THE PERFORMANCE OF BILINGUAL PUERTO RICAN CHILDREN ON VERBAL AND ON NON-LANGUAGE TESTS OF INTELLIGENCE

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THE LITERATURE relating to the effect of bilingualism upon the measurement of the intelligence of children of pre-school age and of elementary school age, indicates that in the more carefully controlled experiments, bilingualists achieve scores significantly inferior to those achieved by matched monoglotes on verbal tests of intelligence whereas on non-verbal tests of intelligence, such inferiority of the bilingualists has not been indicated. ¹ There is, however, a dearth of experimental studies in the field and a great need for more research with the different races and in different environments. It was with this need in mind, that a selected number of the rapidly increasing bilingual Puerto Rican elementary school population of New York City was chosen as the subjects of this investigation.

The Problem

The problem in the present investigation was to determine the performance of bilingual Puerto Rican children on verbal and on non-language tests of intelligence. The investigator sought to answer the following questions:

1. Is there a significant difference between the mean I. Q. achieved on the Pintner General Ability Test, Verbal Series; Intermediate Test, Form B, and the mean I. Q. achieved on the Pintner General Ability Test, Non-Language Series, Form K, when these tests are administered to a selected bilingual Puerto Rican population in grades five and six of two elementary schools in New York City?
2. Is there a significant difference in the mean mental ages of these

subjects when their intelligence is measured by the Pintner Verbal Test and by the Pintner Non-Language Test?

3. To what extent can a reliable non-language test of intelligence such as the Pintner Non-Language Test be substituted for the Pintner Verbal Test when measuring the intelligence of this population?

The Subjects

The subjects of this investigation were 235 children, 117 boys and 118 girls, of Puerto Rican parentage, who, at the time of the investigation, were in grades five and six in two public elementary schools in New York City. The age range of these subjects was from 124 months to 178 months. The mean chronological age was 148.01 months with a standard deviation of 10.62. These children were selected for study because of their bilingual background. The information relating to the language which was spoken in the home was obtained by the teacher of the children from the cumulative record cards and the administrators of the tests corroborated this information by having each child indicate on his test paper the language spoken in the home. When any doubt existed in the mind of the teacher, the teacher interviewed the child to get the necessary data. The final selection was made, therefore, of 235 children in nine classes of grades five and six and all of these subjects heard and spoke Spanish at home, whereas, they heard and spoke English at school.

The Intelligence Tests Employed

Two group intelligence tests were administered to the subjects selected for the investigation. The Pintner General Ability, Verbal Series, Intermediate Test, Form B was used as the verbal means of measuring intelligence and the Pintner General Ability Test, Non-Language Series, Form K was used as the non-verbal means of measurement. In measuring the subjects of this investigation by means of verbal and non-verbal tests, their scores on non-verbal tests of intelligence should be significantly higher than those achieved on the verbal tests. If, however, significant differences were not found to exist between the scores of the bilingualists on the verbal tests and their scores on the non-verbal tests, bilingualism, for the subjects studied, is not to be considered as a hardship when measuring their performance on verbal tests of intelligence.

Method of Investigation

Having enlisted the aid of the principals and the teachers of the children in the schools in which the investigation was conducted in order to determine the chronological ages and the language spoken in the home, the final selection of 235 children in grades five and six was made. The
tests were administered by nine college seniors who, at the time of the investigation, were completing a course in testing in which the investigator was the instructor. Before any testing for the investigation began, each student was trained thoroughly in the administration of both tests and demonstrated his ability in such administration to the satisfaction of the investigator. Each test administrator was assisted by two trained proctors and by the classroom teacher. Not more than forty-eight hours elapsed between the administration of the two tests and the order of administration varied systematically so that any possible effect that the order of administration might have on the test results would be canceled. The test papers were scored and checked by the students and were then carefully rechecked by the investigator.

Analysis of Results

When the mean I. Q. achieved by the 235 subjects on the Pintner Verbal Test was compared with the mean I. Q. achieved on the Pintner Non-Language Test, it was found that they achieved a mean I. Q. of 79.56 with a standard deviation of 14.31 on the Pintner Verbal Test and a mean I. Q. of 87.84 with a standard deviation of 16.52 on the Pintner Non-Language Test. The obtained difference in mean I. Q.'s achieved on two tests was 8.28 in favor of the Pintner Non-Language Test and the critical ratio was found to be 5.81. Therefore, it may be concluded that the difference in mean I. Q.'s, in favor of the Pintner Non-Language Test is a significant one since the critical ratio was found to be greater than three. Table I presents the data on this difference.

The mean mental age achieved by the 235 subjects on the Pintner Verbal Test was 117.92 months with a standard deviation of 16.49 whereas the mean mental age achieved by these subjects on the Pintner Non-Language Test was 126.54 months with a standard deviation of 30.11. The obtained difference in mean mental ages achieved on the two tests was 8.62 in favor of the Pintner Non-Language Test and the critical ratio was found to be 3.85 which, since it is greater than three, indicates a significant difference in favor of the scores achieved on the Pintner Non-Language Test. Table II presents these data.

The statistically significant difference obtained between the mean I. Q.'s on the two tests and the statistically significant difference obtained between the mean mental ages on the two tests were substantiated by the differences between the mean I. Q.'s and the differences between the mean mental ages achieved by the entire group when divided into school classes. A study of Table III will reveal that in every class the mean I. Q. and the mean mental age achieved on the Pintner Non-Language Test are appreciably higher than on the Pintner Verbal Test. Critical ratios were not determined for the classes considered separately be-
TABLE I

DIFFERENCE BETWEEN THE MEAN I. Q. ON THE PINTNER VERBAL TEST AND THE MEAN I. Q. ON THE PINTNER NON-LANGUAGE TEST FOR 235 SUBJECTS

<table>
<thead>
<tr>
<th>Scales Administered</th>
<th>Pintner Verbal Test</th>
<th>Pintner Non-Language Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Subjects</td>
<td>235</td>
<td>235</td>
</tr>
<tr>
<td>Mean I. Q.</td>
<td>79.56</td>
<td>87.84</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>14.31</td>
<td>16.52</td>
</tr>
<tr>
<td>Difference between Means</td>
<td></td>
<td>8.28</td>
</tr>
<tr>
<td>Standard Error of the Difference</td>
<td></td>
<td>1.43</td>
</tr>
<tr>
<td>Critical Ratio</td>
<td></td>
<td>5.81</td>
</tr>
</tbody>
</table>
TABLE II

DIFFERENCE BETWEEN THE MEAN MENTAL AGE ON THE PINTNER VERBAL TEST AND MEAN MENTAL AGE ON THE PINTNER NON-LANGUAGE TEST FOR THE 235 SUBJECTS

<table>
<thead>
<tr>
<th>Scales Administered</th>
<th>Pintner Verbal Test</th>
<th>Pintner Non-Language Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Subjects</td>
<td>235</td>
<td>235</td>
</tr>
<tr>
<td>Mean Mental Age in Months</td>
<td>117.92</td>
<td>126.54</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>16.49</td>
<td>30.11</td>
</tr>
<tr>
<td>Difference between Means</td>
<td></td>
<td>8.62</td>
</tr>
<tr>
<td>Standard Error of the Difference</td>
<td></td>
<td>2.24</td>
</tr>
<tr>
<td>Critical Ratio</td>
<td></td>
<td>3.85</td>
</tr>
</tbody>
</table>
cause of the small number of students in each class. Table III gives a detailed presentation of these data.

In order to determine whether the Pintner Non-Language Test may be used as a substitute for the Pintner Verbal Test when measuring a population such as that of this investigation the Pearson coefficients of correlation were found between the I. Q.'s achieved on the two tests and also between the mental ages achieved on the two tests. The coefficient of correlation between the I. Q.'s achieved on the two tests was .58 with a \[ \text{PER}_1 \] of .03 and the coefficient of correlation between the mental ages achieved on the two tests was .42 with a \[ \text{PER}_2 \] of .04. While these coefficients of correlation are not high enough to warrant the substitution of the Pintner Non-Language Test for the Pintner Verbal Test, the correlation coefficient between the I. Q.'s achieved on both tests is more than nineteen times its probable error and the correlation coefficient between the mental ages achieved on both tests is more than ten times its probable error. Therefore, both of these coefficients of correlation may be accepted as highly reliable and it is evident that the two tests are measuring the same function to a fairly large extent, but certain factors measured by one test are not measured by the other. From an educational standpoint, therefore, it would appear that the administration of both verbal and non-language intelligence tests to a bilingual group of the type studied in this investigation would give a more complete and a truer picture of the intelligence of the group concerned.

Conclusions

The following conclusions, with respect to the particular group studied, may be drawn from the results of this investigation:

1. The mean I. Q. of 87.84 with a standard deviation of 16.52 which was achieved by the 235 subjects on the Pintner Non-Language Test, was significantly higher than the mean I. Q. of 79.56 with a standard deviation of 14.31 which was achieved on the Pintner Verbal Test. The obtained difference between these mean I. Q.'s was 8.28 in favor of the Pintner Non-Language Test and the critical ratio was found to be 5.81.

2. The mean mental age of 126.54 months with a standard deviation of 30.11 which was achieved on the Pintner Non-Language Test by the 235 subjects was significantly higher than the mean mental age of 117.92 months with a standard deviation of 16.49 which was achieved on the Pintner Verbal Test. The obtained difference between these mean mental ages was 8.62 in favor of the Pintner Non-Language Test and the critical ratio was found to be 3.85.

3. These differences in mean I. Q.'s and in mean mental ages were substantiated when the group was divided into its nine school classes. In all classes, there were appreciable differences between the mean
<table>
<thead>
<tr>
<th>Class</th>
<th>No.</th>
<th>CHRONOLOGICAL AGES</th>
<th>MENTAL AGES</th>
<th>INTELLIGENCE QUOTIENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Range in Months</td>
<td>Mean in Months</td>
<td>S. D.</td>
</tr>
<tr>
<td>A</td>
<td>25</td>
<td>178-124</td>
<td>150</td>
<td>10.82</td>
</tr>
<tr>
<td>B</td>
<td>22</td>
<td>178-133</td>
<td>148</td>
<td>10.11</td>
</tr>
<tr>
<td>C</td>
<td>21</td>
<td>165-128</td>
<td>148</td>
<td>10.72</td>
</tr>
<tr>
<td>D</td>
<td>21</td>
<td>163-132</td>
<td>143</td>
<td>8.38</td>
</tr>
<tr>
<td>E</td>
<td>24</td>
<td>161-125</td>
<td>146</td>
<td>10.16</td>
</tr>
<tr>
<td>F</td>
<td>29</td>
<td>173-132</td>
<td>148</td>
<td>10.73</td>
</tr>
<tr>
<td>G</td>
<td>24</td>
<td>176-136</td>
<td>150</td>
<td>11.01</td>
</tr>
<tr>
<td>H</td>
<td>33</td>
<td>183-134</td>
<td>153</td>
<td>9.52</td>
</tr>
<tr>
<td>I</td>
<td>36</td>
<td>171-130</td>
<td>145</td>
<td>10.54</td>
</tr>
</tbody>
</table>

Table III: The mean chronological ages and the mean mental ages and mean I.Q.'s on the Pintner Verbal Test and on the Pintner Non-Language Tests when the subjects were divided according to classes in school.
I. Q. 's and between the mean mental ages on the two tests and in all classes, these differences were in favor of the scores achieved on the Pintner Non-Language Test.

4. The Pearson coefficient of correlation between the I. Q. 's achieved on the Pintner Verbal Test and on the Pintner Non-Language Test was .58 with a $PE_r$ of .03, and the Pearson coefficient of correlation between the mental ages achieved on the Pintner Verbal Test and the Pintner Non-Language Test was .42 with a $PE_r$ of .04. These coefficients of correlation are too low to warrant the substitution of one test for the other but they are highly reliable since the coefficient of correlation between the I. Q. 's is more than nineteen times its probable error and the coefficient of correlation between the mental ages is more than ten times its probable error. It may be concluded, therefore, that the two tests are measuring the same functions to a fairly large extent but not to so great an extent as to warrant the substitution of one test for the other. An educational implication which may be drawn from these results is that the administration of intelligence tests of both the verbal and the non-language types would yield a more valid picture of the intelligence of a bilingual population, such as the one studied in this investigation, than the administration of either a verbal test of intelligence or a non-language test of intelligence as the sole means of intelligence measurement.