td>
<td>24.0</td>
</tr>
<tr>
<td></td>
<td>5.08</td>
<td>6.37</td>
<td>10.17</td>
<td>6.29</td>
<td>6.96</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>A2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Peabody)</td>
<td>Mean</td>
<td>C1</td>
<td>C2</td>
<td>C3</td>
<td>C1</td>
</tr>
<tr>
<td></td>
<td>7.6</td>
<td>19.2</td>
<td>24.2</td>
<td>8.2</td>
<td>24.0</td>
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<tr>
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<td>3.01</td>
<td>5.88</td>
<td>6.76</td>
<td>4.92</td>
<td>9.45</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>A3</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Controls)</td>
<td>Mean</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.4</td>
<td>9.0</td>
<td>11.8</td>
<td>4.6</td>
<td>12.4</td>
</tr>
<tr>
<td></td>
<td>4.32</td>
<td>7.97</td>
<td>8.03</td>
<td>5.71</td>
<td>9.22</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Analysis 23

**Youngs Group Reading Test**

Programmes (A) x Schools (B) x Occasions (C)

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1261.07</td>
<td>2</td>
<td>630.535</td>
<td>16.97</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>B</td>
<td>68.27</td>
<td>3</td>
<td>22.76</td>
<td>&lt;1</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>6953.41</td>
<td>2</td>
<td>3476.71</td>
<td>500.24</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>A x B</td>
<td>222.98</td>
<td>6</td>
<td>37.16</td>
<td>1.16</td>
<td></td>
</tr>
<tr>
<td>A x C</td>
<td>717.56</td>
<td>4</td>
<td>179.39</td>
<td>32.14</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>B x C</td>
<td>41.71</td>
<td>6</td>
<td>6.95</td>
<td>1.24</td>
<td></td>
</tr>
<tr>
<td>A x B x C</td>
<td>48.79</td>
<td>12</td>
<td>4.07</td>
<td>&lt;1</td>
<td></td>
</tr>
<tr>
<td>Pupils (P) within A x B</td>
<td>1530.51</td>
<td>48</td>
<td>31.88</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residual (PxC) within A x B</td>
<td>535.89</td>
<td>96</td>
<td>5.58</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TOTAL** 11380.19 179
### Youngs Group Reading Test

#### Mean Scores on three occasions for the Experimental Groups

<table>
<thead>
<tr>
<th>Programmes</th>
<th>School B1</th>
<th>School B2</th>
<th>School B3</th>
<th>School B4</th>
<th>Schools Combined</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>C1</td>
<td>C2</td>
<td>C3</td>
<td>C1</td>
<td>C2</td>
</tr>
<tr>
<td>A1 (Kirk)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
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<td>21.6</td>
<td>28.2</td>
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<td>22.6</td>
</tr>
<tr>
<td>S.D.</td>
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<td>2.15</td>
<td>2.06</td>
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</tr>
<tr>
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<td>5</td>
<td>5</td>
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</tr>
<tr>
<td>A2 (Peabody)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
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<td>11.2</td>
<td>12.4</td>
<td>8.0</td>
<td>17.0</td>
</tr>
<tr>
<td>S.D.</td>
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<td>2.86</td>
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<td>1.41</td>
<td>2.61</td>
</tr>
<tr>
<td>N</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>A3 (Controls)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>7.4</td>
<td>7.8</td>
<td>18.8</td>
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</tr>
<tr>
<td>S.D.</td>
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</tr>
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<td>5</td>
<td>5</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>
Analysis 24

Ravens Coloured Progressive Matrices Test

Programmes (A) x Schools (B) x Occasions (C)

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1018.37</td>
<td>2</td>
<td>509.19</td>
<td>2.79</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>386.40</td>
<td>3</td>
<td>128.80</td>
<td>&lt;1</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>635.00</td>
<td>2</td>
<td>317.60</td>
<td>6.68</td>
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</tr>
<tr>
<td>AxB</td>
<td>1093.76</td>
<td>6</td>
<td>182.29</td>
<td>1.28</td>
<td></td>
</tr>
<tr>
<td>AxC</td>
<td>329.53</td>
<td>4</td>
<td>82.38</td>
<td>2.16</td>
<td></td>
</tr>
<tr>
<td>BxC</td>
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<td>47.52</td>
<td>1.24</td>
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</tr>
<tr>
<td>AxBxC</td>
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<td>15.58</td>
<td>&lt;1</td>
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</tr>
<tr>
<td>Pupils (P) within AxB</td>
<td>6819.42</td>
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<td>142.07</td>
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</tr>
<tr>
<td>Residual (PxC) within AxB</td>
<td>3660.18</td>
<td>96</td>
<td>38.13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>14418.80</td>
<td>179</td>
<td></td>
<td></td>
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</table>
Ravens Coloured Progressive Matrices Test

Further Analysis of Significant Effects

(i) Breakdown of Occasions (C) Variation

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>C2 - C3</td>
<td>168.03</td>
<td>1</td>
<td>168.03</td>
<td>3.53</td>
<td></td>
</tr>
<tr>
<td>C2 + C3 - C1</td>
<td>466.97</td>
<td>1</td>
<td>466.97</td>
<td>9.82</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B x C</td>
<td>285.13</td>
<td>6</td>
<td>47.52</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Programmes</td>
<td>School B1</td>
<td>School B2</td>
<td>School B3</td>
<td>School B4</td>
<td>Schools Combined</td>
</tr>
<tr>
<td>------------</td>
<td>-----------</td>
<td>-----------</td>
<td>-----------</td>
<td>-----------</td>
<td>-----------------</td>
</tr>
<tr>
<td>A1 (Kirk)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>100.6</td>
<td>107.8</td>
<td>101.2</td>
<td>106.0</td>
<td>112.2</td>
</tr>
<tr>
<td>N</td>
<td>5</td>
<td></td>
<td></td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>A2 (Peabody)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>101.4</td>
<td>101.6</td>
<td>101.4</td>
<td>98.0</td>
<td>98.4</td>
</tr>
<tr>
<td>S.D.</td>
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<td>7.20</td>
<td>3.16</td>
<td>4.18</td>
</tr>
<tr>
<td>N</td>
<td>5</td>
<td></td>
<td></td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>A3 (Controls)</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Mean</td>
<td>99.8</td>
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</tr>
<tr>
<td>N</td>
<td>5</td>
<td></td>
<td></td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX B

Rationale of PLDK
The Peabody Language Development Kit

The PLDK, prepared by Dunn and Smith (1966), has a three-fold purpose: (1) to stimulate the overall oral language facility of the disadvantaged and retarded, (2) to develop their verbal intelligence through training, and therefore, (3) to enhance their school progress.

The kits provide for a continuous language programme spanning the mental age range of 3 to approximately 10 years of age. The series is divided into four levels:

- **Level P**: is designed for children who are functioning at a mental age of 3 to 5 years.
- **Level 1**: is designed for children whose mental ages are in the range 4\(\frac{1}{2}\) to 6\(\frac{1}{2}\) years.
- **Level 2**: is designed for children whose mental ages are in the range 6 to 8 years.
- **Level 3**: is designed for children whose mental ages are in the range 7\(\frac{1}{2}\) to 9\(\frac{1}{2}\) years.

Development of PLDK

The PLDK model draws on Osgood's linguistic theory (1957) on which the ITPA is also based. The theoretical model on the nature and training of human intellect by Guilford (1959), and Guilford and Hoepfner (1963), is utilised in addition to the work of Torrance (1962) in the area of creative thinking. The rationale for the Kit is also based on theory and research related to verbal learning (McGooch and Irion, 1952). An attempt was made to cast the lessons in keeping with the behaviour modification principles of Skinner (1957). It is recognized that most, if not all, of the learning elicited by the lessons involves the need for each and every child to be rewarded for satisfactory performance. Stressed is the efficacy of an intermittent rather than a continuous reinforcement schedule. Motivation is also built in (1) by having most daily lessons contain an activity that
allows free movement on the part of the group, (2) by devising attractive pictures, (3) by pacing the activities so as to move on when interest lags, (4) by having all the children intellectually engaged in all activities at all times, rather than teaching an individual child in a group setting which allows the minds of the rest of the group to wander, and (5) by selecting activities which were found in field testing to be of high interest value to most children for whom the Kit was devised.

The various aspects of language or verbal intelligence trained by the lessons is carefully sequenced and programmed for increasing difficulty. Finally, behaviour theory and research was called upon in building into the lessons overlearning through repetition (Ellis, 1963; Vergason, 1964).

**Rationale of the PLDK**

The PLDK is designed primarily to stimulate the receptive, associative, and expressive components of oral language development. Concomitant goals are to improve intellectual functioning and enhance future school progress. The model of psycholinguistic processes trained by the lessons is outlined below.

**Model of Processes Stimulated by the PLDK Lessons**

<table>
<thead>
<tr>
<th>RECEPTION</th>
<th>CONCEPTUALISATION</th>
<th>EXPRESSION</th>
</tr>
</thead>
<tbody>
<tr>
<td>AUDITORY</td>
<td>DIVERGENT THINKING</td>
<td>VOCAL</td>
</tr>
<tr>
<td>VISUAL</td>
<td>CONVERGENT THINKING</td>
<td>MOTOR</td>
</tr>
<tr>
<td>TACTUAL</td>
<td>ASSOCIATIVE THINKING</td>
<td></td>
</tr>
</tbody>
</table>
The PLDK stresses the training of global oral language and verbal intelligence rather than the specific training of selected psycho-linguistic skill deficits. Reception is provided through the three key sense modalities of sight, hearing, and touch, and expression is provided through the vocal and motor channels. However, exercises are concentrated on the development of verbal intelligence involving divergent, convergent, and associative thinking. A total of 24 different types of activities was used in the Kit. The ones listed below, along with the number of times each was used, are taken from Level 2:

<table>
<thead>
<tr>
<th>Activity</th>
<th>Times used</th>
<th>Activity</th>
<th>Times used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activity Time</td>
<td>42</td>
<td>Pantomiming Time</td>
<td>9</td>
</tr>
<tr>
<td>Brainstorming Time</td>
<td>20</td>
<td>Patterning Time</td>
<td>15</td>
</tr>
<tr>
<td>Classification Time</td>
<td>32</td>
<td>Reasoning Time</td>
<td>45</td>
</tr>
<tr>
<td>Conversation Time</td>
<td>28</td>
<td>Relationships Time</td>
<td>37</td>
</tr>
<tr>
<td>Describing Time</td>
<td>18</td>
<td>Rhyming Time</td>
<td>21</td>
</tr>
<tr>
<td>Dramatisation Time</td>
<td>17</td>
<td>Sentence Building Time</td>
<td>21</td>
</tr>
<tr>
<td>Directions Time</td>
<td>34</td>
<td>Speech Development Time</td>
<td>26</td>
</tr>
<tr>
<td>Guessing Time</td>
<td>25</td>
<td>Speed-up Time</td>
<td>18</td>
</tr>
<tr>
<td>Imagination Time</td>
<td>26</td>
<td>Story Time</td>
<td>18</td>
</tr>
<tr>
<td>Information Time</td>
<td>27</td>
<td>Touching Time</td>
<td>12</td>
</tr>
<tr>
<td>Listening Time</td>
<td>27</td>
<td>Vocabulary Time</td>
<td>31</td>
</tr>
<tr>
<td>Looking Time</td>
<td>16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Memory Time</td>
<td>28</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>593</td>
</tr>
</tbody>
</table>

Each lesson normally contains three of the above activities, but the range is from two to five activities each. The emphasis is placed on sequencing the difficulty of the exercise for a particular activity from the beginning to the end of the year, rather than within any daily lesson. Repetition was built in to ensure retention. All children in the group participate together at one time, the emphasis being on understanding speech, talking and thinking through activities that are highly motivating.
General Directions for Presenting the Lessons

The philosophy of the PLDK is that Language Time should be a daily interlude from conventional school work. The undermentioned guidelines outlining the particular points to be followed are considered to be important (Dunn and Smith, 1967, Manual 3, pp viii-ix):

1. Be sure to make the lessons a game. It is important that they be viewed as a break from traditional school work, and as a time for more talk and activity than is usually allowed. The teacher's attitude is very contagious. It is important that he be enthusiastic, energetic, and supportive.

2. The PLDK is intended to be part of the total language arts programme. It is not intended to replace the regular daily classroom activities, but rather to supplement them.

3. It is important to keep the attention of the children on the changing activities at all times.

4. The activities should be pupil centred; it is primarily a talking time for the children and not the teacher. The teacher's role is to encourage and involve all of the children - even the most retiring.

5. The teacher should reward the participation of each child. Even minimal performance should be reinforced with liberal praise. The teacher should ignore failure and refrain from criticizing the children and should never scold or complain. It is important to call attention to the success of individuals as well as to the group as a whole. Invidious comparisons among children's performances are to be avoided.

6. The teacher should stress overlearning. Practice, drill, and review are to be encouraged as long as the activities can be varied to sustain a high level of interest.
APPENDIX C

Rationale of ITPA
The Illinois Test of Psycholinguistic Abilition

Introduction

As the ITPA is the main criterion test utilized in this study its rationale will be outlined in some detail.

The history of psychometric testing begins with Binet who saw intelligence as highly school-related and largely global. These concepts are reflected in the design of his test. The work of others such as Spearman (1923), Thurstone (1926), and more recently Guilford (1959), has led to the concept that intelligence is multi-dimensional and not global; consequently, a test of intelligence would seek to measure many component abilities. It would take the form of a test battery.

Most of the psychometric tests developed have been used as classification instruments. They yield global scores and allow classification into broad categories for placement purposes. Those tests which yield only an MA, or an IQ score, may be considered classification tests such as most tests of general academic achievement.

Those teachers concerned with remedial education find that classification and placement of children in nominal categories is of limited value. The statement, that a child has a low IQ, or is at the 25th percentile on some measure, does not necessarily lead to educationally relevant hypotheses for remediation. In dealing with children with learning disabilities the primary concern is, through formal and informal methods of evaluation, to delineate abilities and disabilities in children so that a remedial programme can be initiated.
based on the findings. The dissatisfaction with classification instruments has led to the development of diagnostic tests for specific functions that give clues for remediation. The ITPA, represents an effort along these lines.

Inter- and Intraindividual Differences

The term "individual differences" can have a dual meaning. The most common usage of the term in a school refers to interindividual differences, namely, the variability among members of a group. The concept of interindividual differences is linked with the development of testing programmes to determine relative levels of ability of children in a classroom. It also led to broader categories whereby children were classified for placement in special schools. Whilst this is helpful, in an administrative sense, it is unproductive educationally.

Although the term "individual differences" usually evokes the concept of differences among children, there is a different concept which is more meaningful in the field of remedial education. This is the concept of "Intraindividual differences". This concept directs attention, not to the comparison of one child with another, but to differences in ability within a single child. The concept of intraindividual differences has led to the development of psychometric tests that could measure specific and discrete areas of psychoeducational development. The purpose of such an assessment is diagnostic rather than classificatory, since it delineates discrepancies in growth and developmental imbalances within the child himself. It also indicates abilities that can be used as springboards from which to develop the deficient areas. The ITPA was
originally conceived as a diagnostic intraindividual test of psychological and linguistic function. Its principal use is to diagnose a child's psycholinguistic abilities and disabilities so that remediation can be implemented.

The Development of the ITPA

In the early 1950's, Professor S A Kirk then director of the Institute for Research on Exceptional Children at the University of Illinois, needed a language evaluation test for use with handicapped children with low mental ages. About this time Professor C E Osgood in the Department of Psychology at Illinois University was extending his mediation hypothesis to human linguistic behaviour. At the urging of Kirk, Osgood developed a model of human linguistic function that was used to generate a battery of language tests and led to the development of the ITPA.

Many of the characteristics of the ITPA derive from the model upon which it is based. It sees language as another, not a special case of human behaviour. Language eventually can be explained by the same rules as any other learned behaviour. Language is seen as multifaceted and, importantly, far too complex to be explained by directly observable events. Osgood is, incontrovertibly, a cognitive psychologist. He believes no complete explanation of human behaviour - including language - is possible without theorizing about what goes on in the head. The ITPA reflects these views.

In 1961 an experimental edition of the ITPA resulted (McCarthy and Kirk, 1961). After five years of clinical use and the accumulation of many research findings, it was apparent that the ITPA had merit and should be put into final form. The knowledge that had been gained
about each of the sub-tests and the test as a whole suggested certain modifications, but it was believed that the basic design of the test was sound and should be maintained. Over a three year period (1965-1968) the test procedures were redesigned and the test restandardized, utilizing wherever possible the effective aspects of the original test. The revised edition of the ITPA was published in 1968 (Kirk et al., 1968; Paraskevopoulos and Kirk, 1969).

The revised edition of the ITPA consists of twelve sub-tests, each measuring a different aspect of language behaviour. Each test contributes to a composite raw score and can be described in terms of raw score (RS), psycholinguistic age (PLA) and a standard score (SS).

Osgood's Model of Communication

A schematic presentation of Osgood's Model of Communication is shown below.

![Figure 1: Osgood's Model of Communication](image)

The Osgood schema is a multistaged mediation-integration model of language. In this model the chief construct is an implicit, stimulus producing response assumed to mediate between the observable...
Figure 2
Model of the Illinois Test of Psycholinguistic Abilities
stimulus and the observable response and yielding a two stage, $S-r-c-R$ process. The covert reaction ($r$) is a representational process and serves as the meaning of the sign ($S$) for the individual. The covert reaction is also a mediation process because the self-stimulation ($o$) may become associated with an overt act ($R$).

The model shown above encompasses two dimensional language behaviour, language process and levels of organisation.

**The Clinical Model of the ITPA**

Figure 2 is a schematic representation of the model which Kirk employed to develop the ITPA. It is essentially an adaptation of the communication model of Osgood shown in Figure 1. However, the clinical model of the ITPA is still a close parallel to the Osgood schema. Despite the similarities of the two models, there are several important differences between them. First, the names of certain constructs were changed, thus, the integration level became the "automatic" level, and decoding, association and encoding became "receptive", "organizing", and "expressive" processes. Second, the authors chose to exclude the projective level. As the projective level involves physiological and involuntary reflex behaviours it was thought these concepts were of little importance in language acquisition. Third, the ITPA test-model includes memory constructs a significant departure from Osgood's theory which offers no explanation regarding this function.

It will be noted that the ITPA model is three dimensional and contains:
1. The channels of communication, including auditory and visual input and verbal and motor response.

2. Psycholinguistic processes, including reception, organizing, and expression.

3. Levels of organization, including the automatic and representational levels.

Each major dimension is subdivided as follows:

1. Channels of Communication

"These are the routes through which the content of communication flows." (Paraskevopoulos and Kirk, 1969). This refers to the various combinations of stimulus input and response output. The three major modes of input are auditory, visual and tactual. The major modes of output are vocal and motor. Channels, therefore, include auditory-vocal, auditory-motor, visual-vocal, visual-motor, tactual-vocal and tactual-motor combinations. To reduce these combinations to practical proportions only tests of the auditory-vocal and visual-motor channels are incorporated in the ITPA, as these channels seemed most relevant to the acquisition of language in children. The two channels are defined as follows:

(a) The auditory-vocal channel, i.e. the pathway by which sensory stimuli are received through the ear and responses expressed verbally.

(b) The visual-motor channel, i.e. the pathway by which sensory stimuli are received through the eye and responses expressed through gesture and movement.

2. Psycholinguistic Processes

Three main processes involved in communication are considered:
(a) The receptive process (decoding) is the act of obtaining meaning from stimuli, e.g. the understanding of words, pictures or gestures.

(b) The organisng process refers to the internal manipulation of percepts, concepts and linguistic symbols. It is a central mediating process elicited by the receptive process and preceding the expressive process.

(c) The expressive process (encoding) which is those skills required to express ideas or to respond either vocally or by gesture or movement.

3. Levels of Organisation

This dimension describes the functional complexity of the organism. Some psycholinguistic activities exhibited by humans appear to demand much higher levels of organisation than others. Two levels are identified as being important for language acquisition and use:

(a) The representational level, which is sufficiently organized to mediate activities requiring the meaning or significance of linguistic symbols. Semantic generalization and conceptualization enter into linguistic processes at this level to deal adequately with abstract linguistic symbols, to understand these and to express and relate them meaningfully.

(b) The automatic level, which mediates activities requiring the retention of linguistic symbol sequences and the execution of automatic habit chains. The automatic chain of responses at this level includes such activities as visual and auditory closure, speed of perception, ability to reproduce a sequence seen or heard, rote learning, synthesizing isolated sounds into a word, and utilizing the redundancies of experience.
If one refers to the model presented graphically in Figure 2, some of the boxes will be seen to have been left blank. These shaded areas represent functions in the communication model which are not tapped by the ITPA. There are no tests which attempt to measure the receptive process or the expressive process at the automatic level. These were excluded as their construction proved difficult. Furthermore, it was found that isolating the three processes at this level was theoretically problematic. Instead, two tests for each of the two channels at the automatic level were included. The first is the ability to repeat a sequence or non-meaningful stimuli, referred to in the model as "sequential memory". The second ability is referred to, in the model, as "closure" and involves three tests in the auditory-vocal channel and one in the visual-motor channel. The model was finally reduced to twelve subtests which are listed below. These twelve tests will then be described in some detail.

1. Auditory Reception
2. Visual Reception
3. Auditory Association
4. Visual Association
5. Verbal Expression
6. Manual Expression
7. Grammatic Closure
8. Visual Closure
9. Auditory Sequential Memory
10. Visual Sequential Memory
11. Auditory Closure
12. Sound Blending
Functions Tested at the Representational Level

Six of the twelve subtests are located at the representational level, a level of meaningful symbolization. At this level representational mechanisms are developed for the conception of meaning. Therefore, representational level operations include all behaviours called semantics, abstraction-categorization ability, problem solving, purposeful reading and writing, etc. The specific representational level constructs associated with the ITPA are discussed below.

A. The Receptive Process (Decoding)

The receptive tests, of which there are two, measure the child’s ability to comprehend and to interpret incoming auditory and visual stimuli that have meaningful content. The two subtests are:

Auditory Reception

This test is designed to measure the child’s ability to derive meaning from verbally presented material. It is assessed by a controlled vocabulary test in which the vocabulary of the items becomes more and more difficult. As the receptive rather than the expressive process is being explored the response requirements of the test are kept at the simple level of a "yes" or "no", or with a nod or shake of the head. As the vocabulary of the items becomes more difficult, the expressive requirements remain the same. Similarly, the function of determining meaning from syntax has been minimized by utilizing only one sentence form: "Do (NOUN) (VERB) ?" Typical examples are, "Do dogs eat ?" "Do aeroplanes fly ?" "Do chimneys relax ?“ "Do wingless birds soar ?" Since there is a 50% chance of giving a correct reply to each item a generous number of items and a reliable ceiling criterion is necessary. The ceiling criterion can be considered adequate since there is only about 3% probability of
getting five items correct by chance, assuming a smooth ascending order of difficulty. Word alterations were found necessary in two items for reasons of differences in English and American colloquialism (see Mittler et al, 1970).

**Visual Reception**

This test is the visual counterpart of Auditory Reception. It purports to measure the child's ability to obtain meaning from visual symbols. There are 40 picture items which assess the child's ability to select from four pictures one which is "perceptually identical" to a previously shown stimulus picture. The stimulus picture and the selected one are not physically identical but are semantically identified. In this way the choice is made on a conceptual rather than a perceptual, or "look alike", basis. The child is shown the stimulus picture for 3 seconds with the directions, "See this?" Then the page of response pictures is presented with the directions, "Find one here". The credited option is the object or situation which is conceptually similar to the stimulus. The other options include pictures with varying degrees of perceptual rather than conceptual similarity. The test is easy to administer since only a pointing response is required from the child.

**B. The Organizing Process (Association)**

Tests assessing the organizing process are said to be measures of the child's ability to relate, organize, and manipulate visual and auditory symbols in a meaningful way. There are two subtests tapping this process:

**Auditory Association**

This test taps the child's ability to relate concepts presented orally. The auditory and vocal requirements of the test are minimal,
but the associative requirements become greater with each item. A sentence completion technique is used, presenting one statement followed by an incomplete analogous statement, and allowing the child to complete the second statement appropriately. There are 42 orally presented analogies of increasing difficulty, such as "I cut with a saw; I bang with a _____", "A boy runs; an old man _____", "Ice is solid; water is _____." One can observe that children, familiar with every word in an analogy statement, and having the correct response in their speaking vocabulary, still may not correctly complete the analogy. The decoding and encoding functions then, may be adequate, but the association function may not be. Each test item was constructed so that decoding and encoding requirements were at least two years below the level for which a given analogy was designed, so that failure on the test is more likely to result from a defect in associative ability, rather than in either decoding or encoding. It was found necessary to substitute words in five items, make alternative words acceptable in replies to another five items and rewrite one item completely to allow for colloquial differences (see Mittler et al, 1970).

Visual Association

This test measures the ability to form generalizations, abstractions, and concepts in response to visual symbols. The organizing process is assessed by a picture association test, which requires the child to select from among a set of pictures, the one most meaningfully related to a given stimulus picture. The child is shown a single stimulus picture surrounded by four optional pictures, one of which is associated with the stimulus picture. The child is asked, "What goes with this?" (pointing to the stimulus picture). "Which one of these?" (pointing to the four optional pictures). The child is to
choose the one picture which most closely relates to the stimulus
picture, such as a dog goes with a bone; or a screwdriver with a nail.
The test is expanded at the upper level to provide visual analogies
comparable to the auditory analogies. "If this goes with this"
(pointing to each of a preliminary pair of pictures), "then what goes
with this?" (pointing to the central picture as before). The test
consists of 20 items of the simpler form and 22 visual analogies.
Decoding in the test is kept simple by using familiar pictures through-
out; these are all photographs with no distracting backgrounds. To
encode, the child simply indicates his answer by pointing.

C. The Expressive Process (Encoding)

The expressive process refers to the child's ability to use verbal
or manual symbols for purposes of communication. At the represent-

ational level two subtests measure expression.

Verbal Expression

This test evaluates the child's ability to express ideas through
vocal symbols or spoken language. It is measured by the child's
responses to an open ended question, "Tell me about ___ I" as he is
asked to describe in sequence four familiar objects (a ball, a block,
an envelope and a button). The four objects were chosen to be
common, simple, durable, small and to elicit a variety of responses.
A category system incorporating ten basic descriptive dimensions is
used to score the child's responses. Objectivity of scoring is
accomplished by specifying categories so that each and every response
is categorized under only one category. The child's score depends on
the number of unique and meaningful ways in which he characterizes the
given test object.
Manual Expression

The purpose of this test is to determine the child's ability to express ideas through the use of meaningful gestures. He is shown 15 pictures of common objects, one at a time, and asked to, "Show me what to do with a (name of object)." The child pantomimes the use of the object, which may be a telephone, a pencil sharpener, a camera etc. The difficulty level is increased not through the degree of familiarity of the objects pictured, but primarily through increased complexity and/or precision required for adequate communication of object manipulation.

Functions tested at the Automatic Level

The automatic level of mental organization involves less voluntary, nonmeaningful or nonsemantic behaviours. Operations at this level are automatic, overlearned associations of highly integrated stimuli. This includes abilities such as closure operations, speed of perception, the ability to reproduce a sequence seen or heard, rote learning, synthesizing isolated sounds into a word, and utilizing the redundancies of experience. Two functions are measured at this level: closure and short-term sequential memory.

A. Closure Function

Closure is the ability to integrate discrete parts into a whole, such as filling in the missing part in an incomplete picture or verbal expression. There are four tests of closure in the ITPA:

Grammatic Closure

This test assesses the child's ability to make use of the redundancies of oral language in acquiring automatic habits for handling syntax and grammatic inflections. In this test the conceptual
difficulty is low, but the task elicits the child's ability to respond automatically to often repeated verbal expressions of standard American speech. The child comes to expect or predict the grammatic form so that when part of an expression is presented he supplies the missing part.

There are 33 orally presented items accompanied by pictures which portray the content of the verbal expression. The picture is included to avoid contaminating the test with difficulty in the receptive process. Each verbal item consists of a complete statement followed by an incomplete statement to be finished by the child, e.g. "Here is a man; here are two ____." "This man is painting. He is a ____." Plural forms, verb tenses, prepositions, possessives and pronouns are tested. The assumption is made that, these linguistic forms have occurred so frequently in the child's experience, and that his recognition and use of them is so thoroughly overlearned, that they have become automatic.

**Visual Closure**

This test measures the child's ability to recognize a picture of a common object when presented with only portions of the picture. Instead of using a single pictorial representation of the object, scenes are presented with 14 or 15 examples of the object concealed to varying degrees in them. The child's task is to point to particular objects which are partially hidden. It is primarily a test of perceptual speed in a visual closure task, since there is a specified time limit. The task requires minimal receptive and expressive skills. The objects depicted in the four scenes – fish, shoes, bottles, and a hammer and saw, are simple and common and the response consists of pointing to the object. As the hidden pictures
are presented randomly on a narrow strip, the children’s responses are evenly distributed across the page.

**Auditory Closure (Supplementary Test 1)**

Auditory Closure is the ability to recognise a complete auditory symbol when only part is presented. Grammatic Closure is one form of auditory closure where a statement or sentence is completed. Another form of auditory closure is the recognition of a word from hearing only a part of the word. Auditory closure is an automatic function occurring in everyday life in situations such as understanding foreign accents, speech defects, or poor telephone connections. In this test the child is asked, "What am I talking about ___ bo/le ? tele/one ?" There are 30 items of increasing difficulty from easy words such as "airpla/", to more difficult ones such as "ta/le/on" and "/*pe/iter".

**Sound Blending (Supplementary Test 2)**

Sound Blending refers to the ability to synthesize two or more discrete and isolated sounds into a whole. The sounds of a word are spoken singly at half-second intervals, and the child is asked to tell what the word is. Thus he has to synthesize the separate parts of the word and integrate them into a whole. This test covers a wider range of difficulty than most tests of sound blending ability. In order to cater for younger children pictures have been included, whilst at the upper levels the test has been extended by including nonsense words.

**B. Sequential Memory Function**

These tests measure the child’s ability to recall immediately a sequence of auditory or visual stimuli. There are two subtests as described below.
Auditory Sequential Memory

This measures the child's ability to correctly repeat a sequence of symbols; it is a test of auditory recall. It resembles the standard digit repetition test except that (1) digits are uttered at a rate of two per second which is twice the usual rate, (2) the examiner drops his voice at the end of a digit sequence, (3) sequences are repeated if the child fails to correctly repeat the original presentation, and (4) some digit sequences contain the same digit twice. The intent of these alterations is to increase the discrimination of the test. The child is asked to reproduce from memory sequences of digits increasing in length from two to eight digits. The more rapid presentation makes the task easier, which is necessary for two and three year old children. The child receives more credit for success on the first than on the second trial.

Visual Sequential Memory

This test is designed as a visual-motor parallel to the auditory-vocal sequencing test. It assesses the child's ability to reproduce a sequence of visual stimuli from memory. Since in the English language written words occur in horizontal orientation, in simultaneous presentation and in close succession, such stimulus characteristics were thought the most appropriate for incorporation into a test of visual memory. Non-meaningful abstract figures were used so as to counteract the tendency to label the figures and, therefore, recall them through auditory and kinaesthetic rehearsal.

The visual sequential test comprises 25 sequences of symbols varying in length from two to eight figures. The child is shown each sequence of figures for five seconds, then asked to put chips
of corresponding figures in the same order. As with auditory memory
two trials are allowed per sequence when necessary.

According to Kirk et al (1968) the twelve subtests of the ITPA
can be used to

"Isolate defects in (a) three processes of communication,
(b) two levels of language organization, and/or (c) two
channels of language input and output. Performance on
specific sub-tests of this battery should pinpoint specific
psycholinguistic abilities and disabilities. The
identification of specific deficiencies in psycholinguistic
functions thereby leads to the crucial task of remediation
directed to the specific areas of defective functioning.
This is the sine qua non of diagnosis." (p 13)

The Normative Group

Most tests of general intellectual functioning have provided
norms based upon the performance of the general population. To obtain
truly representative samples from such a broadly defined population is
an extremely demanding task. Consequently, samples more often than
not are unrepresentative and biased in various ways. Anastasi (1961)
considered that a more practical and effective procedure is to
standardize the test on a more narrowly defined population, chosen to
suit the specific purposes of the test. This approach was followed in
obtaining the normative data for the ITPA. In consideration of such
utilization of the ITPA, average children of ages two to ten years
were considered the most relevant population to comprise the normative
group. Operationally, the normative group included only those
children of average intellectual ability, average achievement at
school, average characteristics of personal-social adjustment, sensory-
motor integrity, and coming from predominantly English speaking
families.
Selection Criteria for the Normative Group

In the selection of the normative sample 2,413 children were considered initially. From this sample pool the children were then administered, individually, the abbreviated 1960 Stanford Binet Intelligence Scale, Form L - M. If a child’s score on the Binet fell within ± 1 standard deviation of the mean (I.Q. of 84-116), the child was included in the normative group. Following this refining process, 962 children out of the initial pool of 2,413 were retained as acceptable. These 962 children were then administered the revised version of the ITPA and thus comprise the normative group. In arriving at the normative group eight restricted-range age groups were sampled. The age groups, grade placements and numbers of children in each grade were as follows:

<table>
<thead>
<tr>
<th>School age:</th>
<th>No. of children</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-school</td>
<td></td>
</tr>
<tr>
<td>2-7 - 3-1 years</td>
<td>107</td>
</tr>
<tr>
<td>3-7 - 4-1 years</td>
<td>116</td>
</tr>
<tr>
<td>4-7 - 5-1 years</td>
<td>115</td>
</tr>
<tr>
<td>Kindergarten</td>
<td></td>
</tr>
<tr>
<td>5-7 - 6-1 years</td>
<td>128</td>
</tr>
<tr>
<td>Grade 1</td>
<td></td>
</tr>
<tr>
<td>6-7 - 7-1 years</td>
<td>124</td>
</tr>
<tr>
<td>Grade 2</td>
<td></td>
</tr>
<tr>
<td>7-7 - 8-1 years</td>
<td>123</td>
</tr>
<tr>
<td>Grade 3</td>
<td></td>
</tr>
<tr>
<td>8-7 - 9-1 years</td>
<td>127</td>
</tr>
<tr>
<td>Grade 4</td>
<td></td>
</tr>
<tr>
<td>9-7 - 10-1 years</td>
<td>122</td>
</tr>
<tr>
<td></td>
<td><strong>962</strong></td>
</tr>
</tbody>
</table>

Means and standard deviations of chronological ages, Stanford-Binet mental ages, and IQ's of children in the normative group are included in the appendix.

The Deviation and Interpretation of ITPA Scores

When analyzing a child’s test performance on the ITPA a number of scores may be obtained. These include: Raw Scores, Scaled Score norms for each of the 12 subtests, Psycholinguistic Age norms for each
of the 12 subtests, and Composite Psycholinguistic Age norms. Raw Scores, Scaled Scores and Psycholinguistic Ages are discussed below:

**Raw Scores**

The raw scores for each of the ITPA sub-tests represents the sum of the number of creditable responses given on that sub-test. Raw scores, however, are not readily interpretable. This is because the means and standard deviations of raw scores vary, not only from sub-test to sub-test, but from age level to age level. Their use, therefore, is restricted to group comparisons and correlational analyses. To make comparison between subtest performances they must be transformed into Scaled Scores.

**Scaled Scores (SS)**

Scaled Scores, in contrast to raw scores, take into account both group means and variances. Scaled Scores are transformations of Raw Scores such that at each age and for each of the 12 subtests (or the composite), the mean performance of the referral groups is equal to a score of 36 with a standard deviation of 6. Thus scaled scores provide a versatile means of comparing the child's performance from subtest to subtest both within and across age levels. For these reasons scaled scores are generally those most appropriate in making comparisons regarding the individual's standing relative to the normative group or to another child. It is also recommended that Scaled Scores are used on the Profile of Abilities.

By taking the average of the scaled scores on the ten basic subtests the mean scaled score is obtained. This global score provides a reference point with which individual subtest scores may be compared.
Psycholinguistic Ages (PIA)

The psycholinguistic age equivalent of a particular raw score indicates the age group for which that raw score is typical. More specifically, PIA relates the individual's performance on a subtest (or the composite) to the chronological age of those individuals within the normative group who perform at the same level. Psycholinguistic age scores were derived for each of the twelve ITPA subtests and for the ITPA composite. Psycholinguistic ages suffer the same limitations as raw scores in evaluating individual performances across the subtests or in making comparisons across ages. This is because they, also, do not take into account the differences in variance occurring from test to test, or from age to age. They are useful insofar as age scores are more easily communicated to teachers than are the more sophisticated derived scores.

The Composite Psycholinguistic Age (Composite PIA) was derived from the Composite Raw Score (of the ten basic subtests). This score is a global one, an overall index of the level of psycholinguistic development. Its value is one of classification according to overall ability. A Composite PIA which is substantially above or below the CA classifies a child as above or below average in psycholinguistic development.

Part Scores

The scores that have so far been discussed (Scaled Scores, PIA's, and Composite PIA) have only limited value. They are global scores and their chief purpose is for making interindividual comparisons. More discriminating scores are obtained by considering the child's abilities in each of the three dimensions which the ITPA measures, i.e. his scores in the auditory-vocal as compared to his score in
the visual-motor channel, or his scores representing each of the two levels of organization, or each of the three processes. The Summary Sheet of the test booklet is designed to facilitate these comparisons. This page is divided according to level, with tests at the representational level to the left, and those at the automatic level to the right. Thus a part score on the six tests at the representational level can be compared with the six tests at the automatic level. Similarly, all of the auditory-vocal tests are in columns 1 and 3 to facilitate comparisons with the visual-motor scores in columns 2 and 4. Further, comparisons of the reception, association and expression processes can be made by comparing the averages of the two tests in each of the processes.

The Profile of Abilities

To provide a graphic representation of the child's abilities on the twelve ITPA subtests, the Record Form provides a page for plotting the Profile of Abilities. This page contains two profiles: (1) a profile comparing the various developmental measures expressed in age scores, i.e. CA, PLA, and MA; and (2) a profile utilizing the scaled scores of the 12 sub-tests.

Evaluating Discrepancies in Psycholinguistic Development

For diagnostic and remedial purposes, the teacher must know the presence and extent of discrepancies in psycholinguistic functioning. When analyzing discrepancies Scaled Scores rather than Psycholinguistic ages should be utilized always.

To determine whether or not a child has substantial discrepancies in abilities, a point of reference has to be established. For this purpose the overall performance of the child is used. This overall performance is expressed in terms of the Mean Scaled Score or Median
Scaled Score, whichever is more appropriate. The Median SS is more appropriate with profiles in which extremely discrepant scores are unidirectional, that is, the discrepant scores are either all high or low. In other cases, the Mean SS is used. The extent of the difference between the Scaled Score of a subtest and the Mean or Median SS indicates the strength or weakness in psycholinguistic growth.

The following guidelines, for determining when a discrepancy is meaningful, are given in the Examiner's Manual:

1. Differences between a subtext SS and the Mean or Median SS of ± 6 should not be considered an indication of a special ability or a disability. This is the range within which over 80 per cent of average children score.

2. Differences between the Mean or Median SS and the subtest SS of ± 7, ± 8, or ± 9 are considered as borderline discrepancies.

3. A difference between the Mean or Median SS and the subtest SS of ± 10 or greater is considered a substantial discrepancy; that is, a deviation of that magnitude is indicative of a discrepant function.
APPENDIX D

Score Data on Criterion Tests
The Tables on pages 431-441 present the score data for the experimental group children attending schools B1, B2, B3, and B4, on the three occasions C1, C2 and C3. Data are given for the following variables:

- AR - Auditory Reception
- VR - Visual Reception
- AA - Auditory Association
- VA - Visual Association
- VE - Verbal Expression
- ME - Manual Expression
- GC - Grammatic Closure
- VC - Visual Closure
- AM - Auditory Sequential Memory
- VM - Visual Sequential Memory
- SB - Sound Blending
- AC - Auditory Closure
- PLA - Composite PLA
- MSS - Mean Scaled Score
- AL - Automatic Level
- RL - Representational Level
- RP - Reception Process
- AP - Association Process
- EP - Expression Process
- A-V - Auditory-Vocal Channel
- V-M - Visual-Motor Channel
- BV - Burt-Vernon Reading Test
- YG - Young's Group Reading Test
- RPM - Raven's Coloured Progressive Matrices

All the ITPA scores are scaled scores and are to the nearest integer.
### Table 28

**Distribution of sexes within the treatment groups**

<table>
<thead>
<tr>
<th>School B1</th>
<th>School B2</th>
<th>School B3</th>
<th>School B4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kirk Group</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>B</td>
<td>B</td>
<td>B</td>
</tr>
<tr>
<td>B</td>
<td>G</td>
<td>B</td>
<td>G</td>
</tr>
<tr>
<td>G</td>
<td>G</td>
<td>B</td>
<td>B</td>
</tr>
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|    | 22 | 22 | 19 | 22 | 20 | 19 | 30 | 21 | 23 |    |    |    |
|    | 26 | 31 | 21 | 23 | 27 | 22 | 24 | 21 | 23 |    |    |    |
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APPENDIX E

Nature of Input from Kirk and Peabody Programmes
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<th>Lesson</th>
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<td>1</td>
<td><strong>Visual Motor Training</strong>: Help the child develop visual-motor perceptual abilities (p. 184 A4, p. 162 A).</td>
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<td><strong>Visual Sequencing</strong>: Help the child recognise the sequential nature of patterns (p. 182 C1).</td>
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<td><strong>Visual Detail</strong>: Train the child to attend to visual details by underlining letter combinations and calling attention to parts of words (p. 182 B1).</td>
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<td><strong>Visual Discrimination</strong>: Help the child to recognise the distinctive features of letters (p. 184 D1, p. 165 D5).</td>
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<td><strong>Visual Detail</strong>: Give the child training in visual detail involving the letter combination in words and sentences (p. 182 B1, p. 162 A1).</td>
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<td><strong>Memory Sequencing</strong>: Train the child to reproduce from memory words that will be used in reading and spelling. Use the Fernald Kinaesthetic Method of training (p. 184 D).</td>
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<td><strong>Memory Sequencing</strong>: When the child has acquired a sight vocabulary train the child to reproduce phrases and sentences within his ability to reproduce them (p. 184 D2C).</td>
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<td><strong>Visual Memory</strong>: Word matching - Initiate training by overlearning the words presented (p. 184 D1, E).</td>
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<td><strong>Visual Memory</strong>: Key Words - Initiate overlearning, increase the length of the word as the child learns (p. 184 D1, D2, E).</td>
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<td><strong>Visual Discrimination</strong>: Teach the child to discriminate between words of similar perceptual configuration (p. 183 4a, p. 184 2a, p. 184 5, p. 184 E).</td>
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The above activities are drawn from: "Psycholinguistic learning disabilities: diagnosis and remediation" (Kirk and Kirk, 1971).
Table 30

Activities incorporated in the Auditory Closure Programme

| Lesson 1 | - Training in Automatic Habits: Encourage imitation of the teacher's use of correct grammatical language (p. 142 D4, p. 155 C1, p. 156 D3). |
| Lesson 2 | - Automatic Closure: Train the child to repeat and close a sentence after the teacher (p. 157 6b, p. 156 3a) |
| Lesson 3 | - Automatic Closure: Give repetitive exposure to the exceptions of language (p. 156 D1, D2) |
| Lesson (4-6) | - Sound Blending: Give the child training at blending the sounds of three letter words with the vowel sound in the medial position (p. 157 E1, E2). |
| Lesson 7 | - Auditory Acuity: Give the child training to increase his auditory acuity (p. 157 E1, E2) |
| Lesson 8 | - Auditory Acuity: Give the child training to increase consonant and vowel discrimination (p. 136 E, p. 157 E, E2) |
| Lesson 9 | - Auditory Closure: Related Sequences (p. 156, D1, p. 157 6b) |
| Lesson 10 | - Auditory Closure: Evoking paired responses (p. 157 4, p. 157 6b) |
| Lesson 11 | - Auditory Closure: Phrase and Sentence Closure (p. 156 3a, p. 157 4, p. 157 6b) |
| Lesson 12 | - Auditory Closure: Presenting familiar words in incomplete form (p. 157 6c, 6d) |

The above activities are drawn from: "Psycholinguistic learning disabilities: diagnosis and remediation" (Kirk & Kirk, 1971).
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Classification of People and Activities associated to CPA subsystem.

Table 32
APPENDIX F

Attendance Records of Experimental Group
Table 34
Attendance record of Kirk Group children during treatment

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Table 35

Attendance record of Peabody Group children during treatment

<table>
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<th>Pupil</th>
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<th>Total</th>
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### Table 36

Attendance record of Control Group children during treatment

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</table>
Table 31

Comparison of the attendances of the children in the three treatment groups

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<th>Kirk</th>
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<th>Control</th>
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</table>

Group sum 444 437 434
Group mean 22.2 21.85 21.7

Analysis of variance of the data in the above table

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F</th>
<th>p</th>
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<tbody>
<tr>
<td>Between groups</td>
<td>2.63</td>
<td>2</td>
<td>1.32</td>
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<tr>
<td>Within groups</td>
<td>83.95</td>
<td>57</td>
<td>1.47</td>
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<td>Total</td>
<td>86.58</td>
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</table>

As there were no significant differences between the attendances of the children in the three treatment groups, it is unlikely that the differential attendance could account for any of the recorded differences between the groups on the criterion measures.
SECTION XI

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